Primary Care Contributions to Health Systems and Health

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ABSTRACT

Evidence on the health-promoting influence of primary care has been accumulating ever since research has distinguished primary care as a special part of health services. This evidence shows a positive impact of primary care on prevention of illness and death, regardless of whether primary care is characterized as primary care physician supply, as whether or not people have a relationship with a primary care source of care, or as the extent to which the important features of primary care are received by people. There is also evidence that primary care (in contrast to specialty care) is associated with a more equitable distribution of health in populations, a finding that is robust in cross-national studies and within countries. The mechanisms by which primary care improves health have been elucidated, thus suggesting ways to improve overall levels of health and reduce systematic differences in health across major population subgroups.

Keywords: Primary Care, Health Outcomes, Population Health

INTRODUCTION

The term primary care is thought to date back to about 1920, when the Dawson Report was released in the United Kingdom. That report, an official “white paper”, mentioned “primary health care centres”, which were intended as the hub of regionalized services in that country. Although primary care came to be the cornerstone of the health services system in the UK as well as in many other countries, no comparable focus developed in the US. The formation of one after another specialty board in the early decades of the 20th century signaled the increasing specialization of the US physician workforce (Stevens 1971). The GI Bill of Rights, which supported further training of those returning from services in World War II, fueled a further increase in specialization of physicians, many of whom had been general practitioners (generalists) before the war. At that time, physicians who were general practitioners lacked additional training after graduation from medical school apart from a short clinical internship.

Concerned that the survival of generalist physicians would be threatened by the disproportionate increase in the supply of specialists in the US to the detriment of generalist practice, family physicians, working with international colleagues, developed standards for credentialing the new “specialty” of family practice. Thus, in the 1960s and 1970s, longer postgraduate training became part of preparation for the practice of generalist physicians. Recognition of a “specialty” of primary care, which, in the United States, covered general internal medicine as well as general pediatrics, resulted in two reports from the Institute of Medicine (IOM)(IOM 1978; Donaldson et al 1996). These reports defined primary care as “the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community”. This definition is consistent with at least two international reports (WONCA 1991; World Health Organization 1978) and has been used to develop instruments to measure four main features of primary care services: first contact access for each new need; long-term person (not disease) focused care; comprehensiveness in dealing with most needs for health services; and coordination of care when it must be sought elsewhere (Table). Primary care is assessed as “good” based on the degree of attainment of these four main features. For some purposes, an orientation towards family and community are also included (Starfield 1998).

Despite increasing recognition of the importance of primary care as an essential core of health services systems (World Health Organization 1978, 2003), there have been recent professional calls for increasing the supply

of specialist physicians in the US (Cooper 2002). Compared with other industrialized nations, the US already has a surplus of specialists, but not of primary care physicians. We argue, on the basis of the studies reviewed in this paper, that health of the US population will be better if this maldistribution is corrected. Specifically, a greater emphasis on primary care can be expected to lower the costs of care, improve health by means of more appropriate services, and reduce inequities in health in the population.

We first review evidence on the relationship between primary care and health, using three different measures of primary care. The effect of health policy on primary care and health also can be elucidated by between-country comparisons, which we summarize next. We then consider the impact of primary care in reducing disparities in health across population groups. Following a section on cost considerations, we discuss reasons why primary care would be expected to have a beneficial effect on health. We then consider limitations of the analyses and discuss the likely nature of primary care in the future by considering the policy implications of the evidence presented in this paper.

APPROACH TO REVIEWING EVIDENCE

Research on the effects of primary care on health was sought from three types of studies: studies of the supply of primary care physicians, studies of people who identify a primary care physician as their regular source of care, and studies linking the receipt of high quality primary care services with health status. These three lines of evidence represent a progressively stronger demonstration that primary care improves health, first by showing that health is better in areas with more primary care physicians, second by showing that people who receive care from primary care physicians have better health, and third by showing that the characteristics that constitute primary care are associated with better health. Research on these topics was sought from three systematic literature reviews on the subject of primary care (Atun 2004; Health Council of the Netherlands 2004; Engstrom, Foldevi, and Borquist 2001), supplemented by the authors' ongoing. compilation of articles in major national and international general medical journals. Primarily publications in the English language were included; for the most part the studies came from the United States (reflecting the preponderance of studies) but studies in other countries were included if they met the criterion of addressing primary care, as measured by at least one of the three types of studies. Inclusion or exclusion of studies did not depend on the finding of a study; the only criteria for inclusion was a clear conceptualization of primary care, systematic data collection and analysis, and comparison populations. Several

studies identified from the systematic literature reviews, although uniformly favorable to primary care, did not meet these criteria and were therefore excluded.

PRIMARY CARE AND HEALTH: THE EVIDENCE

A. Health outcomes and the supply of primary care physicians

These studies, as a group, cover a variety of health outcomes: total and cause-specific mortality, low birth weight, and self reported health. They examined the relationship between primary care physician supply and health at different levels of geographic aggregation (state, county, metropolitan and non-metropolitan regions); after controlling for a variety of population characteristics (such as income, education, and racial distribution); and used a variety of analytic approaches (standard regressions, path analyses) in both individual years (cross-sectional) as well as over time (longitudinal).

The number of primary care physicians per 10,000 population is the measure of "supply". Primary care physicians include family and general practitioners, general internists, and general pediatricians. These three types of physicians constitute the primary care physician workforce and have been shown to provide the highest levels of primary care characteristics in their practices (Weiner and Starfield 1983).

The following provides a brief summary of each of the studies.

Studies in the early 1990s (Shi 1992, 1994) showed that US states with higher primary care physician to population ratios had better health outcomes, including lower rates of all-cause mortality; mortality from heart disease, cancer, or stroke, infant mortality, low birth weight, and poor self-reported health, even after controlling for sociodemographic measures (% elderly, % urban, % minority, education, income, unemployment, pollution) and lifestyle factors (seatbelt use, obesity, and smoking). Vogel and Ackerman (1998) subsequently showed that the supply of primary care physicians is associated with an increase in life span and with reduced low birth weight rates.

Other studies added sophistication to these early studies by examining the relationship between primary care and health after considering other potentially confounding characteristics. One of these confounders is income inequality, which concerns the extent to which income is concentrated in certain social groups rather than being equitably distributed. In 1999, Shi et al reported that both primary care and income inequality had a strong and significant influence on life expectancy, total mortality, stroke mortality, and postneonatal mortality at the state level. Smoking rates were also found to be related to these outcomes, but the effect of primary care physician supply

persisted after controlling for smoking (Shi et al 1999). A subsequent study confirmed these findings, this time using self-assessed health as the health outcome (Shi and Starfield 2000). These relationships remained significant after controlling for age, sex, race/ethnicity, education, paid work (employment and type of employment), hourly wage, family income, health insurance, physical health (SF-12), and smoking.

Additional studies examined the influence of primary care physician supply at the state level while also taking into account specialist physician supply. These analyses found, both in the same year as well as in time-lagged (over the period 1985-95) analyses, that primary care physician supply was significantly associated with lower all-cause mortality whereas greater specialty physician supply was associated with higher mortality. When primary care physician supply was disaggregated into its components (family physicians, general internists, and pediatricians), only family physician supply showed significant relationships with lower mortality (Shi et al 2003a).

Mortality attributed to cerebrovascular stroke also was found to be influenced by primary care physician supply. Using 11 years of state-level data and adjusting for income inequality, educational level, unemployment, racial/ethnic composition, and percent urban, the primary care physician supply remained significantly associated with reduced mortality, even wiping out the adverse effect of income inequality (Shi et al 2003b).

Consistent with the findings on total and cause-specific mortality, reduction in low birth weight at the state level was significantly associated with primary care physician supply in the concurrent year as well as after one-, three-, and five-year lag periods (Shi et al 2004). Higher primary care physician supply was associated with lower infant mortality as well. The association with primary care physician supply persisted after controlling for a variety of socioeconomic characteristics and income inequality.

County-level analyses confirmed the positive influence of primary care physician supply in showing that all-cause mortality, heart disease mortality, and cancer mortality are lower where primary care physician supply is greater. When urban areas (counties including a city with at least 50,000 people) and non-urban areas were examined separately (Shi et al 2005b), non-urban counties with high primary care physician supply experienced 2% lower all-cause mortality, 4% lower heart disease mortality, and 3% lower cancer mortality than non-urban counties with lower primary care physician supply. In urban areas, however, the relationship appeared more complex, possibly as a result of the lesser degree of income inequality in urban areas and greater racial differences in these areas. A study concerning premature mortality (mortality before age 75) in US metropolitan, urban, and rural areas found inconsistent relationships with primary care physician supply, possibly due to statistical instability resulting

from the way in which physician supply was categorized, which was inappropriate for areas with great variability in physician supply as well as population size (Mansfield et al 1999).

Analyses conducted in counties in the state of Florida used cervical cancer mortality as the health outcome. Controlling for a variety of county-level characteristics (percentage white, low educational level, median household income, percentage of females married, and urban/non-urban), each one per 10,000 population increase in the supply of family physicians was associated with a decrease in mortality of .65 per 100,000 population. That is, a one-third increase in the supply of family physicians was associated with a 20% lower mortality from cervical cancer. The positive effect of primary care was also found in the significant relationships between reduced mortality and the supply of general internists, but not with the supply of obstetrician-gynecologists (Campbell et al 2003).

The relationship between primary care physician supply and better health is not limited to studies in the United States. In England, the standardized mortality ratio for all cause mortality at 15-64 years of age is lower in areas with a greater supply of general practitioners. (In England, pediatricians and internists are not considered and do not function as primary care physicians.) Each additional general practitioner per 10,000 population (a 15-20% increase) is associated with a decrease in mortality of about 6% (Gulliford 2002). A subsequent study (Gulliford et al 2004) found that the ratio of general practitioners to population was significantly associated with lower all-cause mortality, acute myocardial infarction mortality, avoidable mortality, acute hospital admissions (both chronic and acute), and teenage pregnancies, but statistical significance disappeared after controlling for socioeconomic deprivation and for partnership size, which the authors interpreted as suggesting that the structural characteristics of primary care practices may have more of an impact on health outcomes than the mere presence of primary care physicians.

General practitioner supply also has high salience for in-hospital mortality, such that it is more highly associated with lower in-hospital standardized mortality than is the total number of physicians per 100 hospital beds (Jarman et al 1999).

In summary, the studies are consistent in showing a relationship between more or better primary care and most health outcomes studied. Primary care is associated with improved health outcomes regardless of the year (1980-1995), after variable lag periods between assessment of primary care and assessment of health outcomes, level of analysis (state, county, or local area), or type of outcome as measured by all cause mortality, heart disease mortality, stroke mortality, infant mortality, low birth weight, life expectancy, and self rated health. The effect is

also found for cancer mortality in all but a few studies. The magnitude of improved health associated with an increase of one primary care physician per 10,000 population (a 12.6% increase over current average supply) averages 5.3%. The results of these studies suggest that as many as 127,617 deaths per year in the US could potentially be averted through such an increase in the number of primary care physicians (Macinko, Starfield, and Shi 2005).

B. Studies of health according to people's relationship with primary care facilities and providers

Because an increased number of primary care physicians does not necessarily mean that all people in the area have greater access to or receipt of primary care services, analyses that consider people's relationships or experiences with a primary care practitioner are helpful in examining the primary care-health outcome association. Thus the second line of evidence for a positive impact of primary care on health comes from comparisons of the health of people who do or do not have a primary care physician as their regular source of primary care.

A nationally representative survey showed that adult US respondents who reported a primary care physician rather than a specialist as their regular source of care had lower subsequent 5-year mortality, after controlling for initial differences in health status, demographic characteristics, health insurance status, health perceptions, reported diagnoses, and smoking status (Franks and Fiscella 1998). That is, people who go to a primary care physician as their regular source of care have subsequent better health regardless of their initial health or various demographic characteristics.

Populations served by community health centers in the US, which are required to be oriented towards primary care as a condition for federal funding, have better health than populations with comparable levels of social deprivation receiving care in other types of physician's offices or clinics (O'Malley et al 2005). People receiving care in community health centers receive higher levels of indicated preventive services than is the case in the general population (Agency for Healthcare Research and Quality 2004). A comparison of rural patients receiving care in these community health centers with patients receiving care in other types of facilities showed that, despite being sicker, they are significantly more likely to have received a pap smear in the previous three years, more likely to have been vaccinated against pneumococcal infection, and to have lower percentages of low birth weight babies (Regan et al 2003).

In some health systems, both in the US and abroad, people normally go to their primary care physician before seeking care elsewhere (such as from another type of physician). In Spain, strengthening of primary care by reorganizing services to better achieve its main features was mandated by a new law in the mid-1980s, which led to the establishment of a national program of primary health care centers. The impact of this reform on health was evaluated after 10 years by examining mortality for some major causes of death (Villalbi et al 1999). Death rates associated with hypertension and stroke fell most in those zones in which reform was first implemented. Even lung cancer deaths increased less in areas with primary care reform than in other areas. Health outcomes that would not be expected to be influenced by primary care, e.g., perinatal mortality, did not differ across the areas.

Outcomes of care after surgery in Canada have also been shown to be better when care was sought from a primary care physician who then referred children to specialists for recurrent tonsillitis or otitis media, as compared with self-referral to a specialist (Roos 1979). The referred children had fewer postoperative complications, fewer respiratory episodes following surgery, and fewer episodes of otitis media after surgery, thus suggesting that specialist interventions are more appropriate when patients are referred from primary care.

And, finally, it should be noted that Cuba and Costa Rica, which reformed their health systems to enable people to have a source of primary care, now have much lower infant mortality rates than do other countries in Latin America. In Cuba, infant mortality rates now are on a par with those in the United States (Waitzkin et al 1997; Riveron Corteguera 2000, PAHO 2005).

Thus, the findings from studies of the impact of actually receiving care from a primary care source are consistent in showing benefits on a variety of health and health-related outcomes.

C. Studies of health according to how well the characteristics of primary care are achieved.

As noted in the introduction, until recently primary care could be assessed only by determining the type of physician who provided it: family physicians, general internists, and general pediatricians in the US, and family physicians or general practitioners in most other industrialized countries. The intensive examination of criteria for the designation of “primary care” in the most recent half century encouraged the development of tools to assess the adequacy of those health delivery characteristics which, in combination, define the practice of primary care. This development made it possible to examine the extent to which receipt of better primary care is associated with better health.

Using these new methods, several studies have demonstrated a positive association between the adequacy of the features of primary care and provision of preventive services. In a cross-sectional study using a representative sample of 2,889 patients in Ohio, the four primary care attributes (Table 1) were evaluated for their relationship with delivery of preventive services. After controlling for patient age, race, health, and insurance in the hierarchical linear regression model (HLM), each of the measured primary care attributes was significantly associated with patients being up to date on screening, immunization, and health habit counseling services (Flocke, Stange, and Zyzanski 1998). In another study, adolescents with the same regular source of care for preventive and illness care (one indication that the source is focused on providing primary care) are much more likely to receive indicated preventive care and less likely to seek care in emergency rooms (Ryan et al 2001).

The positive impact of primary care also was shown by comparing the self-assessed health of those who actually experienced better primary care (as assessed by the health delivery characteristics of primary care) with those who reported less adequate primary care. Among those who reported better primary care, greater than 5% fewer people reported poor health and 6% fewer reported depression than was the case for people experiencing less adequate primary care. Just considering those who reported the best primary care experiences, 8% fewer reported poor health and more than 10% fewer reported feeling depressed as compared with those with less adequate primary care (Shi et al 2002).

Studies in two different areas of Brazil confirmed the relationship between the adequacy of primary care delivery characteristics and self-reported health. Macinko, Almeida, and Sa (2005), in a study in Petropolis, showed that patients who had better primary care experiences were more likely to report better health even after adjusting for other salient characteristics such as age of the individual, whether or not they had a chronic illness or a recent illness, household wealth, educational level, or type of facility in which they received their care. Using reports of parents about their children's primary care, Harzheim et al confirmed these findings in a study conducted in Porto Alegre (Harzheim 2005, personal communication).

INTERNATIONAL COMPARISONS

An extension of the approach that examines the impact of primary care according to the achievement of its characteristics is provided by international comparisons. Studies based on the characteristics of different health systems are particularly useful because they make it possible to assess the impact of various policy characteristics on

the practice and outcomes of primary care. Three studies, one using data from the mid-1980s and two from a decade later, demonstrated not only that countries with stronger primary care generally have better health but also that certain aspects of policy are important in establishing strong primary care practice.

The first study examined the association of primary care with health outcomes by means of an international comparison conducted in 11 industrialized countries (Starfield 1991, 1994). Primary care in each country was rated according to the four main characteristics of primary care practice: first-contact care; person focused care over time; comprehensiveness of care, and coordination of care, as well as two additional characteristics: family orientation and community orientation. Policy characteristics consisted of attempts to distribute health services resources equitably (according to extent of health needs in different areas of the country); universal or near universal financial coverage guaranteed by a publicly accountable body (government or government regulated insurance carriers); low or no co-payments for health services; percentage of physicians who are not primary care physicians; and professional earnings of primary care physicians relative to other specialists. (Operational definitions of these indicators and the method of scoring them are described in Starfield 1998.) The first important finding is that the score for the practice characteristics was highly correlated with the score for the policy characteristics. That is, the adequate delivery of primary care services is associated with supportive governmental policies. The second point is that those countries with low primary care scores as a group had poorer health outcomes, most notably for indicators in early childhood, particularly low birth weight and postneonatal mortality.

A more recent comparison, with 13 countries and an expanded set of indicators of both primary care policy characteristics and health outcomes, also showed better health outcomes for the primary care-oriented countries even after controlling for income inequality and smoking rates, most significantly so for postneonatal mortality ($r = .74$, $p < .001$), and rates of low birth weight ($r = .38$, $p < .001$). Countries with weak primary care also had poorer performance on most major aspects of health, including aspects of mental health such as years of potential life lost due to suicide (Starfield and Shi 2002). The positive impact of primary care orientation on low birth weight rates possibly reflects a beneficial effect of primary care on mothers' health *before* pregnancy (Starfield and Shi 2002; Davey Smith and Lynch 2004). The characteristics of primary care practice that were present in countries with high primary care scores and absent in countries with low primary care scores were degree of comprehensiveness of primary care (that is, the extent to which primary care practitioners provided a broader range of services rather than making referrals to specialists for those services) and a family orientation (the degree to which services were

provided to all family members by the same practitioner). The most consistent policy characteristics were government attempts to distribute resources equitably, universal financial coverage that is either under the aegis of the government or regulated by the government, and low or no patient cost sharing for primary care services (Starfield and Shi 2002). The latter two have been studied and confirmed by Or (2001).

The positive contributions of primary care to health were also found in a much more extensive time-series analysis including 18 industrialized countries, including the United States (Macinko, Starfield, and Shi 2003). The stronger the primary care orientation of the country (as measured by the same scoring system as in the earlier international comparison), the lower the all-cause mortality, all-cause premature mortality, and cause-specific premature mortality from asthma and bronchitis, emphysema and pneumonia, cardiovascular disease, and heart disease. The relationship was robust even after controlling for a variety of system characteristics (GDP per capita, total physicians per 1000 population, percentage of elderly people) and population characteristics, including average number of ambulatory care visits, per capita income, alcohol consumption, and tobacco consumption. The analyses estimated that increasing a country's primary care score by 5 points (on a 20-point scale) would be expected to reduce premature deaths from asthma and bronchitis by as much as 6.5%; reduction in premature mortality for heart disease could be as high as 15%.

Data from this study were also analyzed to ascertain the robustness of primary care scores over time. The average primary care score increased by nearly one point from the 1970s to the 1990s. Countries that were high performers in the 1970s remained high performers in each subsequent decade. When countries were divided into high and low performers (above or below the mean for each decade), no country crossed the threshold from low to high or from high to low. However, there were movements over time within the two groups of high and low performers. Only one country's score decreased over time; Germany decreased access to ambulatory care services by imposing increased copayments, thus lowering its overall primary care score (Organization for Economic Cooperation and Development 2001). In general, policy changes over time were parallel to improvements in primary care practice. For example, in the late 1980s and early 1990s, Spain strengthened primary care by moving to a tax-based financing system, improving geographic allocation of funds, and increasing the supply of family physicians as well as by developing primary health care centers that improved integration, family orientation, coordination of care, and health promotion services (Larizgoitia and Starfield 1997). The United States score improved slightly over time, almost entirely as a result of increased participation of Americans in health maintenance organizations (HMOs),

which tend, on average, to use a higher percentage of primary care practitioners (Weiner 2004) and have (at least among the not-for-profit HMOs) a tradition of community involvement (Stevens and Shi 2003).

PRIMARY CARE AND DISPARITIES IN HEALTH OUTCOMES

Both the World Health Organization and many countries (including the United States) have recognized the existence of marked disparities ("inequities") in health across population subgroups and have identified reductions (and even elimination in the case of the US) of these as a priority (Sachs and McArthur 2005; United States Department of Health and Human Services 2000). In reviewing the impact of primary care on reductions in disparities in health, this section follows the pattern of the previous section in including studies of physician supply, studies of the association with a primary care physician, and studies of receipt of services that fulfill the criteria for primary care delivery.

Higher primary care physician to population ratios are associated with relatively greater effects on various aspects of health in more socially deprived areas (as measured by high levels of income inequality). Areas with high primary care resources and high income inequality have 17% lower postneonatal mortality (compared with the population mean) whereas postneonatal mortality in high inequality areas with low primary care resources was 7% higher. For stroke mortality, the comparable figures were 2% lower mortality where primary care resources were high and 1% higher where the primary care resources were low (calculated from data in Shi et al 1999). These findings are even more striking in the case of self-reported health. Income inequality and primary care are significantly associated with self-rated health, but primary care physician supply significantly reduces the effects of income inequality on self-reported health status (Shi and Starfield 2000). People in high income inequality areas are 33% more likely to report fair or poor health if primary care resources are low (calculated from data in Shi and Starfield 2000).

As in state-level analyses, the adverse impact of income inequality on all-cause mortality, heart disease mortality, and cancer mortality is considerably reduced in the presence of more primary care physicians in county-level analyses (Shi et al 2005a).

The primary care physician supply in US states has a larger positive impact on low birth weight and infant mortality in areas with high social inequality than in areas with less social inequality (Shi et al 2004).

Eleven years of state-level data found primary care physician supply to be significantly related to lower all-cause mortality in both African-American and white populations, after controlling for income inequality and socioeconomic characteristics (metropolitan area, percent unemployed, and educational levels). In these state-level analyses, the primary care physician supply had a greater positive impact on mortality among African Americans than among whites. Inclusions of both primary care physician supply and sociodemographic characteristics eliminated the negative impact of income inequality. The association between higher primary care physician supply and lower total mortality was found to be four times greater in the African-American population than in the white majority population, indicating a reduction in racial disparities in mortality in US states (Shi et al 2005c). However, in exploring further the relationship between primary care physician supply and health outcomes in African-American and white populations in metropolitan areas of the US, both primary care supply and income inequality were significantly associated with total mortality rates in the white population, whereas only income inequality maintained its significant relationships in African-American populations (Shi and Starfield 2001). The authors interpreted this finding as suggesting that, in many urban areas, a high primary care physician supply does not assure access to primary care for certain population subgroups, which may continue to receive their care in places such as in hospital clinics and emergency rooms, which, in contrast to places such as federally-qualified community health centers, are not oriented to achieving primary care characteristics.

The equity-related effect of having a good primary care source also was found in the study that examined the degree of primary care orientation of services received by people. Good primary care experiences were associated with reductions in the adverse effects of income inequality on health, as differences in self-rated health between higher and lower income inequality areas were reduced where primary care experiences were stronger (Shi et al 2002); although similar in direction of effect, the relationship with “feeling depressed” was not statistically significant.

In county-level analyses in which urban areas were stratified by race, primary care physician supply had a strong and significant influence on white mortality in both low and high income inequality areas, but only a weak association in African-American mortality in low income inequality areas and no significant association in high income inequality areas (Shi et al 2005b).

Thus, in US studies, primary care physician supply has been shown to reduce disparities in health across racial and socioeconomic groups. Multivariate analyses controlling for individual, community, and state-level

characteristics provide strong evidence for the association of primary care with reduced disparities in a variety of aspects of health.

These conclusions are buttressed by a study comparing the type of place where care is received. Disparities between low birth weight percentages between the majority white and African-American infants are lower in infants born of mothers receiving care in primary care-oriented community health centers as compared with the population as a whole. In both white and African-American populations in both urban and rural areas in the US, rates of low birth weight are lower, both in absolute numbers as well as by ratios of rates, where the source of care is a community health center (Politzer et al 2001).

A study of civil servants in the UK, where access to primary care physicians is universal, found that socioeconomic differences in coronary heart disease mortality are NOT a result of differences in cardiac care (Britton et al 2004). Another exploration of the effect of primary care found that blacks in London have no greater rates of diabetes-related lower-extremity amputation than whites (Leggetter et al 2002) whereas blacks in the United States have rates 2-3 times that in the white population. In the UK, the rates are lower in black men than in the white population, a difference wholly accounted for by lower rates of smoking, neuropathy, and peripheral vascular disease. The findings persisted even after control for socioeconomic differences, thus confirming other findings (van Doorslaer, Koolman, and Jones 2004) that a health system oriented towards primary care services (such as in the UK) reduces the disparities in health care that are so prominent in the US (Agency for Healthcare Research and Quality 2004).

Primary care programs aimed at improving health in deprived populations in less developed countries succeed in narrowing gaps in health between socially deprived populations and more socially advantaged ones. A matched case-control study in Mexico (Reyes et al 1997) found that aspects of primary care delivery had an important independent effect in reducing the odds of children dying in socially deprived areas. These processes included adequate referral mechanisms, continuity of care (being seen by the same provider at each visit), and being attended in a public facility designed to provide primary care. A study in Bolivia (Perry et al 1998) found that a community-based approach to planning primary health care services in socially deprived areas reduced under-five mortality as compared with adjacent similar areas or the country as a whole.

The case of Costa Rican primary care reforms in the 1990s, which were instituted first in the most socially deprived areas, illustrates the importance of primary care in reducing health disparities. The Costa Rican primary

care reforms of the 1990s included transfer of responsibility for provision of health care from the Ministry of Health to the Costa Rican Social Security Fund (CCSS), expansion of the number of primary care facilities--particularly in underserved areas, and the re-organization of primary care into "Integrated Primary Care Teams" or EBAIS (Equipos Básicos de Atención Integral en Salud) that consist of teams of health professionals assigned to a geographic region consisting of about 1000 households (Rosero-Bixby 2004b). By 1985, Costa Rica's life expectancy reached 74 years, and infant mortality rates improved from 60/1,000 live births in 1970 to 19/1,000 live births – levels comparable to those in more developed countries. Primary health care improvements were estimated to have reduced infant mortality by between 40% and 75%, depending on the particular study (Klijzing and Taylor, 1982; Haines and Avery, 1982; Rosero-Bixby 1986). For every five additional years after primary health care (PHC) reform, child mortality was reduced by 13%, and adult mortality was reduced by 4%. The quasi-experimental nature of the study provides evidence of the power of PHC policies and services provision to improve health – above and beyond improvements in social and economic indicators (which were controlled for in the longitudinal analyses) (Rosero-Bixby 2004a).

Studies in other developing countries show the considerable potential of primary care to reduce the large disparities associated with socioeconomic deprivation. In seven African countries, the most wealthy 20% of the population receives well over three times as much financial benefit from overall government spending as the lowest 20% of the population (40% versus 12%). For primary care services, the rich-poor ratio in distribution of government expenditures is notably lower (23% to the top group versus 15% to the lowest group) (Castro-Leal et al 2000), leading one international expert to conclude that, "from an equity perspective, the move toward primary care represents a clear step in the right direction" (Gwatkin 2001). An analysis of preventable deaths in children concluded that, in the 42 countries accounting for 90% of child deaths worldwide, 63% of deaths could have been prevented by full implementation of primary care. The primary care interventions included integrated care that addresses the very common problems of diarrhea, pneumonia, measles, malaria, HIV/AIDS, preterm delivery, neonatal tetanus, and neonatal sepsis (Jones et al 2003).

Thus, except in metropolitan areas, where increased primary care physician supply alone may not be associated with reductions in disparities between African-Americans and whites, the findings of reduced disparities by primary care are consistent across all types of studies and are particularly notable in studies examining the actual receipt of primary care services.

COSTS OF CARE

In addition to its relationship with better health outcomes, the primary care physician supply is associated with lower total costs of health services. Areas with higher primary care physician to population ratios have much lower total health care costs than other areas, possibly in part due to better preventive care and lower hospitalization rates. This has been demonstrated to be the case for the total adult population in the US (Franks and Fiscella 1998), as well as among the elderly in the US who live in metropolitan areas (Welch et al 1993; Mark et al 1996). Baicker and Chandra's (2004) analysis showed a linear decrease in Medicare spending with an increase in the primary care physician supply, concomitant with increased in quality of care (as measured by 24 indicators concerning the treatment of six common medical conditions). In contrast, the supply of specialists was associated with increased spending and worse quality of care.

Care for illnesses common in the population, e.g., community-acquired pneumonia, is more expensive if provided by specialists than if provided by generalists, with no difference in outcomes (Whittle et al 1998; Rosser 1996).

Consistent with the findings within countries, international comparisons of primary care show that, countries with weaker primary care have significantly higher costs ($r = .61$, $p < .001$) (Starfield and Shi 2002).

RATIONALE FOR THE BENEFITS OF PRIMARY CARE ON HEALTH

Six mechanisms, alone and in combination, may account for the beneficial impact of primary care on population health. They are 1. increased access to needed services, 2. better quality of care, 3. a greater focus on prevention, 4. early management of health problems, 5. the cumulative effect of the main primary care delivery characteristics, and 6. the role of primary care in reducing unnecessary and potentially harmful specialist care.

1. Primary care increases access to health services for relatively deprived population groups.

Primary care, as the point of first contact with health services, facilitates entry to the rest of the health system for those who need it. Most other industrialized countries have achieved universal and equitable access to primary health services, some of them directly provided and others through assurance of financial coverage for visits (van Doorslaer, Koolman, and Jones 2004). In the US, socially deprived population subgroups are more likely than more advantaged people to lack a regular source of care. The evidence is striking with regard to family income, for

which there are marked gradients in having a regular source of care, hovering around 80% for the poor and near-poor to near 90% for those with middle income, approaching 95% for those with high income, and increasing over time from 1999 to 2001 mainly for those with high income (Agency for Healthcare Research and Quality 2004).

The beneficial impact of health insurance in the United States is largely to facilitate access to primary care (Starfield and Shi 2004; Lillie-Blanton and Hoffman 2005). In the absence of health insurance, socially deprived population groups are less likely to have a source of primary care and thus suffer compromised access to the entire health system. Over the past several decades, attempts to improve access have been mounted by means of expanding eligibility for reimbursement by public funds through Medicare, Medicaid, and related programs such as the State Child Health Insurance Program. Some but not all of these efforts have been accompanied by incentives or even mandated enrollment with a regular source of care, and disparities in identification with a regular source of care have been reduced. However, differences in receipt of good primary care services persist (Stevens and Shi 2002; Seid et al 2003; Shi 1999; Taira 1997). Shi's national study of adults (1999) demonstrated not only differences in the likelihood of having a regular source but also (and more marked) differences in the type of that regular source, with minorities more likely to report a place rather than a person as their regular source of care; having a specialist (other than a primary care physician) if they reported a physician as their source of care; and to experience longer delays in obtaining needed services after controlling for having a regular source of care. The same is the case for children (Newacheck et al 1996). Others have shown that minority children are more likely to use an emergency room as their source of care (Weitzman, Byrd, and Auinger 1999). After controlling for having a regular source of care, there are few if any differences in reporting difficulty in obtaining needed services.

Analyses reported by Weinick and Krauss (2000) and Lieu et al (1993) confirmed the finding that difficulties in access to care are much less or non-existent when the source of care is a primary care source. Once they do have access to adequate primary care services, deprived minority groups often report better experiences with their care than the majority white population, particularly when the studies are conducted in organized health care settings that, by design, eliminate many of the access barriers to primary care services (Taira et al 1997; Murray-Garcia et al 2000; Morales et at 2001).

Thus, a major function of a primary care source is to reduce or eliminate difficulty with access to needed health services.

2. The primary care contribution to the quality of clinical care

Studies designed by specialists to compare the quality of care between specialty and generalist practice often find that specialists are better at adhering to guidelines. For example, adhering to guidelines for asthma management is better in practices of specialists dealing with asthma (Bartter and Pratter 1996), and gastroenterologists have been found to adopt antibiotic therapy for helicobacter pylori earlier than generalists (except if the generalists are in groups with gastroenterologists) (Hirth, Fendrick, and Chernew 1996). Most studies that compare generalists and specialists conclude that condition-specific quality of care provided by specialists is better when the condition is in the specialist's area of special interest, using indicators of quality of care such as the performance of disease-specific preventive procedures, the performance of indicated laboratory tests for monitoring disease status, and the prescribing of indicated medications (Harrold, Field, and Gurwitz 1999).

However, the findings concerning superior quality of care by specialists are not confirmed by other studies. In a demonstration of the effectiveness of primary care for diabetes, general practitioner (GP) diabetic clinics in the UK were found to do as well as hospital specialists in monitoring for diabetic complications (Parnell, Zalin, and Clarke 1993). Also, in systems where the GPs are provided with additional educational support and have an organized system for recall, GP care for diabetic patients is better than that of specialists in hospitals. In such situations, patients of GPs have lower mortality and better glycemic control than patients treated by specialists (Griffin and Kinmonth 1998). Rates of complications, readmission to hospital, and length of convalescence were the same after early discharge from the hospital after minor surgery, regardless of whether the care was provided by hospital outpatient department or general practitioners (Kaag, Wijkel, and deJong 1996). Moreover, the few studies planned and executed by generalists (Donohoe 1998; Grumbach et al 1999) conclude that quality of care is the same or that primary care is better. These differences suggest differences in conceptualization of appropriate "outcomes" by the two types of physicians, with specialists more concerned with specific disease-related measures and adherence to guidelines for these diseases and primary care physicians more targeted on multiple aspects of health, i.e., "generic" health. Assessing generic outcomes, or quality of care OTHER than for the particular conditions under study, is important in view of the fact that co-morbidity is common and that it engenders more visits to both generalists and specialists than do most given specific conditions (Starfield et al 2003; Starfield, Lemke et al 2005). If the interest is in patient health (rather than disease processes or outcomes) as the proper focus of health services, primary care provides superior care, especially for conditions that are commonly seen in primary care, by focusing

not primarily on the condition but on the condition in the context of other health problems or concerns that the patient may have.

Thus, primary care physicians do at least as well as specialists in caring for specific common diseases and do better overall when the measures of quality are generic. For less common conditions, care provided by primary care physicians with appropriate back-up from specialists may be optimum; for rare conditions, appropriate specialist care is undoubtedly important, as primary care physicians would not see such conditions frequently enough to maintain competence in managing them.

3. The impact of primary care on prevention

The evidence is strong in showing that it is in primary care that preventive interventions not related to any one disease or organ system are best carried out. Examples of these "generic" (i.e., not limited to a particular disease or type of disease) measures are breastfeeding, not smoking, use of seat belts, use of smoke detectors, physical activity, and healthy diets. US states with higher ratios of primary care physicians to population have lower smoking rates, less obesity, and higher seatbelt use than states with lower primary care to population ratios (Shi and Starfield 2000; Shi 1994). Good primary care, as assessed by peoples' ratings of its main characteristics, is positively associated with smoking cessation and influenza immunization, as shown in an ongoing 60-community study in the US (Saver 2002). The likelihood of disadvantaged children having any preventive visits is much greater when their source of care is a good primary care practitioner (Gadomski, Jenkins, and Nichols 1998).

To the extent that many preventive activities are focused on early detection of specific diseases ("secondary prevention"), the quality of primary care (as compared with specialty care) would not necessarily be expected to be better. However, the evidence suggests otherwise for those conditions that are common and hence in the purview of primary care. A greater supply of family physicians (although not necessarily internists) is associated with earlier detection of breast cancer, colon cancer, cervical cancer, and melanoma (Campbell et al 2003; Ferrante et al 2000; Roetzheim et al 2000; Roetzheim et al 1999). Ferrante et al (2000) found that each tenth percentile increase in primary care physician supply was associated with a statistically significant 4% increase in the odds of early (rather than late) stage diagnosis. Most mammograms (87%) are ordered by primary care physicians (Schappert 1994); physician advice to have mammograms enhances the receipt of mammograms (Fox, Siu, and Stein 1994; Breen and Kessler 1994; NCI Breast Cancer Screening Consortium 1990; Campbell et al 2003; Roetzheim et al 1999; Roetzheim et al 2000). Another study of differences between primary care physicians and specialists caring for

patients with hypertension, non insulin-dependent diabetes, recent myocardial infarction, or depression showed that the only preventive care procedures better performed by specialists were checks for foot-ulcer and infection status among diabetic patients of endocrinologists (Greenfield et al 1992). Moreover, approaches to prevention in primary care practice are more generic and result in more improvement in patients' health status than is the case in specialty-oriented practice (Bertakis et al 1998). When data are obtained from the general community rather than from practices, having a good primary care source is the major determinant of receiving even disease-focused preventive care consisting of blood pressure screening, clinical breast exams, mammograms, and pap smears (Bindman et al 1996).

4. The impact of primary care on early management of health problems

Another mechanism for the benefit of primary care is its demonstrated impact on managing health problems before they are serious enough to require hospitalizations or emergency services. Several studies support the effectiveness of this role.

Shea and colleagues (1992) examined the relationship between having a primary care physician as the source of care and hospitalization for reasons that should be preventable by good primary care. Men with hypertension who were admitted to the hospital from the emergency room in a large metropolitan area were classified into two groups. One group was composed of those who were admitted for a preventable complication of hypertension; men in the other group were admitted for a condition unrelated to hypertension. The study found that those admitted for the preventable complication were four times more likely to lack a primary care provider than those admitted for a condition unrelated to hypertension, even after considering other factors such as absence of health insurance, level of compliance with anti-hypertensive regimens, or alcohol or drug use-related problems, thus indicating that those with a primary care provider were relatively more protected against hospitalization for a preventable complication of a common medical problem.

In the United Kingdom, each 15-20% increase in GP supply per 10,000 population is significantly associated with a decrease in hospital admission rates of about 14 per 100,000 for acute illnesses and about 11 per 100,000 for chronic illnesses, even after controlling for degree of social deprivation in the area in which people live, their social class, ethnicity, and limiting long-term illness (Gulliford 2002).

In the United States, rates of hospitalization for conditions that should be preventable by exposure to good primary care (ambulatory care-sensitive conditions or ACSC) are strongly associated with socioeconomic

deprivation, at least in part because socially disadvantaged populations are less likely to have a good source of primary care (Agency for Healthcare Research and Quality 2004; Hansell 1991; Stevens and Shi 2002). In contrast, in Spain, rates of hospitalization for these conditions are not associated with socioeconomic characteristics, suggesting that a primary care orientation of the Spanish health system reduces hospitalization rates for these conditions even in the face of social disadvantage (Casanova, Colomer, and Starfield 1996; Casanova and Starfield 1995).

In a large multi-specialty comparison of hospitalization rates, Greenfield et al found that rates of hospitalization are 100% higher when ongoing care is provided by cardiologists and 50% higher when provided by endocrinologists compared with family physicians (Greenfield et al 1992).

The literature is consistent in showing that lower rates of hospitalization for ACSC are strongly associated with receipt of primary care. Geographic areas with more family and general practitioners have lower hospitalization rates for these types of conditions, including diabetes mellitus or hypertension, pneumonia, diabetes mellitus) (Parchman and Culler 1994). Children receiving their care from a primary care source that fulfills the criteria for its main characteristics have lower hospitalization rates for these conditions as well as a lower hospitalization rate overall; these findings are associated with better receipt of preventive care received from primary care providers (Gadomski, Jenkins, and Nichols 1998). Rates of hospital admissions of children are lower in US communities in which primary care physicians are more involved in the care of children both before and during hospitalization (Perrin et al 1996). Adolescents with the same regular source of care for preventive and illness care are less likely to seek care in emergency rooms (Ryan et al 2001). An analysis of national Medicare data showed that the elderly in the United States who are in fair or poor health are more likely to experience a potentially preventable hospitalization if they live in a county designated as primary care shortage area (Parchman and Culler 1999).

Only two studies failed to find a positive impact of primary care physician supply and hospitalizations for conditions sensitive to primary care management. Both were conducted in only one state (Ricketts et al 2001; Schreiber et al 1997). In both studies (in New York and North Carolina) socioeconomic characteristics were more salient and it is possible that, in some places, the availability of more primary care physicians does not necessarily mean that deprived populations have access to them. A later study in one of those states (New York) showed that the primary care physician to population ratios was one of the more salient factors associated with lower levels of hospitalizations for ACSC (Friedman and Basu 2001).

5. The accumulated contribution of primary care characteristics to more appropriate care

As noted in the previous section on quality of care, the beneficial effects of primary care on mortality and morbidity can be attributed, at least in part, to the focus of primary care on the person rather than on the management of particular diseases. Person-focused care is achieved when practitioners attend to overall aspects of people's health rather than to the care of specific diseases they may have; it focuses on achieving better outcomes for health in all of its aspects rather than on procedures directed at improving the processes or outcomes of care for particular conditions. Other aspects of health services delivery that are characteristic of primary care also have been associated with better health outcomes. Although an extensive review of the positive contribution of each of these characteristics is outside the scope of this review (which concerns primary care as an entity within health services systems) and has been covered elsewhere (Starfield 1998), a brief summary of these contributions makes it possible to understand why primary care as a whole might have positive effects.

We noted earlier that an important element of primary care is its role as the first contact for patients when a problem develops. In a seminal article entitled "Gatekeeping revisited – protecting patients from overtreatment", Franks, Clancy, and Nutting (1992) made the case for seeing a primary care physician prior to seeking care from another type of physician. Having a relationship with a primary care practitioner who can serve as an initial point of contact is strongly and statistically significantly associated with reduced use of specialists and emergency rooms (Martin et al 1989, Hurley, Freund, and Taylor 1989). Continuity of care, which implies that individuals use their primary source of care over time for most of their health care needs, is associated with improved satisfaction, better compliance, lower hospitalization and emergency room use (Rosenblatt et al 2000; Mainous and Gill 1998; Freeman and Hjortdahl 1997; Weiss and Blustein 1996). Previous knowledge of a patient, which reflects good continuity of care, increases the odds of the doctor recognizing psychosocial problems influencing the patient's health (Gulbrandsen, Hjortdahl, and Fugelli 1997). Both continuity and first-contact attributes of primary care assure greater efficiency of services in the form of time saved in the consultation, reduced use of laboratory tests, and reduced health care expenditures (Raddish, Horn, and Sharkey 1999; Forrest and Starfield 1996, 1998; Roos, Carriere, and Friesen 1998; Hjortdahl and Borchgrevink 1991). Very short-term relationships with physicians are associated with poor outcomes. For example, veterans with chronic disease who did not have a previous relationship with a primary care physician were randomized to receive an intervention of increased follow-up by a newly assigned nurse and a primary care physician after hospital discharge. Re-hospitalization rates six months later were

higher in this intervention group (Weinberger, Oddone, and Henderson 1996), thus indicating that relationships over time are an important component of primary care. (The study did not assess re-hospitalization rates for veterans who already had a primary care provider, and it may be that assignment of such a provider to people without an existing relationship led to the discovery of new conditions not previously recognized and requiring hospitalization.) At least two years of a relationship (and as many as five) are generally required for patients and practitioners to know each other well enough to provide optimum person-focused care (Starfield 1998, p. 175). A freely chosen primary care practitioner provides better assurance that a good relationship will be achieved than is the case if the practitioner is assigned (Starfield 1998, p. 151). Evidence is strong on the benefits of an ongoing relationship with a particular provider rather than with a particular place or no place at all. People with no source of primary care are more likely to be hospitalized, to delay seeking needed and timely preventive care, to receive care in emergency departments, to have higher subsequent mortality and higher health care costs, and less likely to see a physician in the presence of symptoms. People with just a place (such as a particular hospital clinic) are somewhat better off than those without a regular source of care, in that they are more likely to keep their appointments, have fewer hospitalizations and lower costs, and receive generally better preventive care. In addition, people who report a particular doctor as their regular source of care receive more appropriate preventive care, have their problems better recognized, have fewer diagnostic tests and fewer prescriptions, have fewer hospitalizations and visits to emergency departments, and are more likely to have more accurate diagnoses and lower costs of care than either people having a particular place or people having no place at all as their regular source of care (Starfield 1998, chapter 8).

The benefits of the other two main attributes of good primary care (comprehensiveness and coordination) are less abundantly documented, but existing evidence has been summarized by Starfield (1998, chapters 10 and 11).

6. The role of primary care in reducing unnecessary or inappropriate specialty care.

Virtually all studies of specialist services have concluded that there is either no effect or an adverse effect on major health outcomes from increasing the supply of specialists of increased specialist supply in the United States, which already has a much greater supply of such physicians than other industrialized countries (Starfield, Shi et al 2005). This evidence addresses a wide variety of population health outcomes, including all-cause (total) mortality; heart and cerebrovascular disease mortality; cancer mortality; postneonatal, neonatal, and total infant mortality; and low birth weight, as well as early detection of various cancers including cervical cancer, colorectal cancers, breast cancer, and melanoma (evidence reviewed in Starfield, Shi et al 2005). The evidence is also

consistent that first contact with a primary care physician (before seeking care from a specialist), is associated with more appropriate, more effective, and less costly care (Starfield 1998, chapter 7).

Other countries, most notably the UK and Netherlands, have led the way with primary care innovations to reduce inappropriate seeking of specialist services. These include making better use of information systems and video-communications as well as consultation by specialists in primary care settings.

The adverse effects of seeking care directly from non-primary care specialists have a strong theoretical basis. Since the training of these specialists takes place in the hospital, the patients seen by specialists are not representative of the way in which patients present in community settings because the latter have a much lower prior probability of serious illness requiring the services of a specialist. The properties of diagnostic tests (sensitivity, specificity, predictive power of a positive test) are much different in populations with a high prevalence of serious illness than they are in community settings and thus much different in specialty care than in primary care settings. The result is that specialists practicing in the community over-estimate the likelihood of illness in the patients they see, with consequent inappropriate use of diagnostic and therapeutic modalities, both of which raise the likelihood of adverse effects (Sox 1996; Hashem, Chi, and Friedman 2003; Franks, Clancy, and Nutting 1992). Compared with other Anglophone countries, people in the US experience more adverse effects and medical errors (Schoen et al 2004). This, combined with evidence on the adverse effects of greater supplies of specialists and estimates of the likelihood of adverse effects of medical care, may be at least a partial explanation of the low ranking of the US on health status relative to similarly industrialized countries.

POTENTIAL LIMITATIONS OF THE INTERPRETATIONS OF EXISTING DATA ON PRIMARY CARE EFFECTIVENESS

Despite the consistency of the findings from various types of studies, areas, and populations, and the theoretical rationale for benefit of primary care on population health, it is possible that the results might be over-interpreted. Countries and areas in which primary care is strongest (however measured) may be areas in which other social interventions (such as income supports and welfare policies that influence health) are also strongest. So far, the effort to identify a constellation of social policies that influence health in a major way has not been successful (Graham and Kelly 2004).

Moreover, the mere presence of primary care physicians may not reflect the availability of primary care services to certain population groups. At least two of the reviewed analyses in urban counties showed that the supply of primary care physicians is less related to health of urban African-Americans than it is for urban whites or for African-Americans in rural areas. This is likely to be due to poorer distribution of primary care physicians in more deprived urban areas, with consequent greater seeking of care in places such as hospital outpatient units and emergency rooms. Supporting this hypothesis are two lines of evidence. First, African-Americans are more likely than whites to report having their regular source of care in a facility (such as a hospital) and to report a specialist as their regular source of care (Shi 1999). That is, primary care physicians in urban areas tend to locate in more socially advantaged areas (Weiner et al 1982). Consequently, hospital clinics with predominantly hospital-based physicians not trained to provide the important features of primary care become the "default" regular source of care. Second, even in the presence of adequate primary care resources, African-Americans may be less likely than other racial and ethnic groups to use primary care where other resources (such as hospital clinics) are available; this has been demonstrated to be the case for the medical care of inner city infants (Hoffmann, Broyles, and Tyson 1997). State level analyses are not as susceptible to this type of possible error because primary care is more evenly distributed than is specialty care (Shi and Starfield 2001).

If it is the case that supply of primary care physicians is less associated with health outcomes in urban African-Americans than in whites because of difficulties in access to them, the demonstrated association between supply and health outcomes may actually underestimate the potential impact of primary care services, particularly in deprived populations. Moreover, the studies that employ alternative measures of primary care, including relationships with a primary care physician and studies considering the adequacy of primary care health services delivery characteristics, all confirm the conclusion that care meeting the criteria for primary care is associated with better health of populations receiving it, with a greater impact in more deprived populations.

PRIMARY CARE IN THE FUTURE

What issues remain to be addressed in primary care to improve its contribution to health of populations and equity in distribution of health? A pervasive US focus on "access" to health services rather than on the type of health services has detracted from the need to assure that services are provided in the most appropriate places. Existing national data health interview surveys combine various safety net providers into one group so that people receiving

their care from hospital outpatient clinics are not distinguishable from those receiving care from primary care-oriented clinics. Combining primary care-focused community health centers with hospital emergency and outpatient departments as "safety net providers" will mask the high positive contributions to health of the former with the lesser primary care focus of the latter. Apart from the Community Health Center program of the federal Health Resources and Services Administration and the commitment of certain not-for-profit health care organizations to strong primary care (Weiner 2004), little or nothing has been done to assure that other "regular sources of care" fulfill the criteria for good primary care. In most other industrialized countries, primary care physicians are clearly distinguished from other physicians, and where people receive care is easily identified as primary care or specialty care. Greater appreciation that it is primary care that plays a major role in assuring access to health services should provide the rationale for better distinguishing primary care from specialty care in data on use of health services in the US.

At the very least, primary care has to be recognized as a distinct aspect of a health services system. There are now well-validated methods (for example, see Starfield et al 1998, Shi et al 2001) to assess both the presence and characteristics of primary care; all sources of data on use of health services should include at least a minimum set of these measures. Understanding people's primary care experiences (rather than or in addition to their satisfaction), including the extent to which they receive the range of services appropriate to their needs and have the care they receive elsewhere coordinated and integrated, are important aspects in evaluating the adequacy of health services.

In contrast to the situation in primary care, where intensive conceptual and methodologic study over the past several decades has resulted in a clear understanding of its important aspects, professional specialty groups in the US have made little if any attempt to define the practice of "specialism" or the circumstances that should lead to the seeking of care from specialists. Referrals to specialists apparently have three functions: short-term consultation for diagnosis or management; referral for long-term management of specific illnesses; and recurrent consultation for periodic management. A study of referrals from 80 office-based family practices showed that by far the most referrals for common conditions (over 50% of all referrals to most types of specialists) are expected to be short-term (less than 12 months); for more than 50%, they are for consultation only (no direct intervention) (Starfield et al 2002). Very little is known, however, about the relative frequency of these functions from the viewpoint of specialty practice. One report (Hewlett et al 2005) indicated that about 75% of visits to a pulmonary specialty clinic

are just for the purpose of "checkups", even though patients' primary care physicians, once they have access to specialists' reports, could just as easily perform this function and report the findings to the specialists. Such an approach to reducing the number of visits to specialists could reduce the demand for a greater supply of specialists; it at least deserves to be tested. There is an urgent need for information on indications for specialty care and for the impact on outcomes of direct access to specialists.

Major challenges to primary care practice concern: 1. adequate recognition and management of co-morbidity; 2. preventing the adverse effects of medical interventions; 3. maintaining high quality of the important characteristics of primary care practice; and 4. addressing the need to improve equity in health services and in health of populations (Starfield 2001).

1. Historically, principles of delivery of medical care have been based on the prevention and management of specific diseases. In the current climate of evidence-based medicine, guidelines for the management of diseases are proliferating and increasingly used. The development of guidelines is generally based on evidence from the literature that certain modes of management achieve better outcomes than others. The "gold standard" for evidence is the randomized controlled clinical trial, which generally excludes, as a requirement for participation in the trial, individuals with co-morbid conditions. Co-morbidity (the simultaneous presence of apparently unrelated conditions) is common in the population and not randomly distributed. Although co-morbidity increases in frequency with age, it is in the young that co-morbidity occurs much more frequently than expected by chance occurrence of two or more conditions (van den Akker et al 1998). (That is, the frequency of illness is much greater in the old than in the young so that there is much greater likelihood that two unrelated illnesses will be found together. In the young, illness is much less frequent so that, statistically, it is much less likely that two or more will be found together although, in fact, this is the case.) Data systems should be developed that provide a much better basis for examining the distribution and nature of co-morbidity in primary care; ascertainment of the impact of baseline risks on co-morbidity; likelihood of responsiveness to treatment in the presence of co-morbidity; and susceptibility to adverse effects of medical interventions. Moreover, the applicability to primary care of guidelines developed from randomized controlled clinical trials may be more limited than is generally thought, even apart from the issue of co-morbidity (Rothwell 2005; Kravitz, Duan, and Braslow 2004), particularly when considering the issue of disease-specific versus overall clinical endpoints (Fleming 2005).

2. Primary care practitioners are in the best position to detect the occurrence of potential adverse effects of medical interventions, particularly those stemming from drug reactions and interactions. In systems of care that are oriented to primary care (including some HMOs in the United States), the primary care practitioner is, by far, the most commonly seen physician, for patients with ALL degrees of co-morbidity and both for single common conditions AND for co-morbid conditions. Only when individual conditions are uncommon are specialists the most frequent type of physician seen, and only for that condition (not for co-morbid conditions) (Starfield et al 2003; Starfield, Lemke et al 2005). Thus, primary care physicians are more likely to see the adverse events that result from their own care as well as the care of others whom the patient may see. The challenge for primary care is to develop systems to code presenting symptoms or signs that are unexpected, and to develop information systems that could serve as early warnings of the occurrence of adverse events in persons previously subjected to particular types of interventions. It is possible that the International Classification of Primary Care (ICPC) (Lamberts, Wood, and Hofmans-Okkes 1993), which provides a straightforward classification of problems encountered in primary care while maintaining comparability with the better known International Classification of Diseases (originally developed to code causes of death), could serve as the basis for recording and classifying these symptoms and signs in the US, as it is already being used in several other countries.

3. Improvement in clinical quality and in performance with respect to the main features of primary care practice is a challenge for primary care practice. Although each of these features is known to confer benefits on health, there are remaining issues that require consideration.

- To what extent can teams of practitioners provide first contact care without interfering with the benefits of continuing interpersonal relationships between particular practitioners and patients?
- Ongoing person-focused care means that care should be focused on the person rather than on the disease. Can teams of practitioners fulfill this function?
- Comprehensiveness means that all problems in the population should be cared for in primary care (with short-term referral as needed) except those that are too uncommon (generally a frequency of less than one or two per thousand in the population served) for the primary care practitioner or team to maintain competence in dealing with them. How can data systems provide the information that is needed to decide when problems are best met in primary care, when they can be best dealt with in primary care with appropriate specialty back-up, and when patients need to be seen by specialists?

- Coordination of care means that the primary care practice must integrate all aspects of care when patients must be seen elsewhere. As 13-20% (depending on various assumptions) of an average practice population will require referral in a year, this burden is considerable. Very few health systems, even those that rate high on primary care, achieve high levels of coordination of care, at least as measured by transfer of information from primary care physicians to specialists and vice versa. Systems to facilitate coordinating efforts are urgently needed. Lessons might be gleaned from the experiences of some health systems. For example, and despite design limitations (Talbot-Smith et al 2004) of the study comparing the Kaiser-Permanente health care plan in the US with the National Health Service in the UK (Feachem, Sekhri, and White 2002), the lower hospitalization rates and lower resource use in the former may well be a result of a system specifically designed to enhance coordination between primary care physicians and specialists.

4. The achievement of equity in health services and health is an imperative everywhere. Primary care is inherently a more equitable level of care than other levels of care. It is less costly (hence sparing resources that could be devoted to providing better services to more disadvantaged populations) and, through its key features, it narrows disparities in health between more and less socially deprived population groups. The extent to which primary care in fact does achieve better equity depends on the availability of information about the needs in the various areas on which primary care practices are located. Better information systems, both at the area level and at the practice level will enhance the already-strong benefits of primary care to the health of individuals, population subgroups, and populations (National Committee for Vital and Health Statistics 2001).

POLICY RELEVANCE

The relatively poor performance of the United States on major health indicators, despite per capita health care expenditures that are much higher than any other country, is a pressing concern for policy makers, the business community (which has, historically, paid for much of the health insurance in the country), and ultimately tax payers. Efforts to improve the system to achieve better health at lower cost are rapidly becoming an imperative. Primary care offers an effective and efficient approach to achieve that goal. Evidence of the benefits of a health system with a strong primary care base is abundant and consistent. These benefits are not limited to one or only a few aspects of

health but, rather, extend to the major causes of death and disorders as well as to reducing disparities in health across major population subgroups, including racial and ethnic minorities as well as socially-deprived adults and children.

Federally qualified community health centers (CHCs) currently serve more than 3600 urban and rural communities, which are typically low-income inner city or resource-poor rural communities. But they serve only one-quarter of all people living below poverty level, one in seven people living under 200% of poverty level, and one of eight uninsured Americans (Proser, Shin, and Hawkins 2005). Expansion of the CHC network well beyond the current supply is one appropriate strategy.

There are other policy strategies that would strengthen primary care on a broader level also exist (Starfield and Simpson 1993). These include (but are not limited to) changes in the method of reimbursing primary care physicians and, particularly, better reimbursement rates for primary care services for both common conditions and for providing the important primary care delivery characteristics. Establishing a more rational basis for referrals and improving coordination between primary care and specialist physicians would make primary care practice more challenging and intellectually rewarding. States could encourage a better distribution of physicians (both primary care and specialists) by tailoring licensing policies to health needs in different areas or by providing financial incentives for practicing in underserved areas, as is done in some other countries. Incentives for the training of primary care practitioners could be enhanced through a reorientation of federal support for graduate medical education, with greater support for the training of primary care physicians. Similarly, loan forgiveness for primary care practitioners could be expanded. Reducing paperwork associated with the filing of claims forms, and providing support for electronic medical records would greatly reduce the tedium of record keeping in practice and, at the same time, release time that could be devoted to improving self-monitoring of the quality of care. Bonus payments for team practice could enhance comprehensiveness of primary care. Special recognition of best primary care practices could enhance public recognition of the importance of primary care and its characteristics. And, finally, earmarked funding for better research in primary care, including support of collaborative practice-based networks (Lanier 2005; Wasserman, Slora, and Bocian 2003), would enhance the intellectual challenges associated with contributing to an expanded knowledge base both for the practice of primary care and for the practice of specialty care.

Reference List

Agency for Healthcare Research and Quality. 2004. *2004 National Healthcare Disparities Report.* AHRQ Publication No. 05-0014. Rockville, MD: Agency for Healthcare Research and Quality.

Atun, R. 2004. *What Are the Advantages and Disadvantages of Restructuring a Health Care System to Be More Focused on Primary Care Services?* London, UK: Health Evidence Network.

Baicker, K. and A. Chandra. 2004. Medicare Spending, the Physician Workforce, and Beneficiaries' Quality of Care. *Health Affairs* W4:184-197 (http://content.healthaffairs.org/cgi/reprint/hlthaff.w4.184v1.pdf).

Bartter, T. and M. R. Pratter. 1996. Asthma: Better Outcome at Lower Cost? The Role of the Expert in the Care System. *Chest* 110:1589-1596.

Bertakis, K. D., E. J. Callahan, L. J. Helms, R. Azari, J. A. Robbins, and J. Miller. 1998. Physician Practice Styles and Patient Outcomes: Differences between Family Practice and General Internal Medicine. *Medical Care* 36:879-891.

Bindman, A. B., K. Grumbach, D. Osmond, K. Vranizan, and A. L. Stewart. 1996. Primary Care and Receipt of Preventive Services. *Journal of General Internal Medicine* 11:269-276.

Breen, N. and L. Kessler. 1994. Changes in the Use of Screening Mammography: Evidence from the 1987 and 1990 National Health Interview Surveys. *American Journal of Public Health* 84:62-67.

Britton, A., M. Shipley, M. Marmot, and H. Hemingway. 2004. Does Access to Cardiac Investigation and Treatment Contribute to Social and Ethnic Differences in Coronary Heart Disease? Whitehall II Prospective Cohort Study. *British Medical Journal* 329:318-323.

Campbell, R. J., A. M. Ramirez, K. Perez, and R. G. Roetzheim. 2003. Cervical Cancer Rates and the Supply of Primary Care Physicians in Florida. *Family Medicine* 35:60-64.

Casanova, C., C. Colomer, and B. Starfield. 1996. Pediatric Hospitalization Due to Ambulatory Care-Sensitive Conditions in Valencia (Spain). *International Journal for Quality in Health Care* 8:51-59.

Casanova, C. and B. Starfield. 1995. Hospitalizations of Children and Access to Primary Care: a Cross-National Comparison. *International Journal of Health Services* 25:283-294.

Castro-Leal, F., J. Dayton, L. Demery, and K. Mehra. 2000. Public Spending on Health Care in Africa: Do the Poor Benefit? *Bulletin of the World Health Organization* 78:66-74.

Cooper, R. A., T. E. Getzen, H. J. McKee, and P. Laud. 2002. Economic and Demographic Trends Signal an Impending Physician Shortage. *Health Affairs* 21:140-154.

Davey Smith, G. and J. Lynch. 2004. Commentary: Social Capital, Social Epidemiology and Disease Aetiology. *International Journal of Epidemiology* 33:691-700.

Donaldson, M. S., K. D. Yordy, K. N. Lohr, and N. A. Vanselow. 1996. *Primary Care: America's Health in a New Era*. Washington, DC: National Academy Press.

Donohoe, M. T. 1998. Comparing Generalist and Specialty Care: Discrepancies, Deficiencies, and Excesses. *Archives of Internal Medicine* 158:1596-1608.

Engstrom, S., M. Foldevi, and L. Borgquist. 2001. Is General Practice Effective? A Systematic Literature Review. *Scandinavian Journal of Primary Health Care* 19:131-144.

Feachem, R. G., N. K. Sekhri, and K. L. White. 2002. Getting More for Their Dollar: a Comparison of the NHS with California's Kaiser Permanente. *British Medical Journal* 324:135-141.

Ferrante, J. M., E. C. Gonzalez, N. Pal, and R. G. Roetzheim. 2000. Effects of physician supply on Early Detection of Breast Cancer. *Journal of the American Board of Family Practice* 13:408-414.

Fleming, T. R. 2005. Surrogate Endpoints and FDA's Accelerated Approval Process. *Health Affairs* 24:67-78.

Flocke, S. A., K. C. Stange, and S. J. Zyzanski. 1998. The Association of Attributes of Primary Care with the Delivery of Clinical Preventive Services. *Medical Care* 36:AS21-AS30.

Forrest, C. B. and B. Starfield. 1996. The Effect of First-Contact Care with Primary Care Clinicians on Ambulatory Health Care Expenditures. *Journal of Family Practice* 43:40-48.

------1998. Entry into Primary Care and Continuity: the Effects of Access. *American Journal of Public Health* 88:1330-1336.

Fox, S. A., A. L. Siu, and J. A. Stein. 1994. The Importance of Physician Communication on Breast Cancer Screening of Older Women. *Archives of Internal Medicine* 154:2058-2068.

Franks, P. and K. Fiscella. 1998. Primary Care Physicians and Specialists as Personal Physicians. Health Care Expenditures and Mortality Experience. *Journal of Family Practice* 47:105-109.

Franks, P., C. M. Clancy, and P. A. Nutting. 1992. Gatekeeping revisited – protecting patients from overtreatment. *New England Journal of Medicine* 327:424-429.

Freeman, G. and P. Hjortdahl. 1997. What Future for Continuity of Care in General Practice? *British Medical Journal* 314:1870-1873.

Friedman, B. and J. Basu. 2001. Health Insurance, Primary Care, and Preventable Hospitalization of Children in a Large State. *American Journal of Managed Care* 7:473-481.

Gadomski, A., P. Jenkins, and M. Nichols. 1998. Impact of a Medicaid Primary Care Provider and Preventive Care on Pediatric Hospitalization. *Pediatrics* 101:E1 <http://www.pediatrics.org/cgi/content/full/101/3/e1>.

Graham, H. and M. P. Kelly. 2004. *Health Inequalities: Concepts, Frameworks, and Policy.* http://www.publichealth.nice.org.uk/page.aspx?o=502453 (accessed April 5, 2005). London, UK: National Health Service/Health Development Agency.

Greenfield, S., E. C. Nelson, M. Zubkoff, W. Manning, W. Rogers, R. L. Kravitz, A. Keller, A. R. Tarlov, and J. E. Jr Ware. 1992. Variations in Resource Utilization among Medical Specialties and Systems of Care. Results from the Medical Outcomes Study. *Journal of the American Medical Association* 267:1624-1630.

Griffin, S. and A. Kinmonth. 1998. *Diabetes Care: The Effectiveness of Systems for Routine Surveillance for People with Diabetes*. Cochrane Library.

Grumbach, K., J. V. Selby, J. A. Schmittdiel, and C. P. Quesenberry, Jr. 1999. Quality of Primary Care Practice in a Large HMO according to Physician Specialty. *Health Services Research* 34:485-502.

Gulbrandsen, P., P. Hjortdahl, and P. Fugelli. 1997. General Practitioners' Knowledge of Their Patients' Psychosocial Problems: Multipractice Questionnaire Survey. *British Medical Journal* 314:1014-1018.

Gulliford, M. C. 2002. Availability of Primary Care Doctors and Population Health in England: Is There an Association? *Journal of Public Health Medicine* 24:252-254.

Gulliford, M. C., R. H. Jack, G. Adams, and O. C. Ukoumunne. 2004. Availability and Structure of Primary Medical Care Services and Population Health and Health Care Indicators in England. *BMC Health Services Research* 4:12.

Gwatkin, D. R. 2001. The Need for Equity-Oriented Health Sector Reforms. *International Journal of Epidemiology* 30:720-723.

Haines, M. and R. Avery. 1982. Differential Infant and Child Mortality in Costa Rica. *Population Studies* 36:31-43.

Hansell, M. J. 1991. Sociodemographic Factors and the Quality of Prenatal Care. *American Journal of Public Health* 81:1023-1028.

Harrold, L. R., T. S. Field, and J. H. Gurwitz. 1999. Knowledge, Patterns of Care, and Outcomes of Care for Generalists and Specialists. *Journal of General Internal Medicine* 14:499-511.

Hashem, A., M. T. Chi, and C. P. Friedman. 2003. Medical Errors as a Result of Specialization. *Journal of Biomedical Informatics* 36:61-69.

Health Council of the Netherlands. 2004. *European Primary Care*. Publication No. 2004/20E. The Hague, Netherlands: Health Council of the Netherlands.

Hewlett, S., J. Kirwan, J. Pollock, K. Mitchell, M. Hehir, P. S. Blair, D. Memel, and M. G. Perry. 2005. Patient Initiated Outpatient Follow Up in Rheumatoid Arthritis: Six Year Randomised Controlled Trial. *British Medical Journal* 330:171-175.

Hirth, R. A., A. M. Fendrick, and M. E. Chernew. 1996. Specialist and Generalist Physicians' Adoption of Antibiotic Therapy to Eradicate Helicobacter pylori Infection. *Medical Care* 34:1199-1204.

Hjortdahl, P. and C. F. Borchgrevink. 1991. Continuity of Care: Influence of General Practitioners' Knowledge about Their Patients on Use of Resources in Consultations. *British Medical Journal* 303:1181-1184.

Hoffmann, C., R. S. Broyles, and J. E. Tyson. 1997. Emergency Room Visits Despite the Availability of Primary Care: a Study of High Risk Inner City Infants. *American Journal of Medical Science* 313:99-103.

Hurley, R. E., D. A. Freund, and D. E. Taylor. 1989. Emergency Room Use and Primary Care Case Management: Evidence from Four Medicaid Demonstration Programs. *American Journal of Public Health* 79:843-846.

Institute of Medicine. 1978. *A Manpower Policy for Primary Health Care*. IOM Publication 78-02. Washington, DC: National Academy of Sciences.

Jarman, B., S. Gault, B. Alves, A. Hider, S. Dolan, A. Cook, B. Hurwitz, and L. I. Iezzoni. 1999. Explaining Differences in English Hospital Death Rates Using Routinely Collected Data. *British Medical Journal* 318:1515-1520.

Jones, G., R. W. Steketee, R. E. Black, Z. A. Bhutta, and S. S. Morris. 2003. How Many Child Deaths Can We Prevent This Year? *Lancet* 362:65-71.

Kaag, M. E., D. Wijkel, and D. de Jong. 1996. Primary Health Care Replacing Hospital Care--the Effect on Quality of Care. *International Journal for Quality in Health Care* 8:367-373.

Klijzing, F. and H. Taylor. 1982. The Decline of Infant Mortality in Costa Rica, 1950-73: Modernization or Technological Diffusion? *Malaysian Journal of Tropical Geography* 5:22-29.

Kravitz, R. L., N. Duan, and J. Braslow. 2004. Evidence-based Medicine, Heterogeneity of Treatment Effects, and the Trouble with averages. *Milbank Quarterly* 82:661-687.

Lamberts, H., M. Wood, and I. Hofmans-Okkes. 1993. *The International Classification of Primary Care in the European Community*. Oxford, UK/New York, NY: Oxford University Press.

Lanier, D. 2005. Primary Care Practice-Based Research Comes of Age in the United States. *Annals of Family Medicine* 3:S2-S4.

Larizgoitia, I. and B. Starfield. 1997. Reform of Primary Health Care: the Case of Spain. *Health Policy* 41:121-137.

Leggetter, S., N. Chaturvedi, J. H. Fuller, and M. E. Edmonds. 2002. Ethnicity and Risk of Diabetes-Related Lower Extremity Amputation: a Population-Based, Case-Control Study of African Caribbeans and Europeans in the United kingdom. *Archives of Internal Medicine* 162:73-78.

Lieu, T. A., P. W. Newacheck, and M. A. McManus. 1993. Race, Ethnicity, and Access to Ambulatory Care among US Adolescents. *American Journal of Public Health* 83:960-965.

Lillie-Blanton, M. and C. Hoffman. 2005. The Role of Health Insurance Coverage in Reducing Racial/Ethnic Disparities in Health Care. *Health Affairs* 24:398-408.

Macinko J., C. Almeida, and P. Sa. 2005. Evaluating Primary Care Services in Brazil: A Rapid Appraisal Methodology. Submitted for publication.

Macinko, J., B. Starfield, and L. Shi. 2003. The Contribution of Primary Care Systems to Health Outcomes within Organization for Economic Cooperation and Development (OECD) Countries, 1970-1998. *Health Services Research* 38:831-865.

Macinko J, Starfield B, Shi L. 2005. Quantifying the Health Benefits of Primary Care Physician Supply in the United States. Submitted for publication.

Mainous, A. G., III and J. M. Gill. 1998. The Importance of Continuity of Care in the Likelihood of Future Hospitalization: Is Site of Care Equivalent to a Primary Clinician? *American Journal of Public Health* 88:1539-1541.

Mansfield, C. J., J. L. Wilson, E. J. Kobrinski, and J. Mitchell. 1999. Premature Mortality in the United States: the Roles of Geographic Area, Socioeconomic Status, Household Type, and Availability of Medical Care. *American Journal of Public Health* 89:893-898.

Mark, D. H., M. S. Gottlieb, B. B. Zellner, V. K. Chetty, and J. E. Midtling. 1996. Medicare Costs in Urban Areas and the Supply of Primary Care Physicians. *Journal of Family Practice* 43:33-39.

Martin, D. P., P. Diehr, K. F. Price, and W. C. Richardson. 1989. Effect of a Gatekeeper Plan on Health Services Use and Charges: a Randomized Trial. *American Journal of Public Health* 79:1628-1632.

Morales, L. S., M. N. Elliott, R. Weech-Maldonado, K. L. Spritzer, and R. D. Hays. 2001. Differences in CAHPS Adult Survey Reports and Ratings by Race and Ethnicity: an Analysis of the National CAHPS Benchmarking Data 1.0. *Health Services Research* 36:595-617.

Murray-Garcia, J. L., J. V. Selby, J. Schmittdiel, K. Grumbach, and C. P. Quesenberry, Jr. 2000. Racial and Ethnic Differences in a Patient Survey: Patients' Values, Ratings, and Reports Regarding Physician Primary Care Performance in a Large Health Maintenance Organization. *Medical Care* 38:300-310.

NCI Breast Cancer Screening Consortium. 1990. Screening Mammography: a Missed Clinical Opportunity? *Journal of the American Medical Association* 264:54-58.

National Committee for Vital and Health Statistics. 2001. *Information for Health: A Strategy for Building the National Health Information Infrastructure*. Washington, DC: US Department of Health and Human Services.

Newacheck, P. W., D. C. Hughes, and J. J. Stoddard. 1996. Children's Access to Primary Care: Differences by Race, Income, and Insurance Status. *Pediatrics* 97:26-32.

O'Malley, A. S., C. B. Forrest, R. M. Politzer, J. T. Wulu, and L. Shi. 2005. Health Center Trends, 1994-2001: What Do They Portend for the Federal Growth Initiative? *Health Affairs* 24:465-472.

Or, Z. 2001. *Exploring the Effects of Health Care on Mortality across OECD Countries*. Labour Market and Social Policy Occasional Papers No. 46. Paris, France: Organization for Economic Cooperation and Development.

Organization for Economic Cooperation and Development. 2001. *Health Data 2001: a Comparative Analysis of 30 Countries*. Paris, France: Organization for Economic Cooperation and Development.

Pan American Health Organization. 2005. *Regional Core Health Data* (http://www.paho.org/English/SHA/coredata/tabulator/newTabulator.htm accessed June 8, 2005). Washington, DC: Pan American Health Organization.

Parchman, M. L. and S. Culler. 1994. Primary Care Physicians and Avoidable Hospitalizations. *Journal of Family Practice* 39:123-128.

Parchman, M. L. and S. D. Culler. 1999. Preventable Hospitalizations in Primary Care Shortage Areas. An Analysis of Vulnerable Medicare Beneficiaries. *Archives of Family Medicine* 8:487-491.

Parnell, S. J., A. M. Zalin, and C. W. Clarke. 1993. Care of Diabetic Patients in Hospital Clinics and General Practice Clinics: a Study in Dudley. *British Journal of General Practice* 43:65-69; erratum 1993; 43(369): 163.

Perrin, J. M., P. Greenspan, S. R. Bloom, D. Finkelstein, S. Yazdgerdi, J. M. Leventhal, L. Rodewald, P. Szilagyi, and C. J. Homer. 1996. Primary Care Involvement among Hospitalized Children. *Archives of Pediatric and Adolescent Medicine* 150:479-486.

Perry, H., N. Robison, D. Chavez, O. Taja, C. Hilari, D. Shanklin, and J. Wyon. 1998. The Census-Based, Impact-Oriented Approach: Its Effectiveness in Promoting Child Health in Bolivia. *Health Policy and Planning* 13:140-151.

Politzer, R. M., J. Yoon, L. Shi, R. G. Hughes, J. Regan, and M. H. Gaston. 2001. Inequality in America: the Contribution of Health Centers in Reducing and Eliminating Disparities in Access to Care. *Medical Care Research and Review* 58:234-248.

Proser, M., P. Shin, and D. Hawkins. 2005. *A Nation's Health at Risk III: Growing Uninsured, Budget Cutbacks Challenge President's Initiative to Put a Health Center in Every Poor County.* Washington, DC: National Association of Community Health Centers and The George Washington University.

Raddish, M., S. D. Horn, and P. D. Sharkey. 1999. Continuity of Care: Is It Cost Effective? *American Journal of Managed Care* 5:727-734.

Regan, J., A. H. Schempf, J. Yoon, and R. M. Politzer. 2003. The Role of Federally Funded Health Centers in Serving the Rural Population. *Journal of Rural Health* 19:117-124.

Reyes, H., R. Perez-Cuevas, J. Salmeron, P. Tome, H. Guiscafre, and G. Gutierrez. 1997. Infant Mortality Due to Acute Respiratory Infections: the Influence of Primary Care Processes. *Health Policy and Planning* 12:214-223.

Ricketts, T. C., R. Randolph, H. A. Howard, D. Pathman, and T. Carey. 2001. Hospitalization Rates as Indicators of Access to Primary Care. *Health and Place* 7:27-38.

Riveron Corteguera, R. 2000. Estrategias Para Reducir la Mortalidad Infantil. Cuba 1995-1999. *Revista Cubana de Pediatria* 72:147-164.

Roetzheim, R. G., N. Pal, E. C. Gonzalez, J. M. Ferrante, D. J. Van Durme, J. Z. Ayanian, and J. P. Krischer. 1999. The Effects of Physician Supply on the Early Detection of Colorectal Cancer. *Journal of Family Practice* 48:850-858.

Roetzheim, R. G., N. Pal, D. J. Van Durme, D. Wathington, J. M. Ferrante, E. C. Gonzalez, and J. P. Krischer. 2000. Increasing Supplies of Dermatologists and Family Physicians Are Associated with Earlier Stage of Melanoma Detection. *Journal of the American Academy of Dermatology* 43:211-218.

Roos, N. P. 1979. Who Should Do the Surgery? Tonsillectomy-Adenoidectomy in One Canadian Province. *Inquiry* 16:73-83.

Roos, N. P., K. C. Carriere, and D. Friesen. 1998. Factors Influencing the Frequency of Visits by Hypertensive Patients to Primary Care Physicians in Winnipeg. *Canadian Medical Association Journal* 159:777-783.

Rosenblatt, R. A., G. E. Wright, L. M. Baldwin, L. Chan, P. Clitherow, F. M. Chen, and L. G. Hart. 2000. The Effect of the Doctor-Patient Relationship on Emergency Department Use among the Elderly. *American Journal of Public Health* 90:97-102.

Rosero-Bixby, L. 1986. Infant Mortality in Costa Rica: Explaining the Recent Decline. *Studies in Family Planning* 17:57-65.

------2004a. Evaluación del Impacto de la Reforma del Sector de la Salud en Costa Rica Mediante un Estudio Cuasiexperimental. *Revista Panamamericana de Salud Publica* 15:94-103.

------2004b. Spatial access to health care in Costa Rica and its equity: a GIS-based study. *Social Science and Medicine* 58:1271-1284.

Rosser, W. W. 1996. Approach to Diagnosis by Primary Care Clinicians and Specialists: Is There a Difference? *Journal of Family Practice* 42:139-144.

Rothwell, P. M. 2005. Treating Individuals 2. Subgroup Analysis in Randomised Controlled Trials: Importance, Indications, and Interpretation. *Lancet* 365:176-186.

Ryan, S., A. Riley, M. Kang, and B. Starfield. 2001. The Effects of Regular Source of Care and Health Need on Medical Care Use among Rural Adolescents. *Archives of Pediatric and Adolescent Medicine* 155:184-190.

Sachs, J. D. and J. W. McArthur. 2005. The Millennium Project: a Plan for Meeting the Millennium Development Goals. *Lancet* 365:347-353.

Saver, B. 2002. Financing and Organization Findings Brief. *Academy for Research and Health Care Policy* 5:1-2.

Schappert, S. M. 1994. National Ambulatory Medical Care Survey 1991. *Vital and Health Statistics* 13:1-110.

Schoen, C., R. Osborn, P. T. Huynh, M. Doty, K. Davis, K. Zapert, and J. Peugh. 2004. Primary Care and Health System Performance: Adults' Experiences in Five Countries. *Health Affairs* W4:487-503.

Schreiber, S. and T. Zielinski. 1997. The Meaning of Ambulatory Care Sensitive Admissions: Urban and Rural Perspectives. *Journal of Rural Health* 13:276-284.

Seid, M., G. D. Stevens, and J. W. Varni. 2003. Parents' Perceptions of Pediatric Primary Care Quality: Effects of Race/ethnicity, Language, and Access. *Health Services Research* 38:1009-1031.

Shea, S., D. Misra, M. H. Ehrlich, L. Field, and C. K. Francis. 1992. Predisposing Factors for Severe, Uncontrolled Hypertension in an Inner-City Minority Population. *New England Journal of Medicine* 327:776-781.

Shi, L. 1992. The Relationship between Primary Care and Life Chances. *Journal of Health Care for the Poor and Underserved* 3:321-335.

------1994. Primary Care, Specialty Care, and Life Chances. *International Journal of Health Services* 24:431-458.

------1999. Experience of Primary Care by Racial and Ethnic Groups in the United States. *Medical Care* 37:1068-1077.

Shi, L., B. Starfield, and J. Xu. 2001. Validating the Adult Primary Care Assessment Tool. *Journal of Family Practice* 50:161W-175W (http://jfponline.com/content/2001/02/jfp_0201_01610.asp).

Shi, L., J. Macinko, B. Starfield, J. Wulu, J. Regan, and R. Politzer. 2003a. The Relationship between Primary Care, Income Inequality, and Mortality in US States, 1980-1995. *Journal of the American Board of Family Practice* 16:412-422.

Shi, L., J. Macinko, B. Starfield, J. Xu, and R. Politzer. 2003b. Primary Care, Income Inequality, and Stroke Mortality in the United States. A Longitudinal Analysis, 1985-1995. *Stroke* 34:1958-1964.

Shi, L., J. Macinko, B. Starfield, J. Xu, J. Regan, R. Politzer, and J. Wulu. 2004. Primary Care, Infant Mortality, and Low Birth Weight in the States of the USA. *Journal of Epidemiology and Community Health* 58:374-380.

Shi, L., J. Macinko, B. Starfield, R. Politzer, J. Wulu, and J. Xu. 2005a. Primary Care, Social Inequalities, and All-Cause, Heart Disease, and Cancer Mortality in US Counties, 1990. *American Journal of Public Health* 95:674-680.

Shi, L., J. Macinko, B. Starfield, R. Politzer, J. Wulu, J. Xu. 2005b. Primary Care, Social Inequalities, and All-Cause, Heart Disease, and Cancer Mortality in US Counties: a Comparison of Urban and Rural Areas. *Public Health* 119:699-710.

Shi, L., J. Macinko, B. Starfield, R. Politzer, and J. Xu. 2005c. Primary Care, Race, and Mortality in US States. *Social Science and Medicine* 61:65-75.

Shi, L. and B. Starfield. 2000. Primary Care, Income Inequality, and Self-Rated Health in the United States: a Mixed-Level Analysis. *International Journal of Health Services* 30:541-555.

------2001. The Effect of Primary Care Physician Supply and Income Inequality on Mortality among Blacks and Whites in US Metropolitan Areas. *American Journal of Public Health* 91:1246-1250.

Shi, L., B. Starfield, B. P. Kennedy, and I. Kawachi. 1999. Income Inequality, Primary Care, and Health Indicators. *Journal of Family Practice* 48:275-284.

Shi, L., B. Starfield, R. Politzer, and J. Regan. 2002. Primary Care, Self-Rated Health, and Reductions in Social Disparities in Health. *Health Services Research* 37:529-550.

Sox, H. C. 1996. Decision-making: a comparison of referral practice and primary care. *Journal of Family Practice* 42:155-160.

Starfield, B. 1991. Primary Care and Health. A Cross-National Comparison. *Journal of the American Medical Association* 266:2268-2271.

------1994. Is Primary Care Essential? *Lancet* 344:1129-1133.

------1998. *Primary Care: Balancing Health Needs, Services, and Technology.* New York, NY: Oxford University Press.

------2001. New Paradigms for Quality in Primary Care. *British Journal of General Practice* 51:303-309.

Starfield, B., C. Cassady, J. Nanda, C. B. Forrest, and R. Berk. 1998. Consumer experiences and provider perceptions of the quality of primary care: implications for managed care. *Journal of Family Practice* 46:216-226.

Starfield, B., C. B. Forrest, P. A. Nutting, and S. von Schrader. 2002. Variability in physician referral decisions. *Journal of the American Board of Family Practice* 15:473-480.

Starfield, B., K. W. Lemke, T. Bernhardt, S. S. Foldes, C. B. Forrest, and J. P. Weiner. 2003. Comorbidity: Implications for the Importance of Primary Care in 'Case' Management. *Annals of Family Medicine* 1:8-14.

Starfield, B., K. W. Lemke, R. Herbert, W. D. Pavlovich, G. Anderson G. 2005. Co-morbidity and the use of primary care and specialist care in the elderly. *Annals of Family Medicine*, in press.

Starfield, B. and L. Shi. 2002. Policy Relevant Determinants of Health: an International Perspective. *Health Policy* 60:201-218.

Starfield, B. and L. Shi. 2004. The Medical Home, Access to Care, and Insurance: a Review of Evidence. *Pediatrics* 113:1493-1498.

Starfield, B., L. Shi, A. Grover, J. Macinko. 2005. The Role of Evidence in Physician Workforce Policy. *Health Affairs* W5:97-107 (http://content.healthaffairs.org/cgi/reprint/hlthaff.w5.97v1).

Starfield, B. and L. Simpson. 1993. Primary Care as Part of US Health Services Reform. *Journal of the American Medical Association* 269:3136-3139.

Stevens, G. D. and L. Shi. 2002. Racial and Ethnic Disparities in the Quality of Primary Care for Children. *Journal of Family Practice* 51:573.

------2003. Racial and Ethnic Disparities in the Primary Care Experiences of Children: a Review of the Literature. *Medical Care Research and Review* 60:3-30.

Stevens, R. 1971. *American Medicine and the Public Interest*. New Haven, CT: Yale University Press.

Taira, D. A., D. G. Safran, T. B. Seto, W. H. Rogers, M. Kosinski, J. E. Ware, N. Lieberman, and A. R. Tarlov. 1997. Asian-American Patient Ratings of Physician Primary Care Performance. *Journal of General Internal Medicine* 12:237-242.

Talbot-Smith, A., S. Gnani, A. M. Pollock, and D. P. Gray. 2004. Questioning the Claims from Kaiser. *British Journal of General Practice* 54:415-421.

US Department of Health and Human Services. 2000. *Healthy People 2010, 2nd edition, with Understanding and Improving Health and Objectives for Improving Health*. Washington, DC: US Government Printing Office.

van den Akker, M., F. Buntinx, J. F. Metsemakers, S. Roos, and J. A. Knottnerus. 1998. Multimorbidity in General Practice: Prevalence, Incidence, and Determinants of Co-occurring Chronic and Recurrent Diseases. *Journal of Clinical Epidemiology* 51:367-375.

van Doorslaer, E., X. Koolman, and A. M. Jones. 2004. Explaining income-related inequalities in doctor utilisation in Europe. *Health Economics* 13:629-647.

Villalbi, J. R., A. Guarga, M. I. Pasarin, M. Gil, C. Borrell, M. Ferran, and E. Cirera. 1999. An Evaluation of the Impact of Primary Care Reform on Health. *Atención Primaria* 24:468-474.

Vogel, R. L. and R. J. Ackermann. 1998. Is Primary Care Physician Supply Correlated with Health Outcomes? *International Journal of Health Services* 28:183-196.

Waitzkin, H., K. Wald, R. Kee, R. Danielson, and L. Robinson. 1997. Primary Care in Cuba: Low- and High-Technology Developments Pertinent to Family Medicine. *Journal of Family Practice* 45:250-258.

Wasserman, R., E. Slora, and A. Bocian. 2003. Current status of pediatric practice-based research networks. *Current.Problems in Pediatric and Adolescent Health Care* 33:115-123.

Weinberger, M., E. Z. Oddone, and W. G. Henderson. 1996. Does Increased Access to Primary Care Reduce Hospital Readmissions? Veterans Affairs Cooperative Study Group on Primary Care and Hospital Readmission. *New England Journal of Medicine* 334:1441-1447.

Weiner, J. P. 2004. Prepaid Group Practice Staffing and U.S. Physician Supply: Lessons for Workforce Policy. *Health Affairs* Suppl Web Exclusives:W4-59.

Weiner, J. P., L. E. Kassel, T. D. Baker, and B. H. Lane. 1982. Baltimore City Primary Care Study: the Role of the Office-Based Physician. *Maryland State Medical Journal* 31:48-52.

Weiner, J. P. and B. Starfield. 1983. Measurement of the Primary Care Roles of Office-Based Physicians. *American Journal of Public Health* 73:666-671.

Weinick, R. M. and N. A. Krauss. 2000. Racial/Ethnic Differences in Children's Access to Care. *American Journal of Public Health* 90:1771-1774.

Weiss, L. J. and J. Blustein. 1996. Faithful Patients: the Effect of Long-Term Physician-Patient Relationships on the Costs and Use of Health Care by Older Americans. *American Journal of Public Health* 86:1742-1747.

Weitzman, M., R. S. Byrd, and P. Auinger. 1999. Black and White Middle Class Children Who Have Private Health Insurance in the United States. *Pediatrics* 104:151-157.

Welch, W. P., M. E. Miller, H. G. Welch, E. S. Fisher, and J. E. Wennberg. 1993. Geographic Variation in Expenditures for Physicians' Services in the United States. *New England Journal of Medicine* 328:621-627.

Whittle, J., C. J. Lin, J. R. Lave, M. J. Fine, K. M. Delaney, D. Z. Joyce, W. W. Young, and W. N. Kapoor. 1998. Relationship of Provider Characteristics to Outcomes, Process, and Costs of Care for Community-Acquired Pneumonia. *Medical Care* 36:977-987.

WONCA. 1991. *The Role of the General Practitioner/Family Physician in Health Care Systems*. Victoria: World Organization of National Colleges, Academies and Academic Association of General Practitioners/Family Physicians (WONCA).

World Health Organization. 1978. *Declaration of Alma-Ata: International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978*. http://www.who.int/hpr/NPH/docs/declaration_almaata.pdf (accessed December 30, 2004). Geneva, Switzerland: World Health Organization.

World Health Organization. 2003. *A Global Review of Primary Health Care: Emerging Messages*. Geneva, Switzerland: World Health Organization.

Table: Characteristics Which, in Combination, Define Primary Care

First contact: accessibility to facilitate the seeking of care for each new need or problem and the seeking of care from the primary care source before going elsewhere (except in emergencies).

Long-term person-focused care: temporal and interpersonal continuity based on people's total health-related needs, not on the presence or absence of particular diagnoses or types of diagnoses.

Comprehensiveness of care: having available and providing for all health-related needs except those too uncommon to maintain competence

Coordination of care: integrating care when it is necessary for people to receive care elsewhere (as in the case of referrals for special or specialized services)