Income Inequality and Health: A Critical Review of the Literature

James A. Macinko
New York University Steinhardt School of Education

Leiyu Shi
Johns Hopkins Bloomberg School of Public Health

Barbara Starfield
Johns Hopkins Medical Institutions

John T. Wulu, Jr.
Bureau of Primary Health Care, HRSA/DHHS

This article critically reviews published literature on the relationship between income inequality and health outcomes. Studies are systematically assessed in terms of design, data quality, measures, health outcomes, and covariates analyzed. At least 33 studies indicate a significant association between income inequality and health outcomes, while at least 12 studies do not find such an association. Inconsistencies include the following: (1) the model of health determinants is different in nearly every study, (2) income inequality measures and data are inconsistent, (3) studies are performed on different combinations of countries and/or states, (4) the time period in which studies are conducted is not consistent, and (5) health outcome measures differ. The relationship between income inequality and health is unclear. Future studies will require a more comprehensive model of health production that includes health system covariates, sufficient sample size, and adjustment for inconsistencies in income inequality data.

Keywords: income inequality; health determinants; social epidemiology; health inequalities

Over the past decade, there has been an ongoing debate over the role of income inequality as a determinant of population health. The debate conti-
ues, with evidence both for and against what has become known as the relative income hypothesis—the proposition that the distribution of income within societies (independent of absolute levels of income or wealth) is an important determinant of that population’s health. This document presents a critical examination of the public health and social science literature describing the relationship between income inequality and health status. It reviews the numerous empirical studies in the area, assesses the strength of study designs and data sources, presents a summary of the major theories describing the observed relationship, and proposes a comprehensive conceptual framework and specific considerations that should be taken into account for future studies.

NEW CONTRIBUTION

This review differs from previous efforts (see Wagstaff and van Doorslaer 2000; Lynch, Smith, et al. 2000) because it looks at a comprehensive range of literature, both within and outside of the public health field. This review examines nearly 50 studies on income inequality and health, including the following: (1) studies aiming to demonstrate or refute the relationship between income inequality and health, (2) theoretical and empirical literature on the pathways through which income inequality could influence health, and (3) social science literature on the production of income inequalities within and between countries. This review also emphasizes the role of the health system as a potential mediator of the relationship, a factor largely unexplored in the existing literature. Finally, this review proposes a comprehensive conceptual framework for ordering and understanding the relationships among political, economic, social, and biological factors proposed as causes, consequences, or confounders of the relationship between income inequality and health outcomes. Such a framework is intended not only to organize this review but also to suggest a more conceptually sound model for exploring the relationship between income inequality and health outcomes.

METHOD

This integrative literature review was conducted between October 2001 and January 2002. It utilized methods identified by Shi (1996) and Fink (1998). The search used the following electronic databases: PubMed, OVID (in-
including all sociological, political science, psychology, education, and economics journals), and dissertation abstracts. Each database was searched for articles that contained the phrase “income inequality AND health” in either the title or abstract. The search was not limited by date but only included articles written in English, French, or Spanish. This process revealed 327 potential articles. In addition, individual journals that publish frequently on the topic were each searched from 1990 to the present. This revealed an additional 30 relevant articles. All articles were culled to identify another 18 references. Finally, to ensure that the search parameters were wide enough, an additional search for the terms income inequality and health AND inequality was conducted through the Library of Congress catalog, which, after inspection of titles and descriptions, revealed 17 relevant books. After inspection of abstracts and evaluation of methodologies, 47 key articles were retrieved and abstracted (see the appendix). Only articles published in peer-reviewed journals and representing empirical studies or literature reviews were abstracted, although other articles, books, and editorials are discussed throughout this document. The theoretical literature was used to supplement empirical studies to develop the conceptual framework and assess the adequacy of the empirical models reviewed, especially in terms of the plausibility of results and the inclusion of a minimum set of covariates used in multivariate models.

**CONCEPTUAL FRAMEWORK**

To organize this review and to attempt to integrate the many strands of literature examining the relationship between income inequality and health, we propose a multidimensional conceptual framework, as presented in Figure 1. The framework is based on the work of Starfield and Shi (1999) and others but has been modified based on findings of the literature reviewed here. Thus, the framework is an outcome and a method of organizing this review.

Figure 1 describes distal and proximal determinants of health at the macro and micro levels. It organizes these determinants into four main columns. Beginning at the left, Panel A represents national political, cultural, and historical factors that produce income inequality and influence all other health determinants. Examples include systems of governance, legal and institutional factors governing union formation and health financing, cultural attitudes toward welfare and charity, and historical patterns of social relations.

Panel B shows income inequality. It is important to note that previous studies have positioned income inequality in different places within the framework. Our review of the sociology and economics literature suggests that it is most appropriately viewed as a consequence of political and cultural factors, and a potential modifier of macro- and microlevel health determinants. The
literature reviewed here does not suggest that there is any direct effect of income inequality on health outcomes. Instead, income inequality is hypothesized to work through one or more health determinants.

Panel C shows macrolevel determinants of health. In the literature reviewed here, none of these factors (with the possible exception of social cohesion) is hypothesized to have a direct impact on health, but all are nonetheless important precursors to the factors presented in Panel D. Macrolevel health determinants include the physical environment (e.g., air and water pollution, community or neighborhood characteristics, and infrastructure), macroeconomic environment (e.g., employment, gross national product [GNP], cost of living), social relations and cohesion (e.g., social class structure, community-level social capital), and health and welfare services (e.g., primary care services, educational institutions, welfare programs). Note that the framework does not attempt to describe the relationships among factors within each panel.

Panel D describes microlevel health determinants. These include exposures and risk factors (e.g., exposure to pollutants and external causes of injuries, and unhealthy behaviors such as drinking and smoking), economic resources (e.g., income), social resources (e.g., social networks, coping
abilities), and access and use of services (e.g., ability to use health services, obtain medicines, and join Women, Infants, Children [WIC] programs whenever needed). It is clear that these factors are often interrelated (e.g., availability of income can help determine whether one will use health services), but we make no attempt to tease out the relationships among the separate variables.

Finally, Panel E represents health outcomes. These include life expectancy, mortality, self-rated health, morbidity, mental health, and others. It is likely that a more detailed look at the causes of these outcomes would necessitate modifications to the conceptual framework; however, for the purposes of this review, we do not make such distinctions.

The framework presented above organizes this review. First, this review describes the literature examining simple associations between income inequality and health. Then, it examines studies that propose a pathway between income inequality and health outcomes. It then reviews criticism of these approaches and presents alternative explanations for the observed relationship between income inequalities and health. Finally, we present an analysis of the empirical evidence and provide suggestions for future studies on this topic.

INCOME INEQUALITY AND HEALTH

The health and social science literature is replete with studies of the impact of income, poverty, and social policies on the health of individuals (see overviews by Rodriguez-Garcia and Goldman 1992; World Bank 1993; Basch 1990). Numerous studies have supported the hypothesis that individual socioeconomic status (Antoft, Gadegaard, and Lind 1974; Blaxter 1987; Hollingsworth 1981; Mackenbach et al. 1997; Marmot et al. 1991) or its components of income (Blackburn 1994; Grant 1977; Salkever 1975; Wilkins, Adams, and Brancker 1989), education (Christenson and Johnson 1995), and occupation (Chandola 1998; Robinson 1984) have profound effects on an individual’s health. Similar results have been found for social class (Antonovsky 1967; Bunker 1983; Dougherty, Pless, and Wilkins 1990; Gregory and Piche 1983; Soderfeldt, Danermark, and Larsson 1989).

In the mid-1970s, researchers began to doubt whether national income continued to play a role in determining population health within industrialized countries (Fuchs 1974; Preston 1976). It appeared that at a certain level of development, additional increases in income had little effect on increasing national life expectancy (Preston 1976). This coincided with Omran’s epidemiological transition theory that stated that as countries move toward increased levels of economic prosperity, two things can be expected to happen. First, an epidemiological transition will take place: the cause of deaths
will shift from infectious to chronic diseases. Second, a demographic transition will take place: the burden of mortality will become increasingly made up of the old rather than the very young, and overall life expectancy will increase (Omran 1971).

Although the literature search revealed several early studies on the distribution of health within countries (see Antoft, Gadegaard, and Lind 1974; Mathers 1974; Smith and Kaluzny 1974), it was with the 1980 publication of Britain’s Black Report on health inequalities that intense research efforts began to focus less on aggregate income and health measures and more on the distribution of economic and health benefits across different social and economic groups within and across societies (Black et al. 1980). Consequently, research on variations in health status among people with different socioeconomic status has intensified over the past two decades.

An unexpected and important finding has been that better health outcomes appear to be positively correlated not only with absolute levels of income but, in some cases, even more strongly correlated with the equitable distribution of income within society. Wilkinson (1994, 61) summarized this position by stating that “mortality rates are no longer related to per capita economic growth, but are related instead to the scale of income inequality in each society.”

The earliest studies on the relationship between income inequality and health stressed associational measures between health outcomes and levels of income distribution. Referring to our framework in Figure 1, these studies assess the association between income inequality (B.1) and a variety of health outcomes (E.1) and occasionally control for other health determinants such as GNP (C.2) or health system resources (C.4).

Rodgers (1979) found that in multiple regressions using 56 countries, the level of income inequality (as measured by the Gini coefficient) was a significant predictor of life expectancy. The study estimated that differences in life expectancy between an egalitarian and nonegalitarian country might be as much as 5 to 10 years. This relationship held for all countries studied but was less pronounced among a sample of developing countries with a GNP per capita of less than US$1,000.

Further cross-sectional ecological studies by Waldman (1992) conducted with 1960 and 1970 data from 56 countries showed that a rise of 1 percent of national income held by the richest 5 percent of a given population could result in an increase in the infant mortality rate (IMR) of about 2 infant deaths per 1,000 live births. Consistent with Rodgers (1979), this effect was somewhat reduced in developing countries but also significant, even after controlling for GDP per capita, total number of physicians and nurses per 1,000 population, percentage of the country that was urban, levels of primary school enrollment, female literacy, and the gross reproductive rate.
Wilkinson (1992, 33) made the claim that few countries having achieved a life expectancy of 70 years or more had a GNP of less than US$5,000 per year and that beyond that threshold “there is little systematic relation between gross national product per head and life expectancy.” This led Wilkinson to posit what has become known as the relative income hypothesis. According to Wilkinson,

the sense of relative deprivation, of being at a disadvantage to those better off, probably extends far beyond conventional boundaries of poverty. A shift in emphasis from absolute to relative standards indicates a fall in the importance of direct material circumstances relative to psychosocial influences. The social consequences of people’s differing circumstances in terms of stress, self-esteem, and social relations may now be one of the most important influences on health. (p. 34)

More sophisticated research designs offered support for the relative income hypothesis. For example, several studies suggested that the relationship held for units of analysis smaller than countries. One study found a strong gradient in mortality related to the gap between the rich and poor within English wards/counties (Ben-Schlomo, White, and Marmot 1996). The authors suggested that the effect of relative income is primarily an ecological or contextual phenomenon.

Kaplan et al. (1996) found a statistically significant correlation between the percentage of income received by the less well-off and all-cause mortality among U.S. states. Variations in states’ income inequality were also significantly associated with homicides, crime, low birth rate, educational attainment, disability, expenditures on health care, imprisonment, and lack of medical insurance.

Kennedy, Kawachi, and Prothrow-Stith (1996) found that inequality in the distribution of income explains a significant proportion of cross-state variance in several causes of mortality in the United States, independent of poverty and smoking. The size of the gap in income between rich and poor—distinct from the average income level of the poor—was related to mortality within U.S. states. They used the Robin Hood Index (the percentage of income of the richest 50 percent of the population necessary to transfer to the poorest 50 percent of the population to have total income distributed equally between the two population halves) as an alternate measure of income inequality. This measure is thought to be less sensitive to outliers in the highest and lowest income categories.

Lynch et al. (1998) suggested that excess mortality within U.S. metropolitan statistical areas (MSAs) attributable to income inequality could be as high as
64.7 to 95.8 deaths per 100,000, depending on the income inequality measure used. The authors concluded that if U.S. states with the highest income inequality could redistribute their income to the level of those U.S. states with the lowest income inequality, then the high income inequality states could reduce their overall mortality by as much as 139.8 deaths/100,000. This mortality difference was similar in magnitude to the combined loss of life from lung cancer, diabetes, motor vehicle accidents, HIV, suicide, and homicide in 1995.

Several studies present evidence that the relative income hypothesis also holds for health outcomes other than mortality. For example, Diez-Roux, Link, and Northridge (2000) found that state inequality was associated with several cardiovascular disease risk factors (body mass index, hypertension, and sedentarism). Income inequality was also found to be associated with higher abdominal weight gain among a representative sample of U.S. men (Kahn et al. 1998).

Soobader and LeClere (1999) showed that income inequality exerts an independent adverse effect on self-rated health at the county level. Kahn et al. (2000) found that women in the lowest income categories were more likely to report depressive symptoms or fair/poor health. Among women in the lowest income quintiles, those women who lived in states with higher income inequality were more likely to report depressive symptoms or fair/poor health status than comparable women who live in states with lower income inequality, even while adjusting for individual characteristics such as age, marital status, education, race/ethnicity, and household size. The relationship was consistent for women in the three lowest income quintiles.

Multilevel designs have been used to measure the individual and contextual effects of income inequality on population health. For example, Kennedy et al. (1998) found that inequalities in income at the state level had an independent, negative effect on an individual’s risk of reporting fair or poor health. Inequalities in statewide income distribution were found to be associated with self-rated fair or poor health, even while controlling for individual income and other risk factors. Lochner et al. (2001), using a prospective multi-level design, also found that individuals living in states of higher income inequality had a 12 percent increased relative risk of mortality, even after adjusting for age, gender, race/ethnicity, marital status, and annual income.

Studies on non-U.S. populations include those by Duleep (1995), who confirmed the relationship between income inequality and mortality for a sample of the Organization for Economic Cooperation and Development (OECD) and former Soviet states. Humphries and van Doorslaer (2000) found that income-related health inequality in Canada was between that of the United Kingdom and the United States.
Chiang (1999) provided evidence from Taiwan that income distribution may become a more important determinant of mortality than absolute income as a country develops economically. In 1976, absolute income (GNP) was a powerful and significant predictor of under-5 mortality in Taiwan. By 1995, the distribution of income (Gini) had become a more significant predictor of mortality in Taiwan than GNP per capita.

PATHWAYS THROUGH WHICH INCOME INEQUALITIES INFLUENCE POPULATION HEALTH

Several possible explanations have been offered for how income inequalities might affect health. These explanations are summarized in Table 1.

PSYCHOSOCIAL PATHWAYS

The first set of explanations is based on individual and society-level psychosocial characteristics, such as levels of interpersonal trust and social cohesion. The theoretical basis for these explanations comes from the work of Emile Durkheim. Referring to Figure 1, these studies primarily explore the relationships between income inequality (B.1), macrolevel (C.3) or microlevel (D.3) social factors, and health (E.1).

At the individual level, the psychosocial explanation posits that “cognitive processes of social comparison” work to increase individuals’ levels of stress that concomitantly lead to poorer health status. Stress, poor social support, and lack of control over one’s work are related to poor health and have a greater effect on those at the bottom of social hierarchies (Wilkinson 1996, 1998). This hypothesis is supported by the Whitehall study that shows a continuous social gradient in health, that is, within a social (or economic) hierarchy, individuals at a given level in a hierarchy tend to exhibit poorer health than individuals in the next highest level of the hierarchy. This relationship holds for individuals at each and every level of the hierarchy (Marmot et al. 1991).

Interestingly, Adam Smith also discussed the idea of relative income and its impact on social functioning and well-being. Sen (1999, 71) reminds us of Smith’s concern that what counts as a necessity in one society is not absolute but is determined by social norms and expectations. For example, to be able to appear in public and to carry out one’s social functioning may require a higher standard of clothing or other forms of conspicuous consumption in a richer society than in a poorer one, and “the same parametric variability may apply to personal resources needed for fulfillment of self-respect.”
The psychosocial explanation has its correlate at the macro level. Advocates of the relative income hypothesis have theorized that income inequality may lead to changes in society by creating a climate of mistrust, reduced cooperation, and decreased propensity to join voluntary organizations. Several authors have variously termed this concept social cohesion, social trust, and social capital. In spite of difficulties with the definitions and measurement of these concepts (see Macinko and Starfield 2001), all suggest a social mechanism that is related to psychosocial stresses associated with the status and power differentials caused by income inequalities. This explanation is based on the role of social relations and networks in determining individual and

### TABLE 1  Explanations for the Relationship between Income Inequality and Health

<table>
<thead>
<tr>
<th>Explanation</th>
<th>Synopsis of the Argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychosocial (micro):</td>
<td></td>
</tr>
<tr>
<td>Social status</td>
<td>Income inequality results in “invidious processes of social comparison” that enforce social hierarchies causing chronic stress leading to poorer health outcomes for those at the bottom.</td>
</tr>
<tr>
<td>Psychosocial (macro):</td>
<td></td>
</tr>
<tr>
<td>Social cohesion</td>
<td>Income inequality erodes social bonds that allow people to work together, decreases social resources, and results in less trust and civic participation, greater crime, and other unhealthy conditions.</td>
</tr>
<tr>
<td>Neo-material (micro):</td>
<td></td>
</tr>
<tr>
<td>Individual income</td>
<td>Income inequality means fewer economic resources among the poorest, resulting in lessened ability to avoid risks, cure injury or disease, and/or prevent illness.</td>
</tr>
<tr>
<td>Neo-material (macro):</td>
<td></td>
</tr>
<tr>
<td>Social disinvestment</td>
<td>Income inequality results in less investment in social and environmental conditions (safe housing, good schools, etc.) necessary for promoting health among the poorest.</td>
</tr>
<tr>
<td>Statistical artifact</td>
<td>The poorest in any society are usually the sickest. A society with high levels of income inequality has high numbers of poor and consequently will have more people who are sick.</td>
</tr>
<tr>
<td>Health selection</td>
<td>People are not sick because they are poor. Rather, poor health lowers one’s income and limits one’s earning potential.</td>
</tr>
</tbody>
</table>

The psychosocial explanation has its correlate at the macro level. Advocates of the relative income hypothesis have theorized that income inequality may lead to changes in society by creating a climate of mistrust, reduced cooperation, and decreased propensity to join voluntary organizations. Several authors have variously termed this concept social cohesion, social trust, and social capital. In spite of difficulties with the definitions and measurement of these concepts (see Macinko and Starfield 2001), all suggest a social mechanism that is related to psychosocial stresses associated with the status and power differentials caused by income inequalities. This explanation is based on the role of social relations and networks in determining individual and
population-level health (Berkman and Kawachi 2000; Berkman and Syme 1979; Durkheim 1951).

For example, Kawachi et al. (1997) found that income inequality within states (as measured by the Robin Hood Index) was correlated with group membership and lack of social trust. Aggregated rates of social mistrust (the percentage of respondents who answered that “you can’t be too careful in dealing with other people”), perceived lack of fairness (the percentage of respondents who answered that “most people would try to take advantage of you if they got the chance”), and per capita membership in voluntary organizations were associated with total state all-cause mortality while adjusting for poverty and income inequality. Path analysis suggested that income inequality leads to a lowering of social trust that then leads to increased mortality.

Kawachi, Kennedy, and Glass (1998) expanded on these findings. They used General Social Survey (GSS) measures of civic trust, reciprocity (helpfulness of others), and civic engagement. Using a multilevel model, they found that a person living in a state with low levels of social trust was 40 percent more likely to report lower self-assessed health status than someone living in an area of higher social trust. Similar results were found for those living in states characterized as having low and medium group membership and low and medium reciprocity (Kawachi, Kennedy, and Glass 1998).

Kawachi, Kennedy, and Wilkinson (1999) further expanded on the meaning of social capital by proposing that among U.S. states, inequalities in environmental and social characteristics help to predict geographic variation in crime. The results suggested that state-level income inequality (as measured by the Robin Hood Index) was highly associated with violent crime such as homicide. Low levels of interpersonal trust and the number of female-headed households were correlated with higher homicide rates. Health status measures were not included in the study. These studies follow others showing associations between income inequality, crime, and other unfavorable social conditions (see Chiu and Madden 1998; Sampson, Raudenbush, and Earls 1997; Walberg 1998).

Kawachi, Kennedy, and Brainerd (1998) applied measures of social capital to explain increased mortality in Russia after the fall of the Soviet Union. They used voting rates and trust in government as social capital measures and also included a number of variables related to what the authors term social cohesion. These include crime, divorce rates, and conflicts in the workplace. Each of these social indicators was strongly associated with all cause age-adjusted mortality and life expectancy for men and women.
NEO-MATERIAL PATHWAYS

The second main set of explanations emphasizes neo-material and economic factors and stems from either a Marxist or rational choice orientation. These studies primarily explore the relationships among income inequality (B.1), macroeconomic factors (C.2), individual economic resources (D.2), and health (E.1). They also occasionally incorporate measures of the physical environment (C.1) and individual exposures (D.1).

In many ways, the neo-material approach developed out of critiques of the psychosocial pathway literature. It is founded on the proposition that material factors, such as income and living conditions, are the most important determinants of health. In contrast to the Durkheimian theories of psychosocial stress and social cohesion, the individual-level income hypothesis holds that aggregate-level associations between income inequality and health reflect only the individual-level associations between absolute income and health. The neo-material explanation incorporates the individual-level health hypothesis but goes further by claiming “health inequalities result from the differential accumulation of exposures and experiences that have their sources in the material world” (Lynch, Smith, et al. 2000, 1202). The effect of income inequality on health is thought to be the result of negative exposures, lack of resources, and systematic underinvestment in human, physical, health, and social infrastructure. Thus, it incorporates individual- and contextual-level factors but emphasizes that accumulated exposures resulting from poorer physical conditions and reduced quality of education and other social services adversely affect the life chances and health outcomes of those at the lowest end of the social spectrum. As an illustration of this concept, Kaplan et al. (1996) found that U.S. states with high income inequality also had lower rates of medical care expenditures and higher rates of unemployment.

Muntaner and Lynch (1999) argued that the psychosocial explanation is flawed because of the following: (1) Class relations are ignored, (2) international economic relations are not analyzed, (3) politics are not included as a determinant of population health, (4) social cohesion is not well defined, (5) the role of medical care is underemphasized, and (6) there is little evidence that social cohesion and equality are related.

Lynch, Due, et al. (2000, 406) offered an alternative explanation for the role of social capital and income inequality on population health. They claimed that “absolute and relative income differences may represent the unequal distribution of the material conditions that structure the likelihood of possessing and accessing health protective resources; of reducing negative health exposures; and of facilitating full participation in the society.” Essentially, they
argued that disturbed social relations are the effect of health and social inequalities, not their cause.

Lynch, Smith, et al. (2000) asserted that data for the association between psychosocial pathways and income inequality are ambiguous at best. Their objections include the following: (1) the macrolevel social cohesion hypothesis ignores structural causes of the inequality, (2) it oversimplifies the role of social cohesion, and (3) the data do not clearly show that as income inequality increases, social indicators also uniformly decrease. Instead, they suggested that systematic differences in material conditions (at the individual and contextual levels) better explain the observed relationship between income inequality and health. Lynch, Smith, et al. suggested specific public policy interventions such as investments in schooling, health care, social welfare, and working conditions and more equitable distribution of public and private resources as ways to address inequalities in health. A similar argument was presented by Bobak et al. (2000).

Lynch et al. (2001) conducted an ecological study that was improved over previous studies because it used income inequality measures from the Luxembourg Income Survey (LIS)—widely considered to be the most accurate and consistent income data available (Atkinson, Rainwater, and Smeeding 1995)—and tested a wide range of health outcomes. The authors found that in a sample of 16 OECD countries, higher income inequality was consistently associated with higher infant mortality. Associations between income inequality and all-cause mortality decreased with age, and actually reversed in populations older than 65 years. Cause-specific mortality showed no clear relationship. Psychosocial variables (trust, organizational membership, volunteering) showed weak and inconsistent relationships. They concluded that overall, psychosocial pathways seem to play little role in the relationship between income inequality and health (Lynch et al. 2001). The study did not include any measures of the medical or social services system.

THE ROLE OF HEALTH SERVICES AND PRIMARY CARE

In general, the studies reviewed here did not incorporate the role of health services in the analysis of the relationship between income inequality and health. In our conceptual framework, there are two main levels at which the health system may influence the relationship between income inequality and health: through the structure and availability of health and other social services (C.4) and individual access and use of specific services (D.4).
Although the literature indicates some skepticism as to the overall contribution of medical care to the improvement of population health worldwide (McKeown 1976; McKeown, Record, and Turner 1975; McKinlay and McKinlay 1977), there is evidence that access to certain types of medical care may be more beneficial than others in reducing a country’s overall burden of disease (Starfield 1996). For example, Bunker (2001) has suggested that in some countries, as much as half of the 7.5 years of increased life expectancy since 1950 is the result of improved medical care. Another study on the determinants of decline in mortality rates in the Netherlands from 1875 to 1924 likewise highlighted the historical role of medical care—particularly public health interventions and health education provided through primary care settings—in contributing to long-term improvements in population health (Wolleswinkel et al. 2001).

Other authors have suggested that at least some of the historical differences in health status between the rich and poor may be in part due to differential access to basic health services (Mackenbach, Stronks, and Kunst 1989). In particular, primary care, defined as “that level of a health service system that provides entry into the system . . . provides person-focused care over time, provides care for all but very uncommon or unusual conditions, and coordinates or integrates care provided elsewhere or by others” (Starfield 1998, 8-9), has been shown to have an important impact on health outcomes for some of the most common medical problems (Starfield 1996). Furthermore, several studies have demonstrated that the extent of primary care orientation (as opposed to a system based on physician specialists) has a statistically significant effect on improving life chances, particularly among the disadvantaged (Shi 1994).

Among the studies abstracted in the appendix, there were contradictory findings as to whether access to health services was associated with health status and income inequalities. Flegg (1982) found that the number of physicians and nurses per capita had a statistically significant effect on health outcomes in models including income inequalities, while Judge, Mulligan, and Benzeval (1998a, 1998b) and van Doorslaer et al. (1997) found no consistent association. One possible explanation for this discrepancy is that Flegg’s analysis included primarily developing and middle-income countries, while Judge et al. and van Doorslaer et al. included only wealthy OECD countries in their analysis. This choice of countries is important because generic measures of medical care may be stronger predictors of overall population health status in developing countries than in more wealthy ones. Moreover, none of these authors differentiated between primary care and specialty care, which is a particularly important distinction when examining the impact of health care on outcomes in wealthy OECD countries (Shi and Starfield 2000; Starfield and Shi 2002).
Other health and social services indicators, such as overall social expenditures (Gustafsson and Johansson 1999) and investments in medical care (Kaplan et al. 1996), have been found to be associated with lower income inequality, but these same expenditure variables have not always been found to be associated with mortality (Judge, Mulligan, and Benzeval 1998a; van Doorslaer et al. 1997).

Shi et al. (1999), in an ecologic study in the United States, found that income inequality and primary care (measured by primary care physicians per 10,000 population) exerted a strong and statistically significant influence on state-level mortality and life expectancy. Path analysis suggested that primary care might overcome some of the adverse health impacts of income inequality on population health.

In a multilevel model including individual-, community-, and state-level variables, Shi and Starfield (2000) present stronger evidence for the ability of primary care to partially attenuate the adverse health effects of income inequalities. In multivariate analyses, income inequality and primary care were significantly associated with self-rated health. Primary care significantly attenuated the effects of income inequality on self-reported health status. Adding individual-level socioeconomic status variables somewhat reduced the magnitude of the association between income inequality, primary care, and self-reported health. The study found that while controlling for all covariates, an increase of one primary care physician per 10,000 population was associated with a 2 percent increase in the odds of reporting excellent/good health.

Although the authors do not propose any specific mechanisms, there may be several possible explanations for the observed relationship between income inequality, primary care, and health. One mechanism for such an influence is that access to a regular source of primary care may improve health promotion and early detection of diseases such as complications of hypertension (Shea et al. 1992). Primary care is conceived of as that aspect of the health care system where the majority of care is provided through its role of first contact with the health system and its attributes of providing comprehensive, coordinated, and longitudinal care (World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians [WONCA] 1991).

Second, there is evidence that strong primary care can lead to appropriate and more efficient secondary and tertiary care (Casanova, Colomer, and Starfield 1996; Casanova and Starfield 1995).

Third, because primary care implies person-oriented, longitudinal, and first-contact care, it is expected that in the best of circumstances, individuals
living in areas with high levels of primary care providers may develop an important social tie with their primary care provider.

Finally, primary care may function as an important measure of social transfer that could compensate individuals for their relative income deprivation with an essential social service.

**CRITIQUES OF THE RELATIVE INCOME HYPOTHESIS**

Although much of the early literature on income inequality and health confirmed the findings that such a relationship existed, there is now a growing body of literature that questions the validity of the relative income hypothesis and its explanatory theories. The studies reviewed here consist of critiques of the relative income hypothesis, negative findings, and alternative explanations for the observed relationship. These studies are organized into several categories to aid analysis and describe trends in the intellectual development of this literature. These categories include discussions of data quality, methodological discussions, and alternative explanations for the observed relationship. Taken as a whole, these studies cast doubt on several features of the relative income hypothesis and argue that the role of income inequality on health may be modest and perhaps limited to only certain societies and certain health outcomes.

**MEASURING INCOME AND INCOME INEQUALITY**

Income and income inequality are notoriously difficult to measure. Table 2 provides a summary of the major measures of income inequality and their advantages, disadvantages, and most common data sources. In addition to differences in the construction and interpretation of the income inequality measures, the household income data on which inequality indices are derived can differ significantly from study to study. Two key concepts are disposable (net) versus total (earned) income, and income that has been equivalized for household size. Disposable income refers to household income that is net of taxes and other income transfers. The idea is that disposable income is a more valid and comparable income measure because different households will have different purchasing power, depending on the taxes and social transfers. Such differences in real purchasing power would not be captured by using total (gross) family income. This distinction can be important. For example, in a country with a highly progressive tax system, using gross household income to assess income distribution may indicate high levels of inequality, while using a posttax and transfer measure of income to calculate the income


<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition</th>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Data Source</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gini coefficient</td>
<td>Ranges from 0 (perfect equality) to 1 (perfect inequality); ratio of area between Lorenz curve and a line of perfect income equality</td>
<td>Most commonly used; simple interpretation</td>
<td>Comparability problems; not always constructed identically; lack of good data; not available for many countries/years</td>
<td>LIS; World Bank (Deininger and Squire 1996); WIID; U.S. census</td>
<td>0.355 0.344</td>
</tr>
<tr>
<td>Income shares</td>
<td>Ratio of income of person at the xth percentile (often the 90th) to a person at the yth percentile (often the 10th)</td>
<td>Easily interpreted; can examine a range of extreme distributions</td>
<td>Lack of good data; not available for many countries/years</td>
<td>LIS; World Bank (Deininger and Squire 1996); WIID; U.S. census</td>
<td>90:10, 90:10, 5.85; 80:20, 80:20, 3.11</td>
</tr>
<tr>
<td>Atkinson Index</td>
<td>Ranges from 0 to 1; relative position of the poorest is weighted by parameter e that measures society’s aversion to inequality</td>
<td>Weighs the relative position of the poorest; allows for a range of e weights</td>
<td>Not commonly used; no consensus on best value for e; lack of good data; not available for many countries/years</td>
<td>LIS; World Bank (Deininger and Squire 1996); U.S. census</td>
<td>e = 1, 0.214; e = 0.5, 0.105</td>
</tr>
<tr>
<td>Measure</td>
<td>Definition</td>
<td>Advantage</td>
<td>Disadvantage</td>
<td>Data Source</td>
<td>Example</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Theil Index</td>
<td>Ranges from 0 (complete equality) to infinity; a member of the entropy class of inequality measures</td>
<td>Weighs relative position of poorest; reliable data sets available</td>
<td>Not commonly used; not easily interpreted; based on wages, not income</td>
<td>University of Texas Inequality Project (UTIP)</td>
<td>.0280</td>
</tr>
<tr>
<td>Robin Hood Index</td>
<td>Ranges from 0 to 1; percentage of income needed to transfer from the richest 50 percent to the poorest 50 percent to obtain equality</td>
<td>Intuitively appealing; less sensitive to highly skewed distributions</td>
<td>Ignores the distribution of income within each 50 percent share; not available for many countries/years</td>
<td>U.S. census</td>
<td>NA</td>
</tr>
</tbody>
</table>

Note: LIS = Luxembourg Income Survey; WIID = World Income Inequality Database.
distribution in the same population could reveal a more egalitarian society. The World Income Inequality Database (UNU/WIDER 2000) suggests that Gini coefficients calculated from gross income are 5 to 10 points higher than those calculated from net income.

Another distinction in terms of household income data is whether such data have been “equivalized” for household size. Dividing household income by family size (often the square root of family size) is considered good practice because a family of four does not necessarily need twice the income of a family of two to live equally well. Failure to make this adjustment may render interhousehold comparability significantly less reliable, because the unit of analysis (the household) is in reality composed of a number of different units (the family) that vary in size and composition. Atkinson, Rainwater, and Smeeding (1995), Judge and Paterson (2002), and Coulter (1989) provide more detailed discussions of income inequality measurement issues.

Judge (1995) presented a critique of Wilkinson’s early work that addresses some of the problems inherent in many income inequality measures. Judge pointed out that Wilkinson and others used measures of income inequality (the Gini coefficient) that were derived from household surveys conducted independently in each country. One of the key difficulties in comparing household income studies is that they often differ in how they solicit total income from the households they interview. It is therefore possible that reported differences in income distribution between countries could be biased because each country did not measure income the same way (Galbraith, Conceição, and Kum 2000). Second, some income inequality databases (such as the World Bank’s “Deininger and Squire” or the United Nations’ “WIDER” databases) include a mix of Gini coefficients calculated from household data that differ not only in how income was measured but also in whether the final Gini coefficients are adjusted for taxes or other income transfers (Deininger and Squire 1996). Although within such data sets one can select income inequality data that have more or less consistent definitions, this is not always done in practice because data are rarely available for every country and year of interest. Third, not all income inequality measures were calculated by using equivalized family income.

Judge (1995) used the LIS as a source of internationally comparable, standardized measures of income inequality. The LIS income inequality measures are based on a similar household income data collection methodology, are based on net income, and are equivalized for family size. Using the LIS income inequality measures, Judge did not find a relationship between life expectancy and the distribution of income. He concluded that the previously reported relationship was in large part due to the weaknesses of the income data used to calculate the income inequality measures.
METHODOLOGICAL CRITIQUES

Judge, Mulligan, and Benzeval (1998a) provided a critique of the methodology used in much of the income inequality and health literature. Their objections included the observations that (1) authors generally used small sample sizes so their conclusions are prone to error, (2) some studies used data on developing and developed countries but then generalize the results only to the developed countries, (3) many studies used bivariate analyses only and thus fail to control for other health determinants, and (4) income inequality data were generally unreliable, are not available for a wide range of years, and were not consistently adjusted for taxation and family size.

Judge, Mulligan, and Benzeval’s (1998a) critique, although pertinent to much of Wilkinson’s work, is not a generalizable critique; multilevel and time-series studies in the United States (see Blakely et al. 2000; Kennedy et al. 1998; Lynch et al. 1998; Wolfson et al. 1999), studies using a variety of outcome variables (Soobader and LeClere 1999), studies conducted in Canada (Cairney and Wade 1998) and Australia (Clarke and Smith, 2000), and studies using equivalent disposable income to construct inequality data (Humphries and van Doorslaer 2000; Shi and Starfield 2000) provide much stronger evidence for the relative income hypothesis and address each of Judge, Mulligan, and Benzeval’s objections.

However, more sophisticated research designs have also resulted in negative findings. For example, Fiscella and Franks (1997) used a U.S.-based longitudinal cohort study (National Health Examination Survey and its follow-up components) and a multilevel model to test the relationships between individual income, neighborhood-level income inequality, and an individual’s risk of dying. Their results showed that although there seems to be a bivariate relationship between survival rates and community income inequality, after adjustment for household income, no significant relationship was found between neighborhood income inequality and mortality. They suggested that previous ecological-level studies using larger geographical units may have suffered from the confounding influence of the interrelations between contextual-level income inequality measures and individual-level family income. They concluded that poverty, rather than income inequality, determines mortality at the community level.

Wagstaff and van Doorslaer (2000, 543) conducted a literature review of individual-level studies on the impact of income inequality on health. In their review of six major studies, they found that the literature “reveals strong support for the absolute income hypothesis and little or no support for the income inequality hypothesis.” The authors concluded that many of the individual-level studies conducted in the United States suffer from methodological flaws.
in the income inequality measures used, do not account for fixed state and year effects, and are not generally consistent with several hypothetical pathways through which income inequality is posited to influence individual health.

Several individual-level international studies further called into question the universality of the relative income hypothesis. Research conducted in Japan (Shibuya, Hashimoto, and Yano 2002) and Denmark (Osler et al. 2002) showed that individual-level health (measured by self-rated health status and mortality risk, respectively) was not associated with income inequality measured at the level of prefectures (states) in Japan, or smaller areas of aggregation (parishes) in Denmark. Both studies suggested that individual income is a more important predictor of health outcomes at the individual level than income inequality. The authors of both studies also suggested that features of the Japanese and Danish welfare state may protect people from the adverse effects of income inequality in ways that social protections in countries such as the United States, Taiwan, and the United Kingdom do not. Finally, another study reported that income inequality is not significantly related to mortality in Canada at either the regional or metropolitan level, although there was a relationship between income inequality and health in the United States (Ross et al. 2000).

Sturm and Gresenz (2001) present a further methodological critique of the literature. The authors argue that associations between self-rated health and income inequality became nonsignificant when adjusted for other individual-level covariates (income, age, gender, race/ethnicity, family size). Furthermore, they found a strong gradient in the relationship between better health and improved levels of education and absolute (not relative) family income.

Perhaps the most comprehensive study to date is that by Mellor and Milyo (2001). Their study examined the country-level relationship between income inequality (measured by the Gini coefficient and income ratios of the bottom 20th percentile to the top 20th percentile) and aggregate health outcomes (life expectancy at birth, infant mortality) across 30 countries over a four-decade span. It also examined 48 U.S. states over five decades using the Gini coefficient to measure income inequality and all-cause mortality, infant mortality rates, low-weight births, homicides, suicides, and six different specific causes of death as dependent variables. At the international and state levels, the authors found that contrary to previous literature, there was no consistent relationship between income inequality and health outcomes. The analysis controlled for demographic variables such as median income, educational levels, and year-specific effects. The state-level analyses also controlled for percentage of population that is urban, black, and college educated. In the 54 regression equations reported, income inequality was significantly associated
with poorer aggregate health outcomes in only 11 cases but was significantly associated with better health outcomes in 15 cases.

ALTERNATIVE HYPOTHESES

Gravelle (1999) presented an alternative explanation for the observed relationship between income inequality and health outcomes. He claimed that the relationship between individual income and mortality is curvilinear—beyond a certain point, increases in income have little effect on mortality. Because of this relationship, he argued that a statistical artifact might explain the observed relationship between income inequality and health. His logic was that if one population has a more equal distribution of income than another, then there are more individuals at the middle income levels and fewer outliers at the high and low ends. This means, in general, better health status for those at the lowest income groups (especially since more people at the higher end of the income distribution will not be expected to influence health outcomes because of the curvilinear relationship between income and health). The average poor person can thus appear to be better off in a more egalitarian society because he or she is likely to have a higher individual income, which will reduce the risk of mortality. Therefore, the relative income hypothesis is simply an artifact of absolute income.

Gravelle, Wildman, and Sutton (2001) then reexamined Rodgers’s (1979) study using more consistent income inequality data derived from the LIS. In multivariate regression analyses using data from 56 countries at two time periods (1980-1982 and 1988-1990) and controlling for GDP and several transformations of average national income, the relationship between income inequality and life expectancy was not significant. Box-Cox and nonparametric estimations also revealed no significant association between life expectancy and income inequality. They concluded that the relationship between income inequality and health was indeed a statistical artifact.

Other alternate explanations for the observed relationship between income inequality and health include the hypothesis that racial and ethnic minority populations within countries (which often have a poorer health profile and represent a larger share of the lower income quintiles) may explain the higher mortality among lower income deciles. Wilkinson (1992) showed that minority groups have a small impact on health in England (one of the more ethnically diverse countries in Europe), implying that the scale of income inequality was too large to be accounted for by ethnic minorities alone (Wilkinson 1992). However, studies in the United States showed a different pattern.

Deaton and Lubotsky (2002) examined the impact of race on the relationship between income inequality and mortality among U.S. states and MSAs in
1980 and 1990. They found that “once the fraction [of the state or MSA that is] black is controlled for, income inequality has no effect” (p. 11). Their findings are significant even after stratifying by age groups and gender and after controlling for income, education, and state fixed effects. The authors argue that the association between income inequality and health in the United States might be the result of confounding with race, since those areas with a higher proportion of black population also have higher income inequality and higher mortality—for whites as well as for the entire population. They proposed that the social cohesion argument made to explain the impact of income inequality on health might be applied to segregation based on race. Muller (2002) found similar results. While Shi and Starfield (2001) found that in an ecological study of U.S. MSAs in 1990, income inequality was a significant predictor of mortality for both black and white populations; even while conditioning on per capita income, education, unemployment, urban residence, and primary care in both combined and race-stratified analyses.

Other authors suggested that the health selection hypothesis might be at work. This hypothesis holds that ill health precedes poor educational or work performance. That is, sicker people are more likely to be poorer because of the economic consequences of their illness (West 1991).

Finally, Judge and Paterson (2002) discussed the possibility that income inequality might also have a negative impact on the health of those at the highest income levels. This is supported by Weich, Lewis, and Jenkins (2001), who found an association between regional income inequality and self-reported mental health in Britain. This relationship was statistically significant only among individuals in the wealthiest income quintile, and held when controlling for a range of individual-level health determinants, including social class, employment status, age, gender, income, and physical health status.

COMPARISON OF EMPIRICAL STUDIES

The appendix presents an analysis of the main peer-reviewed studies on the relationship between income inequality and health. Forty-five empirical studies and two literature reviews are included in the table. Criteria for comparison include the type of income inequality measure; main outcome variable(s); whether the study controlled for at least the following covariates—GDP per capita or mean/median income for ecological studies and income, age, and gender for individual-level studies; unit of analysis (ecological, individual, mixed); study population and time period; which pathway (if any) was tested; and whether income inequality was found to be associated with health outcomes.
Table 3 presents a summary of the findings and main characteristics of the studies reviewed. The table presents the study results according to three overall classifications—by health outcome, income inequality measure, and level of analysis. This table is not meant to present results of a formal meta-analytic method. Instead, it is intended to facilitate analysis of the results of the many studies contained in the appendix. It is also important to note that publication bias is likely to have limited the number of studies published that showed no relationship between income inequality and health. Therefore, we caution against a simple comparison of number of studies that found or failed to find an association between income inequality and health, particularly when examination of the authorship of the articles points to a group of less than 10 researchers being responsible for the vast majority of the studies reviewed. Instead, we constructed the table to see if there might be patterns in the study design, health outcomes tested, or country analyzed that were more likely to find positive or negative results. The results of this analysis follow.

Several conclusions can be drawn from an examination of Table 3. First, there are contradictory findings based on the health outcomes measure used. Overall, 33 analyses showed a statistically significant relationship between income inequality and health outcomes, while 12 studies generally showed no relationship. For each health outcome (life expectancy, infant mortality, all-cause adult mortality, and self-rated health), there is evidence both for and against an effect of income inequality.

Studies also differed by the measure of income inequality used. The most prevalent measure of income inequality was the Gini coefficient, followed by different combinations of income shares. For each type of income inequality measure, there is evidence both for and against its association with health outcomes. There was little consistency even among studies using the same measure of income inequality. For example, among those studies using the Gini coefficient, some calculated it by using household as opposed to family income, while others used gross (pre-tax) instead of net (post-tax) income. By and large, international studies using the LIS Gini measures (adjusted for taxes and household size) did not find an association between income inequality and health, while studies using other Gini measures did find an association. But it is important to note that not all of these studies used exactly the same countries, the same years, the same control variables, or even the same outcomes measures, rendering comparison among even seemingly similar studies inconclusive.

In terms of level of analysis, evidence is also mixed. Ecological studies were the most prevalent, and the results, often conducted on the same unit of analysis (U.S. states or OECD countries), varied. Individual-level and multilevel studies all revealed positive and negative findings. This was the case even...
when the same outcomes, data sets, and units of analysis were used. For example, Lochner et al. (2001) found a significant relationship between income inequality and mortality using a multilevel design with the U.S. National Health Interview Survey, while Fiscella and Franks (1997), using a similar design and the same data set, did not find a relationship.

Some authors have suggested that there is more evidence of a relationship between income inequality and health within the United States than within (or between) other countries (Judge and Paterson 2002). This review only partially supports such a conclusion. Some individual-level within-country

---

**TABLE 3  Summary of Literature Review Findings**

<table>
<thead>
<tr>
<th>Study Characteristic</th>
<th>Association between Income Inequality and Health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td></td>
</tr>
<tr>
<td>Life expectancy</td>
<td>3</td>
</tr>
<tr>
<td>Infant mortality rate (IMR)</td>
<td>5</td>
</tr>
<tr>
<td>Mortality</td>
<td>9</td>
</tr>
<tr>
<td>Self-rated health</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
</tr>
<tr>
<td><strong>Income inequality measure</strong></td>
<td></td>
</tr>
<tr>
<td>Gini</td>
<td>15</td>
</tr>
<tr>
<td>Robin Hood</td>
<td>3</td>
</tr>
<tr>
<td>Income decile ratios</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
</tr>
<tr>
<td><strong>Level of analysis</strong></td>
<td></td>
</tr>
<tr>
<td>Individual</td>
<td>10</td>
</tr>
<tr>
<td>Ecologic</td>
<td>17</td>
</tr>
<tr>
<td>Multilevel</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
</tr>
<tr>
<td><strong>Countries studied</strong></td>
<td></td>
</tr>
<tr>
<td>United States only</td>
<td>17</td>
</tr>
<tr>
<td>Non–United States (single country)</td>
<td>5</td>
</tr>
<tr>
<td>International (multicountry)</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
</tr>
</tbody>
</table>

---

a. Some studies examined multiple outcomes, including IMR. Although only the study’s main findings are presented in the table, at least two studies additionally present evidence of no statistical association between income inequality and IMR.
studies conducted at the individual or state level provide limited evidence that income inequality may affect health in Australia, New Zealand, Taiwan, and the United States, and there is evidence both for and against an association within Canada. There are also mixed findings regarding multicountry studies. Even though recent literature (see Deaton 2002; Mellor and Milyo 2001) has called into question the validity of conclusions drawn from Wilkinson’s (1992) and Rodgers’s (1979) international (multicountry) ecological studies, several more sophisticated analyses (see Lynch et al. 2001) did find an association across countries between income inequality and some, but not all, categories of health outcomes.

**DISCUSSION**

The literature review has described the wide range of studies exploring the relationship between income inequality and health. We have attempted to provide structure to the literature by describing its historical development, outlining its major theoretical and empirical basis, and categorizing the many criticisms, alternative explanations, and negative findings presented in the literature.

This review suggests that there are inconsistent findings on the relationship between income inequality and health. The most frequently reported associations seem to be in studies based in the United States (primarily using self-rated health and measuring income inequality at the state level) and international studies that use infant mortality as an outcome. But even within these studies there is variation. For example, in studies conducted within the United States, many that find a relationship between income inequality and health create categories of income inequality and then rank the unit of analysis (usually U.S. states) by categories of high, medium, or low income inequality, rather than using the actual value of the income inequality measure (such as the Gini coefficient) in the analysis. This is in contrast to many of the studies that do not find a relationship: they usually use the value of the income inequality measure itself in multivariate analyses.

In light of these findings, the main conclusion from this review is that the lack of consistency in the study design, data used, measures constructed, conceptual models employed, and unit of analysis makes it difficult to draw a definitive conclusion about the relationship between income inequality and health. For nearly each empirical study reviewed, another mostly similar study produces a negative finding. Then, a new publication appears to challenge the negative finding and reassert the original study’s conclusions. Normally, such disputes could be resolved by analyzing of the strength of different study designs, but even prospective, multilevel designs controlling for a
variety of relevant covariates revealed contradictory results often because they used similar (but not identical) income inequality measures. The lack of systematic replication of results has certainly increased the number of articles published on this topic, but it has done little to address the central question of whether (and if it is, to what extent and how) income inequality is related to health outcomes.

To answer these questions, we make several suggestions that we believe would facilitate future studies and ultimately help shape future policies and programs designed to address the impact of income and other social inequalities on health.

First, although the majority of studies control for covariates thought to be associated with health, the actual model of health production specified is different in nearly every study. Our conceptual framework shows that although multiple pathways have been mentioned in the literature, few studies test competing pathways. Almost none have placed analyses within a larger socioeconomic framework that considers the causes of income inequality as well as its potential impacts on health and other population outcomes. As part of the conceptual framework of health determinants, future studies should include, at the very least, a macro-level measure such as GDP per capita and health systems and services, as well as micro (or aggregate) measures of individual income, socioeconomic status (SES) measures of education or occupational prestige (or social class), and racial/ethnic composition.

Second, the link between the theoretical literature and the empirical model used to test hypotheses is often weak. At the very least, the range of covariates and the specific theoretical framework for each study should be better justified in terms of the health outcome being evaluated. In addition, issues of proximal determinants of income inequality and health outcomes are rarely (if ever) addressed. Here, the economics and sociology literatures present numerous studies of how (and why) income and other social disparities develop within nations (see Alderson and Nielson 1999; Chase-Dunn 1975; Gradstein and Milanovic 2000; Gustafsson and Johansson 1999; Lipset 1959). Few studies in the literature reviewed have attempted to analyze the role of macropolitical effects through techniques such as instrumental variables or structural equation modeling. Doing so could enrich the health literature enormously by building on the rich theoretical and empirical traditions in fields that have long studied the distribution and consequences of inequalities on populations.

Third, there is a need to improve the framework and analyses by sorting out the various levels of health determinants, that is, ecological and individual, and the need to assess at which ecological levels (nation, state, MSA, county, city, neighborhood, etc.) that income inequality makes most sense in
influencing health. We have attempted to provide a basic framework for ordering these analyses in our conceptual framework. The literature reviewed here suggests that different results can be obtained by examining the same populations at different levels of analysis. Further work will be necessary to satisfactorily explain such discrepancies and justify the level of analysis used in future studies.

Fourth, there are great differences in the measure of income inequality, the data used to calculate income inequality measures, and the years for which data are derived. These inconsistencies greatly impede study comparability. At the very least, income inequality measures should contain some weight or identify the position of the poorest in the income distribution. This is why income share ratios, concentration curves, and Atkinson and Theil indices should be preferred to the Gini or the Robin Hood Index. Moreover, household inequality data must be consistent. The economics literature suggests that household income used for calculating income inequality measures should be net of taxes and other transfers and should be equivalized for family size. Future studies will need to be explicit about the income data used to derive the inequality index and discuss the implications of the limitations of the income data they employ.

Fifth, very few of the studies reviewed included health system components. Those studies that do incorporate health system variables, particularly measures of primary care, found that they are important determinants of health outcomes and in some cases reduce the impact of income inequality and other socioeconomic measures on health outcomes. The finding that aspects of the health system can interact in some way with social or economic determinants of health offers what Starfield and Shi (2002) term a “palliative strategy” to partially reduce the negative effects in inequalities on health in the absence of more comprehensive efforts to tackle the root causes of such inequalities. Greater efforts should be taken to ensure that the health system is included not only in further research but also in the design of policies and programs meant to address social disparities.

Sixth, because of the complexity of the analyses required, methodological problems continue to plague most published studies. Time lags (Blakely et al. 2000), data quality (Judge 1995; Judge, Mulligan, and Benzeval 1998a; Wagstaff and van Doorslaer 2000), controlling for median versus mean income (Blakely and Kawachi 2001)—just to name a few issues—have all been found to influence results. Moreover, issues such as multicollinearity among economic variables are rarely dealt with systematically. To date, no single study has comprehensively addressed each of these potential limitations. For this
reason, it is difficult to compare different studies since each contains its own, often unique, flaws. Although it will be a challenging task, if we are to satisfactorily investigate the impact (if any) of income inequalities on health, resources should be directed at designing a thorough, rigorous, and replicable study that addresses each of these methodological issues.

CONCLUSIONS

Some authors have recently asserted that “evidence favoring a negative correlation between income inequality and life expectancy has disappeared” (Mackenbach 2002, 1). Based on the analysis of the literature reviewed here, this conclusion appears premature. It is difficult to draw a firm conclusion about the true nature of the relationship between income inequality and health because a combination of limited data of questionable quality, noncomparable study designs, radically different conceptual frameworks, and different analytical methodologies has complicated rather than clarified our understanding of this relationship.

Moreover, none of the studies or editorials discussing the relationship between income inequality and health has claimed that income inequality itself has a direct influence on health. Instead, income inequality is viewed as a proxy for something else—some other psychological, social, economic, political, or environmental determinant of health. Based on the literature reviewed here, it appears that income inequality performs rather poorly as a proximate cause of health.

Finally, regardless of the relationship between income inequality and health detected, nearly every study has confirmed the importance of individual income on health outcomes—even within countries with universal insurance and relatively generous social welfare policies. This suggests that one benefit of research on income inequality is that it has highlighted the role of economic and social resources and their impact on health inequalities (Mackenbach 2002). We also believe another important contribution has been a reexamination of the role of the health system, particularly primary care, as an important determinant of population health in advanced industrialized nations, an area that deserves further thought, analysis, and action.
## APPENDIX

### Literature Review

<table>
<thead>
<tr>
<th>Author</th>
<th>Income Inequality Measure</th>
<th>Main Outcome Variable</th>
<th>Controlled for Covariates</th>
<th>Unit of Analysis</th>
<th>Study Design, Population</th>
<th>Hypothesis/Pathway Explored</th>
<th>Income Inequality Related to Health?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bobak et al. (2000)</td>
<td>Gini (country-level)</td>
<td>Self-rated health</td>
<td>Yes (material deprivation = food, clothing, heating; control, education, income)</td>
<td>Individuals</td>
<td>Cross-sectional study; representative samples of adults in 1996/1998 in Russia, Estonia, Czech, Lithuania, Poland, Latvia, Hungary</td>
<td>Material and psychosocial</td>
<td>No (not after controlling for material deprivation score)</td>
</tr>
<tr>
<td>Authors</td>
<td>Methodology</td>
<td>Main Findings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiscella and Franks (1997)</td>
<td>Longitudinal cohort study; sample of adults included in the National Health and Nutrition Examination Survey, 1971-1975 to 1987</td>
<td>Mortality related to individual or community income inequality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Author</th>
<th>Gini, Theil, coefficient of variation</th>
<th>Infant mortality rate (IMR)</th>
<th>Yes (female illiteracy and labor force, physician/nurse per 1,000, GDPpc, income transfers)</th>
<th>Ecological (country)</th>
<th>Cross-sectional study; multivariate and bivariate OLS regressions for 46 underdeveloped countries, data from 1970s</th>
<th>IMR and different measures of income inequality</th>
<th>Yes (with Gini)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravelle (1999)</td>
<td>Relative and absolute income levels by income shares</td>
<td>Mortality</td>
<td>No</td>
<td>Theory</td>
<td>Reexamination of the relationship between income and mortality; no data used.</td>
<td>Is the relationship a statistical artifact</td>
<td>No</td>
</tr>
<tr>
<td>Humphries and van Doorslaer (2000)</td>
<td>Health Concentration Index</td>
<td>Self-assessed health status</td>
<td>Yes (income, Health Utility Index)</td>
<td>Individual</td>
<td>Cross-sectional; 1994 Canadian National Population Health Survey</td>
<td>Absolute versus relative income</td>
<td>Yes (but does not explain all income-related health inequalities)</td>
</tr>
<tr>
<td>Study Reference</td>
<td>Measure of Income Inequality</td>
<td>Measure of Health Outcomes</td>
<td>Association</td>
<td>Methodology</td>
<td>Findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------</td>
<td>---------------------------</td>
<td>-------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge (1995)</td>
<td>Gini, percentage of population with less than 50 percent income</td>
<td>Life expectancy</td>
<td>No</td>
<td>Cross-sectional study; 13 Organization for Economic Cooperation and Development (OECD) countries; Luxembourg Income Survey (LIS) data, 1994</td>
<td>Is the relative income hypothesis valid? No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge, Mulligan, and Benzeval (1998a)</td>
<td>Share of income going to different income deciles, Gini, 90:10 ratio</td>
<td>Life expectancy, infant mortality</td>
<td>Yes</td>
<td>Ecologic (country) Literature review and cross-sectional study; OLS regression; 16 OECD countries; LIS income inequality data</td>
<td>Further critique of the relative income hypothesis No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kahn et al. (1998)</td>
<td>Percentage total income received by richest 50 percent in each state</td>
<td>Abdominal obesity</td>
<td>Yes</td>
<td>Individual Cohort from 21 states; follow-up of American Cancer Nutrition Survey</td>
<td>Psychosocial stress Yes (men only)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continued)
### APPENDIX (continued)

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Income Inequality Measure</th>
<th>Main Outcome Variable</th>
<th>Controlled for Covariates</th>
<th>Unit of Analysis</th>
<th>Study Design, Population</th>
<th>Hypothesis/Pathway Explored</th>
<th>Income Inequality Related to Health?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaplan et al. (1996)</td>
<td>Income received by lowest 50 percent in state</td>
<td>Age-adjusted all-cause mortality; low birth weight</td>
<td>No (bivariate relationships only)</td>
<td>Ecological (states)</td>
<td>Cross-sectional study; U.S. states, 1980, 1990, 1989-1991; data from the National Center for Health Statistics (NCHS) and 1980 and 1990 census</td>
<td>Income inequality and mortality</td>
<td>Yes (also with homicide, crime, insurance, imprisonment)</td>
</tr>
<tr>
<td>Kawachi et al. (1997)</td>
<td>Robin Hood Index</td>
<td>Social capital variables</td>
<td>No (only controlled for state poverty)</td>
<td>Ecological (states)</td>
<td>U.S. cross-sectional ecological analysis; 39 U.S. states</td>
<td>Components of social capital</td>
<td>Yes</td>
</tr>
<tr>
<td>Kawachi, Kennedy, and Glass (1999)</td>
<td>State-level social capital (categories of trust, group membership reciprocity)</td>
<td>Self-rated health</td>
<td>Yes (income education, smoking, age, gender)</td>
<td>Multilevel</td>
<td>Multilevel analysis; Behavioral Risk Factor Surveillance System (U.S. adults)</td>
<td>Social capital</td>
<td>Yes</td>
</tr>
<tr>
<td>Study</td>
<td>Measure of Income Inequality</td>
<td>Measure of Health</td>
<td>Design</td>
<td>Data Source</td>
<td>Findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------</td>
<td>-------------------</td>
<td>--------</td>
<td>-------------</td>
<td>----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LeGrand (1987)</td>
<td>Share of income for bottom 20 percent</td>
<td>Age at death</td>
<td>Yes (GDP, welfare, health care)</td>
<td>Ecological (countries)</td>
<td>Cross-sectional analysis of 17 developed countries; 1980s data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lynch et al. (1998)</td>
<td>Gini, Atkinson, Theil, below 50, 50:10 and 90:10 income shares</td>
<td>All-cause mortality by age group</td>
<td>Yes (per capita income, household size, 200 percent poverty rate)</td>
<td>Ecological (metropolitan statistical area [MSA])</td>
<td>Cross-sectional design; U.S. population using 1990 census data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lynch et al. (2001)</td>
<td>Gini coefficient, LIS data</td>
<td>Mortality categories, IMR, life expectancy, distrust, organizational membership, control, union, women in government</td>
<td>Yes (GDP and population size)</td>
<td>Ecological (countries)</td>
<td>Cross-sectional; correlations only; OECD countries; World Health Organization (WHO) and world values survey data, from mid-1990s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McIsaac and Wilkinson (1997)</td>
<td>Decile shares of income (LIS data)</td>
<td>Mortality (multiple categories), IMR, potential years of life lost (PYLL)</td>
<td>No</td>
<td>Ecological (countries)</td>
<td>Cross-sectional; correlations only; data from 12 wealthy OECD countries</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Yes (most pronounced for near-poor whites)*

*Yes (for infant mortality and aged 15-64 group)*

*Yes (for IMR only), no (psychosocial variables show mixed results)*

(continued)
### APPENDIX (continued)

<table>
<thead>
<tr>
<th>Author</th>
<th>Income Inequality Measure</th>
<th>Main Outcome Variable</th>
<th>Controlled for Covariates</th>
<th>Unit of Analysis</th>
<th>Study Design, Population</th>
<th>Hypothesis/Pathway Explored</th>
<th>Income Inequality Related to Health?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muller (1985)</td>
<td>Income share of upper quartile</td>
<td>Homicide from political violence</td>
<td>Yes (economic growth, regime, oppression, years of democracy)</td>
<td>Ecological (country)</td>
<td>Cross-sectional study; OLS regression and path analysis, 57 countries</td>
<td>Mortality from political violence</td>
<td>Yes</td>
</tr>
<tr>
<td>Osler et al. (2002)</td>
<td>Median income share by parish</td>
<td>Mortality risk</td>
<td>Yes (household income, household and demographic characteristics)</td>
<td>Individual</td>
<td>Pooled, representative cohort studies (more than 25,000 people followed for 13 years) in Denmark</td>
<td>Income inequality, mortality, and individual income</td>
<td>No</td>
</tr>
<tr>
<td>Rodgers (1979)</td>
<td>Gini</td>
<td>Life expectancy at birth and age 5 and IMR</td>
<td>Yes (GNP per capita and log transformations of GNP)</td>
<td>Ecological (countries)</td>
<td>Cross-sectional study, 56 countries, 1973</td>
<td>Income inequality as a determinant of mortality</td>
<td>Yes</td>
</tr>
<tr>
<td>Ross et al. (2000)</td>
<td>50 percent income share</td>
<td>Mortality</td>
<td>Yes</td>
<td>Ecological (states and MSAs)</td>
<td>Cross-sectional study, OLS regression model; Canadian provinces and MSAs, U.S. states and MSAs; Census data 1990-1991</td>
<td>Income inequality and health</td>
<td>Yes for United States, no for Canada</td>
</tr>
</tbody>
</table>

Note: IMR = infant mortality rate
<table>
<thead>
<tr>
<th>Study</th>
<th>Measure</th>
<th>Outcome</th>
<th>Study Type</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shi et al. (1999)</td>
<td>Gini</td>
<td>Mortality, post and neonatal mortality, life expectancy</td>
<td>Ecological study; U.S. census and others, 1990</td>
<td>Primary care</td>
</tr>
<tr>
<td>Shi and Starfield (2000)</td>
<td>Gini (state)</td>
<td>Self-rated health</td>
<td>Multilevel study; U.S. Community Tracking Survey (state, MSA/community, individual), 1996</td>
<td>Primary care</td>
</tr>
<tr>
<td>Shibuya, Hasimoto, and Yano (2002)</td>
<td>Gini</td>
<td>Self-rated health</td>
<td>Individual study; Income inequality and self-rated health, Yes (individual income and demographic characteristics)</td>
<td>No</td>
</tr>
<tr>
<td>Soobader and LeClerc (1999)</td>
<td>Gini</td>
<td>Self-rated health</td>
<td>Individual study; Income inequality and morbidity, Yes (at county level, but reduced at census tract level)</td>
<td>No</td>
</tr>
<tr>
<td>Sturm and Gresenz (2001)</td>
<td>Gini</td>
<td>Self-rated health, chronic medical conditions, and mental health</td>
<td>Individual study; Income inequality, family income, and mental health, No (not after controlling for education and family income—strong predictors of health in this study)</td>
<td>No</td>
</tr>
<tr>
<td>Turrell and Mathers (2001)</td>
<td>Gini</td>
<td>Propensity to not report income</td>
<td>Individual study; Is income underreporting significant?</td>
<td>NA (income underreporting most prevalent among high income groups)</td>
</tr>
</tbody>
</table>
### APPENDIX (continued)

<table>
<thead>
<tr>
<th>Author</th>
<th>Income Inequality Measure</th>
<th>Main Outcome Variable</th>
<th>Controlled for Covariates</th>
<th>Unit of Analysis</th>
<th>Study Design, Population</th>
<th>Hypothesis/Pathway Explored</th>
<th>Income Inequality Related to Health?</th>
</tr>
</thead>
<tbody>
<tr>
<td>van Doorslaer et al. (1997)</td>
<td>Health concentration curve</td>
<td>Self-reported health</td>
<td>Yes (health and social expenditures)</td>
<td>Individual</td>
<td>Cross-sectional; Finland, Germany, Netherlands, Spain, England, United States, Sweden, Switzerland; data from 1982-1992</td>
<td>Income inequality and health in OECD countries</td>
<td>Yes</td>
</tr>
<tr>
<td>Wagstaff and van Doorslaer (2000)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Individual</td>
<td>Literature review of six individual-level studies</td>
<td>Income inequality and health</td>
<td>No consistent relationship</td>
</tr>
<tr>
<td>Waldmann (1992)</td>
<td>Log income share of top 5 percent and bottom 20 percent</td>
<td>IMR (log-transformed)</td>
<td>Yes (GDP, doctors/1,000, urban, primary school, female literacy, reproductive rate)</td>
<td>Ecological (countries)</td>
<td>Cross-sectional study; 57 countries; data from World Tables, UN statistics, World Bank 1960/1970</td>
<td>Income distribution and IMR</td>
<td>Yes</td>
</tr>
<tr>
<td>Weich, Lewis, and Jenkins (2001)</td>
<td>Gini (net current income)</td>
<td>Self-reported mental health</td>
<td>Yes (age, gender, social class, employment, ethnicity, physical health)</td>
<td>Individual</td>
<td>Cross-sectional analysis of adults in England, Wales, and Scotland; data from early 1990s</td>
<td>Income inequality and mental health</td>
<td>Yes (but only among the wealthiest income quintile)</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Methodology</td>
<td>Key Findings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>------</td>
<td>--------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilkinson</td>
<td>1994</td>
<td>Gini (posttax, standardized for household size)</td>
<td>Life expectancy: Yes (GDP per capita)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilkinson</td>
<td>1992</td>
<td>Income decile shares (family net cash income)</td>
<td>Life expectancy: No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wolfson et al.</td>
<td>1999</td>
<td>Income shares</td>
<td>All-cause mortality: Yes (state income levels)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cross-sectional study; some time-series analyses; 12-22 OECD countries, 1970-1990

Cross-sectional study; bivariate correlations; 23 OECD countries; data from World Tables, LIS, WHO, OECD, 1975-1985

Multivariate statistical simulation model; data from 1990 U.S. census, CDC, and national longitudinal mortality study

Developed versus developing countries

Income distribution and life expectancy in developed countries

Relation between mortality and income inequality a statistical artifact?
REFERENCES


