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THE FIRST INJUSTICE: Socioeconomic Disparities, Health Services Technology, and Infant Mortality

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ABSTRACT

Infant mortality has long been viewed as a synoptic indicator of the health and social condition of a population. In this article we examine critically the structure of this reflective capacity with a particular emphasis on how new health care technologies may have altered traditional pathways of social influence. The infant mortality rate is a composite of a series of component rates, each with its own relationship to social factors. Advances in health care have reduced dramatically the risk of mortality for the critically ill newborn, thereby elevating the importance of access to this care in shaping absolute and disparate infant mortality rates. These advances in health services technology have also had the effect of concentrating infant mortality among extremely premature and low birth-weight infants, a group tied directly to social factors operating through maternal influences and the general well-being of women.

In this manner, current patterns of infant mortality in the United States provide a useful illustration of the dynamic interaction of underlying social forces and technological innovation in determining trends in health outcomes. We review the implications of this perspective for sociological research into disparate infant mortality, including the social and economic structure of societies, access to health services, the potential for prenatal intervention, women's health status, and racial and ethnic disparities.

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DISPARITIES IN INFANT MORTALITY RATES: NO LONGER A SIMPLE SOCIAL MIRROR

High rates of death and disease among individuals of lower social and economic status have been extensively documented in industrialized countries throughout the past century. Indeed, in spite of substantial increases in economic indicators such as gross national product (GNP) and increases in dollars spent on medical care in the United States, socioeconomic disparities in mortality and morbidity persist to the present day (Marmot et al 1987, Hahn et al 1995, Pappas et al 1993). This documentation has been hailed as "one of sociology's most enduring contributions to the health field" (Williams & Collins 1995).

Infant mortality rates in particular have long been considered a sensitive indicator of the impact of socioeconomic disparities on the health of populations, due in large part to the special vulnerability of the newborn to poverty and substandard living conditions (Marx 1967). In this manner, infant mortality rates have typically been seen to represent a kind of "social mirror," reflecting broad inequalities in society and, because of the inherent innocence of young children, illuminating the machinery of social injustice (Wise & Pursley 1992). This reflective capacity has been circumstantially supported by the persistence of disparities in infant mortality rates throughout this century, mirroring the persistence of larger social and economic inequalities in the United States (Children's Bureau 1921, Gortmaker 1979a, Wise et al 1985).

A premise of the present review, however, is that mechanisms that traditionally defined infant mortality as a social mirror have been altered appreciably by rapid innovations in health services technology. Such technological change also creates new opportunities for socioeconomic differentiation as life-saving therapies or preventive interventions potentially are made available only to the economically advantaged. This, in fact, currently happens on an international scale, where many seriously ill newborns in developing countries die of conditions currently treatable by health services commonly available in the industrialized world.

The sociological literature has generally focused on the relationship between social and economic variables and the risk of infant mortality, but it has largely ignored the role of changing health care technology. In this review our aim is to illustrate the fact that there is now abundant evidence for the substantial impact of health services technology in reducing infant mortality rates, as well as for the powerful influence of social and economic inequalities independent of health services technology. We review the evidence for declining infant mortality rates in the United States and other industrialized countries, and we document the continuing disparities in rates by social and economic characteristics of the population. These different trends suggest that the interaction of social and

technologic determinants has operated to decrease absolute rates while simultaneously maintaining broad disparities in these rates (Wise & Pursley 1992). In this empirical context, the perspective of Ogburn (Ogburn 1969) suggests that innovation in technology has resulted in a broad array of sociological consequences, only some of which have been examined.

We have accordingly structured this review to critically examine three issues:

1. The evolution of infant mortality patterns in the United States

2. The extent to which the long-documented mechanisms of socioeconomic influence on infant mortality have been altered by a technical revolution in modern health services for pregnant women and newborns

3. The impact of these altered causal pathways on the conceptual legitimacy of using infant mortality rates as a marker of social and economic inequalities

While our focus is on infant mortality, the empirical and theoretical work we cite can be directly applied to other arenas of disparate health outcomes as well. We focus on the United States experience, although similar issues arise in the other industrialized countries of the world.

THE EVOLUTION OF INFANT MORTALITY PATTERNS IN THE UNITED STATES

One of the most enduring indictments of social and health policies in the United States is the consistently poor showing of the United States in international rankings of infant mortality. Although the United States is the wealthiest country in the world and expends more per capita on health and medical care than any other country, our infant mortality rates consistently rank below those of many other nations—twenty-second in 1990, below Italy, Spain, and Singapore (UNICEF 1992) (see Figure 1). While there are some reporting differences between the United States and other countries that contribute to these disparities (e.g. in some countries, an infant death during the first few hours after birth is not counted as a live birth), these can account for only a part of the differences observed (Hartford 1992). The clear message derived from these data is that the United States ranks lower than all the other industrialized countries in infant survival.

In addition to a relatively high overall rate of infant mortality, there are pronounced disparities within the United States among social, economic, racial, and ethnic groups and geographic areas. Some communities in the United States experience infant mortality rates resembling those of developing countries. The

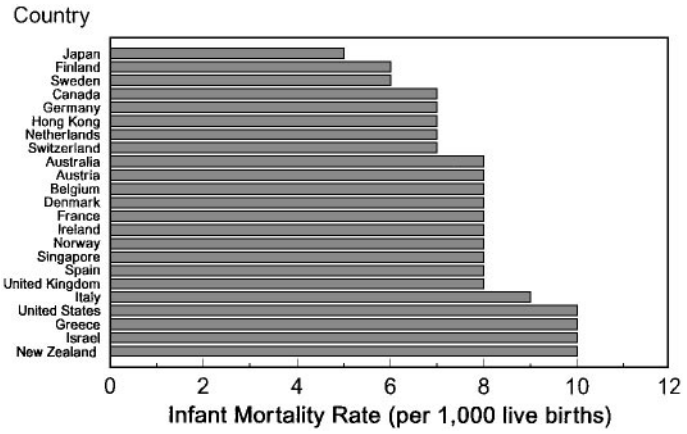

Figure 1 #Infant mortality rates by country 1990.

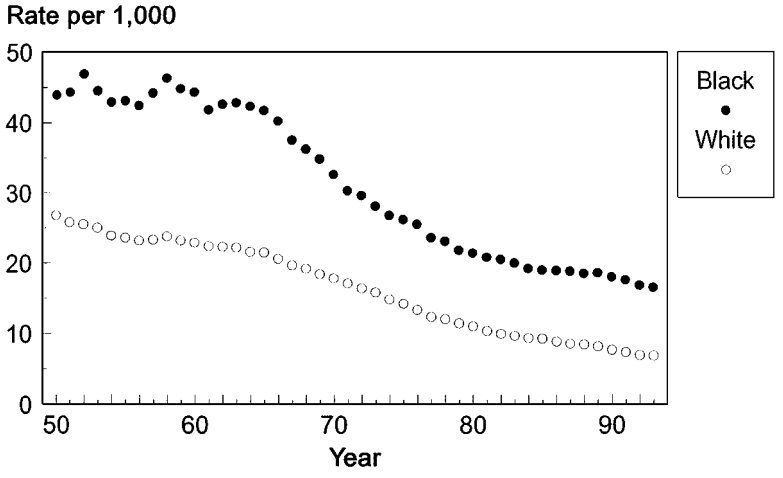

Figure 2 Black and white infant mortality rates in the United States 1950–1993.

reasons for these disparities are complex but are generally thought to reflect the powerful effects of social and economic inequality.

One important indicator of continuing disparity is provided by trends in the infant mortality rates of black (African-American) and white infants in the United States during the period 1950–1993 (see Figure 2). These data document the persistently higher rate of infant mortality among African-American infants

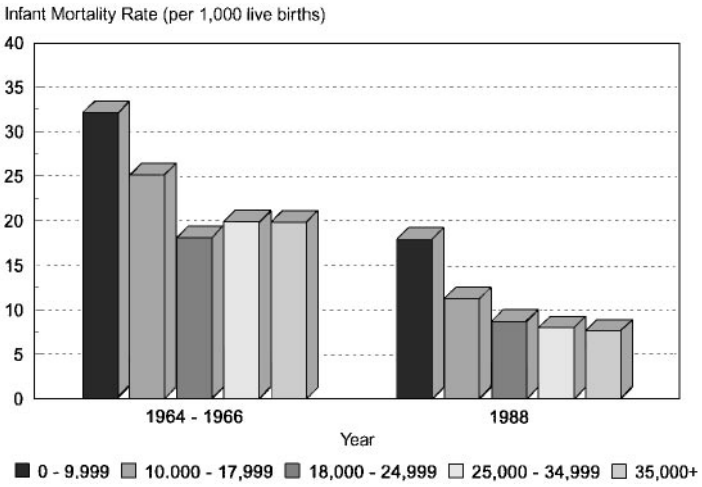

Figure 3 Infant mortality rates by household yearly income in the United States 1964–1966 and 1988.

in the United States and describe a black/white disparity that has not been narrowing during the past three decades.

A striking recent confirmation of the persistence of economic disparities can be seen from tabulations of data from two national infant mortality studies in the United States, the 1964–1966 National Natality and Infant Mortality Followback Surveys (NNS and NIMS) (National Center for Health Statistics 1972) and the 1988 National Maternal and Infant Health Survey (Sanderson et al 1991) (Figure 3). These data provide the only national estimates of disparities in infant mortality by household income. The income categories are only approximately similar, because categories of income were used in the survey, adjusted for changes in the Consumer Price Index (United States Bureau of the Census 1989).

The 1964–1965 data precedes the implementation of Medicaid and thus provides important "baseline" information concerning economic disparities. The 1988 data comes after more than a decade of operation of this major health care financing program that includes poor families with children. Early evaluations of the implementation of Medicaid indicate that it helped to reduce disparities in the utilization of health services between poor and nonpoor families (Butler & Scotch 1978), while more recent studies have documented problems in access and declining physician participation in Medicaid (Yudkowsky et al 1990). The data displayed in Figure 3 indicate no attenuation in the relative risk of infant mortality experienced by women with lower, compared with higher,

levels of household income during the past quarter of a century. These findings mirror those observed in Britain where, decades after the implementation of the National Health Service, social class disparities in infant mortality persist (Black et al 1982, Gray 1982).

The apparent lack of progress in improving the international ranking or reducing social disparities in infant mortality in the United States should not, however, be perceived as suggesting a lack of change in the overall rate or its underlying dynamics. Quite to the contrary, the past two decades have witnessed the most profound alterations ever recorded in the structure of infant mortality patterns in the United States. This dynamic character challenges the traditional social interpretation of the infant mortality rate and lies therefore at the heart of this discussion.

Although disparities persist, absolute rates of infant mortality for all groups in the United States have fallen dramatically over the past three decades. The infant mortality rate in 1990 was approximately 32% of the rate recorded in 1960. Similar dramatic reductions were seen for both black and white newborns, with the 1990 rates among whites being about 30% of the rate in 1960 and the 1990 rate among blacks being 37% of the earlier rate. Therefore, the persistence of social disparities in infant mortality has occurred in a setting of significant reductions in absolute rates, a consequence of the rapid improvements in health services technology surrounding childbirth.

THE IMPACT OF HEALTH SERVICES TECHNOLOGY

In order to explore the determinants of these complex trends, it is useful first to recognize that the infant mortality rate is actually a composite of a number of component rates, each with its own set of relationships with social factors and health services technology. One broad categorization separates infant deaths into those occurring during the neonatal period (the first 28 days following birth) and those occurring during the postneonatal period (the rest of the first year of life). This distinction, based on age at death, serves as a traditional proxy for cause of death. Postneonatal deaths have historically been due to viral and bacterial processes such as gastroenteritis and pneumonia and to injuries, all of which have long been closely linked to socioeconomic factors like poverty-level income (Gortmaker 1979a). Neonatal mortality has been more deeply shaped by processes associated with birth, including congenital anomalies, prematurity and low birth weight, and obstetrical catastrophes associated with delivery. These causes, though generally associated with social variables, tend to operate more directly through maternal and pregnancy-related pathways. Although the divide between the causes of neonatal and postneonatal mortality has never been sharp, this stratification still holds some importance in that it

attests to the heterogeneity of infant death and depicts an initial fork in potential pathways of social influence on infant mortality (Wise 1990).

In this context it is important to note that in 1990 approximately 63% of infant mortality in the United States occurred in the neonatal period, compared to 70% in 1950. This continuing concentration of death in the first 28 days has been due to a precipitous decline of both postneonatal and neonatal mortality during the 1960s, 1970s, and 1980s. While postneonatal mortality rates remain higher than those of many other industrialized countries, death in this age group from injuries and infectious processes has become relatively rare in the United States. The largest contributors to postneonatal mortality today include the consequences of prematurity and sudden infant death syndrome (SIDS), a diagnosis that probably captures a variety of pathologies but is broadly defined by the sudden, unexpected death of a previously healthy infant. Although SIDS is associated with an important social gradient, it is less profound than those related to more traditional postneonatal causes.

While postneonatal mortality has been altered significantly, neonatal mortality has been most substantially transformed. Because neonatal mortality is so deeply tied to the health of the newborn at birth, it is useful to stratify the neonatal mortality rate into two components based on birth weight, the most generally meaningful indicator of risk at birth. Birth weight operates in this manner because it reflects the adequacy of the intrauterine environment and serves as a general proxy for gestational age, which is difficult to assess accurately in large populations. Stratifying the neonatal mortality rate by birth weight results in defining two mechanisms by which differences in neonatal mortality can occur: differences in the distribution of birth weights [a larger portion of births falling into the very low birth weight (less than 1500 g) groups would generate a higher risk of neonatal death in the population] or differences in birth weight–specific mortality (higher mortality within each birth-weight group would generate higher overall neonatal mortality).

When neonatal mortality trends are examined in this manner, two major findings emerge. First, recent reductions in neonatal mortality in the United States have been due almost entirely to improvements in birth weight–specific survival; birth-weight distributions have remained relatively stable over the past 30 years. For example, national evidence indicates that during the period 1960–1980, 15% of the decline in white infant mortality risk can be attributed to improving birth-weight distribution, and 85% to improved birth weight–specific mortality. Among blacks, −3% of the change in infant mortality rates during this period can be attributed to a worsening birth-weight distribution, and 103% to declining birth weight–specific mortality (Buehler et al 1987).

Second, the primary determinant of the poor international standing of the United States and of social disparities in the infant mortality rate in the United

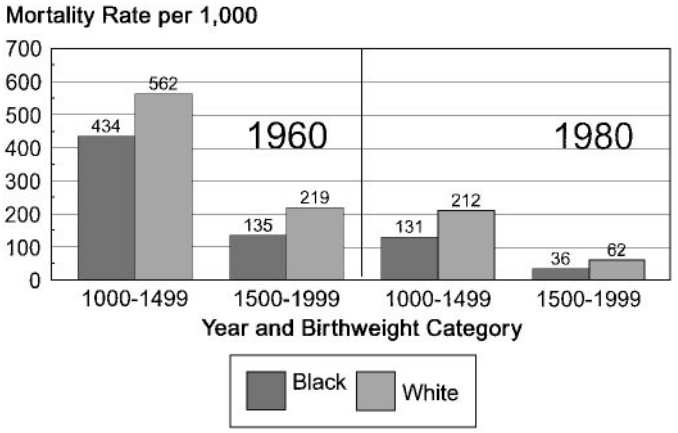

Figure 4 Neonatal mortality rates by birth weight and race: United States, 1960 and 1980.

States is an elevated rate of extremely low birth-weight (i.e. less than 1000 g) infants; the survival rates of US newborns when birth weight is controlled are among the best in the world (Guyer et al 1982, Alberman et al 1992). Therefore, the substantial improvement in birth weight–specific survival in the United States has had the effect of concentrating mortality into the most premature and very low birth-weight categories, thereby making the United States infant mortality rate increasingly sensitive to factors associated with extreme prematurity. More than 50% of all neonatal deaths in the United States are currently due to newborns born at less than 25 weeks of gestation (the legal abortion limit is 24 weeks), and infants born weighing less than 1500 g make up 1.2% of all births but 64% of all neonatal deaths (Wise et al 1995).

What then is responsible for these major improvements in the survival rates of ill newborns? A series of studies have identified a revolution in medical management of high-risk deliveries and critically ill newborns as accounting for this improved survival. These dramatic reductions are graphically displayed in Figure 4, for both black and white infants weighing 1000–1999 g at birth during the period 1960–1980. During these two decades, the rate of neonatal death among black infants weighing 1500–1999 g at birth decreased 66%, and among whites this decrease was 67% (Buehler et al 1987).

The dramatic effectiveness of this technology, however, did not lead to an attenuation of social and economic disparities in infant mortality rates. The similar decline in rates among both black and white infants indicates similar access to this technology during this period. One study of a geographic region of the United States with virtual universal access to neonatal intensive care

technology (Boston in the mid 1980s) reveals substantial social and economic differences in infant mortality rates, even though virtually all of these births occurred in Level III centers, meaning that all of the women and their infants had available the most sophisticated medical technology at birth (Wise et al 1988). These findings indicate that the causes of the decline in infant mortality rates—intensive care technology—are different from the effects of social and economic forces that still produce disparate outcomes. When effective medical technology is available to all in a geographic area, social and economic forces still emerge as visible factors.

In addition, this explanation also suggests that increases in infant mortality rates over coming decades could, paradoxically, be possible in areas that achieve an excellent system of access to neonatal intensive care and relatively low infant mortality rates. If restrictions in access to this neonatal intensive care occur, mortality rates could increase. As managed care systems increase in prominence in the United States in coming years, potential changes in access to services for high-risk infants need to be carefully evaluated (McCormick & Richardson 1995).

The remarkable success of neonatal intensive care has in many respects been overshadowed by questions of the appropriateness of intensive interventions for the most premature and seriously ill newborns. There are clear questions of cost although neonatal intensive care unit (NICU)-associated care is a minuscule component of overall health care spending, and studies have indicated NICU technology to be cost-effective as well as cost-beneficial for all but the very smallest infants (Office of Technology Assessment 1987, Boyle et al 1983). Moreover, the improved survival of ill newborns has produced little evidence of an aggregate increase in the prevalence of chronic childhood disorders, probably due to improvements in medical care (Shapiro et al 1983, Gortmaker & Sappenfield 1984, McCormick 1993). Although the exploration of the ethical and resource allocation issues involved in neonatal intensive care is, of course, important, and although the identification and elimination of iatrogenic health services must continue, such considerations should not obscure the documented effectiveness of neonatal intensive care in reducing mortality, nor the huge impact of these interventions in altering the nature of infant mortality in the United States.

We suggest that the structure of infant mortality in the United States has been altered forever by major technical advances in the clinical management of the high-risk pregnancy and the critically ill newborn. This contention, in turn, demands a reconsideration of the approaches used traditionally to examine the social determinants of infant survival as well as the practical strategies long advanced as being the most effective means of preventing infant death.

SOCIAL INFLUENCE AND TECHNOLOGICAL INNOVATION

Perhaps the most striking characteristic of the vast literature concerned with the causal pathways of infant mortality is its profound dichotomization. One view focuses on the direct impact of social and economic environments on the risk of infant mortality, while the second focuses on the impact of variations in health services (Gortmaker 1979a). One example of the first approach to the infant mortality problem in the United States is provided by Marsden Wagner, in remarks to the National Commission to Prevent Infant Mortality:

> Infant mortality is not a health problem. Infant mortality is a social problem with health consequences. It is analogous to traffic accident mortality in children: the first priority for improving traffic accident mortality in children is not to build more and better medical facilities, but rather to change traffic laws and better educate drivers and children. In other words, the solution is not primarily medical, but environmental, social and educational. The same is true for infant mortality: the first priority is not more obstetricians or pediatricians or hospitals, nor even more prenatal clinics or well-baby clinics, but rather to provide more social, financial and educational support to families with pregnant women and infants (Wagner 1988).

This perspective focuses on the powerful role of social and economic forces in the production of disparities in infant mortality rates, and for many sociologists it is a signal illustration (in a world preoccupied with the drama of medical discovery) of the importance of social status in defining health. With deep historical roots, this elevation of social causation in defining an inherently tragic health outcome has held special currency as a stark counterargument to the claims of modern medicine. Steadily improving socioeconomic environments of families, including improvements in food supplies and in sanitation, have traditionally been credited with causing reductions in infant mortality and improvements in life expectancy. Only a very marginal part of this improvement in mortality has been attributed to improvements in the delivery of effective medical care. As Dubos noted in 1959:

> The control of childhood diseases . . . resulted more from better nutrition and sanitary practices than from the introduction of new drugs. It is remarkable, in contrast, that little practical progress has been made toward controlling the diseases that were not dealt with by the nineteenth-century reformers (Dubos 1959).

This elevation of social pathways as fundamental is, of course, well-supported by an extensive research base throughout this century, and it is precisely why the infant mortality rate is so widely embraced as a legitimate indicator of underlying social conditions. However, as we have discussed, recent decreases in infant mortality rates are due solely to improved health care technology. Social and economic disparities in infant mortality rates persist, but very little empirical

data documents the mechanisms whereby inequalities are ultimately expressed in the biologic reality of infant death. Associations have been reported with infant mortality rates in multiple arenas where inequality is manifest, including the mother and household as discussed above, as well as the community and the larger society (LaVeist 1992, Kennedy et al 1996). Yet, one of the central tasks of any sociologic theory is to explain how inequality in these domains is ultimately transformed into infant death. This process, which might be termed "domain transformations" requires greater empirical inquiry. Do social and economic inequalities deprive people of the necessities of life such as nutrition, shelter, or social relations? Is social stress a major influence? Do these conditions increase the risk of infection or produce more risky health behaviors such as smoking (Gortmaker & Wise 1994)? Are multiple aspects of stratification involved, including characteristics of individual, household, and community? How do racism, sexism, and social class interact to impact infant health (Krieger et al 1993)? Is longer-term poverty a more fundamental cause than low income represented by the typical yearly income measure (Starfield et al 1991)?

One concern is that a tight focus on broad associations of infant mortality with social variables such as poverty, low educational attainment, or race and ethnicity can disrespect the power of technical interventions to alter both the intensity and nature of social and economic influence on infant survival. While it is important to document associations of inequality and infant mortality, it is even more important to understand underlying causal mechanisms, so that effective policies and programs can be developed. If a clinical or public health intervention is developed that is highly effective in preventing infant death from causes associated with poverty, then much, if not all, of a domain's established influence may fall away. Effective interventions, therefore, have the capability of uncoupling long recognized social influences such as poverty from specific outcomes such as infant death (Gortmaker & Wise 1994). Independent of such interventions, policies and programs can also focus on the often more difficult task of alleviating the underlying inequality as a social strategy.

Technical innovation can both modulate pathways of social influence and also create social influence for conditions traditionally insensitive to social factors. To illustrate this point, Jencks described the case of phenylketonuria (PKU), a genetically based disorder that can be controlled by a properly regulated diet (Jencks 1980). While PKU is a disorder that is completely genetic in origin, because there is a highly effective health intervention (diet in this case), any disparity in outcome can now be viewed as social in origin, particularly related to access to the intervention.

As noted above, new technology can also lead to increases in disparity. One newly emergent case that may fit this pattern is that of surfactant therapy for respiratory distress syndrome, a major cause of infant mortality due to prematurity.

After this therapy became available, neonatal mortality rates improved more for white than for black infants with similar very low birth weights (Hamvas et al 1996).

In this context, the impact of neonatal intensive care on recent trends in infant mortality in the United States provides an important arena for examining how technical innovation can alter traditional pathways of social influence. Such alterations are likely to be important for health conditions for which technical improvements in prevention or treatment are advancing rapidly.

The influence of social and economic forces on the prevalence of the HIV-1 (AIDS) virus is useful to explore from this perspective. The HIV-1 virus is not a major cause of infant mortality, but in some areas it has emerged as a substantial cause of early childhood death. A number of social factors have been associated with the risk of HIV-1 in infants and young children, in particular, maternal exposure to injection drug use (either her own or her sex partner's). Broader social forces are also at work: Housing destruction apparently led to the migration of a large IV drug-using population, with high rates of HIV-1 infection, throughout New York City (Wallace et al 1995). The development of new combination therapies for HIV-1–infected women and evidence for the effectiveness of the drug zidovudine (AZT) in preventing perinatal transmission (Connor et al 1994) (from infected mother to newborn child) have generated a new, powerful arena of social influence in determining relative access to an effective but often expensive intervention that can save infant lives.

Our intent in stressing the impact of technological innovation is not to diminish the fundamental importance of social forces in shaping patterns of infant mortality nor the relevance of sociology to their essential exploration. Rather, it is to call attention to the inherent volatility of this social influence and the importance of the sociology of health care in explaining this dynamic character. In this way, our objective in invoking the efficacy of clinical and public health intervention is not to limit the realm of sociology, but to plead for recognition among infant mortality specialists of an opportunity to expand their disciplinary embrace to include the social forces that shape both the dimensions of medical progress and differential access to the fruits of this technical struggle.

FUTURE DIRECTIONS IN SOCIOLOGICAL RESEARCH

We point out the dynamic nature of the causes of infant mortality in order to highlight the importance of critical sociological research in illuminating how social and economic forces and health services technology will shape the risk of infant death in the United States in the years to come.

Societal Characteristics and the Generation of Disparities in Infant Mortality Rates

A wide range of evidence indicates relationships between social and economic fortunes of societies and the risk of infant death. Some of the most dramatic historical evidence comes from studies of social structural change following World War II: Holland experienced very large increases in infant mortality as a consequence of starvation following the end of the war (Smith 1947, Susser & Stein 1994). Perhaps the most profound increase in infant mortality in an industrialized country to be observed during the past 30 years occurred in the USSR during the period 1971–1975—a 34% rise from 22.9 to 30.6 per 1000 (Davis & Feshbach 1980, Eberstadt 1981). The authorities in the USSR stopped publishing infant mortality rates soon thereafter, but the documented increases are unlike those seen anywhere in the industrialized world. More recent reports indicate a worsening of infant mortality rates in many Eastern European countries in the 1980s (Nanda et al 1993). Note that these recent increases occurred in the absence of modern neonatal intensive care capability.

Recent cross-sectional studies of countries and states indicate higher mortality rates in areas with greater income inequality (Waldman 1992, Kennedy et al 1996). Segregation indices are substantially correlated with rates of infant mortality among cities in the United States (Polednak 1991, LaVeist 1992). One study pointed out that countries with higher defense spending experience higher infant mortality rates (Woolhandler & Himmelstein 1985).

Others have examined yearly fluctuations in the economy. Brenner analyzed time-series data for the United States and other industrialized countries during the first half of the twentieth century and found evidence for an association between variations in rates of unemployment at the national level and rates of neonatal mortality (Brenner 1973, Brenner 1983). More recent evidence in support of this relationship has been reported, based on data from Los Angeles County, although the authors note very small effects (Catalano & Serxner 1992). One of the few individual level randomized studies based on the negative income tax experiment indicated that an income supplementation program can improve birth-weight outcomes (Kerher & Wohlin 1979).

Substantial limitations to these analyses of generally aggregate data exist: One fundamental problem is the difficulty of making causal inferences from geographically aggregated data (Susser 1994, Geronimus et al 1996). More importantly, these analyses generally do not provide insight into the pathways whereby social and economic conditions or the lack of effective health services may be producing disparities in infant mortality. During these times of enormous change in both the social and economic reconstruction of societies, including the current focus on “welfare reform” in the United States, and the

reorganization of health services, it is crucial that different potential routes of influence are critically evaluated.

Access to Health Services

One of the central consequences of the increasing efficacy of health services for the newborn is an increasing burden on society to provide these services equitably. In this sense, technical progress elevates the importance of access in the determination of disparities in mortality outcome.

Government-funded medical financing programs in the United States such as Medicaid have grown enormously in size and scope during recent decades. The Clinton administration attempted without success to considerably restructure the present health care system in the United States (The President's Health Security Plan 1993)—a system that can provide excellent quality of medical care, but that also leaves a substantial fraction of the population without financial coverage for health care (Blendon et al 1989). It is also a system that focuses most readily on treatment of illness, and less often and effectively on the prevention of illness. Research based on the National Health Insurance Experiment indicates that providing complete financial coverage for inpatient hospital care to children will not lead to mushrooming medical care costs. There is also no evidence to justify reimbursing acute ambulatory care at a higher rate than preventive services (Leibowitz et al 1985). However, the United States is still one of only two industrialized countries in the world (South Africa being the other) that do not provide financial coverage for health care for all pregnant women and children (Miller 1987).

It is not clear whether socioeconomic disparities in infant mortality could be eliminated by universal access to health services for children and women in the United States. We have already noted that disparities remain in Great Britain even though the National Health Service provides accessible care to the whole population. Universal coverage should help to reduce the number of areas reporting excess rates of infant death throughout the United States, now generally the poorest communities.

As neonatal intensive care technology has increased in effectiveness, access to this technology has become more crucial, and yet there are few studies of access to this care. Only a minority of hospitals can afford to staff neonatal intensive care units (NICUs), and this has lead to the regionalization of services (McCormick & Richardson 1995). One analysis of a metropolitan area in the 1970s found no social class disparities in neonatal mortality among very low birth-weight infants, indicating relatively uniform access to this emergency health service (Paneth et al 1982). A more recent analysis found a similar attenuation of the association of social factors and infant death among lower birth-weight infants (Eberstein et al 1990). Another study of four states in

the early 1980s indicates substantial variation in access to NICU care, with sick rural infants most at risk of being born in a hospital without these capabilities (Gortmaker et al 1985). The most crucial changes, however, may now be appearing as managed care plans grow throughout the United States, and as pressures to limit costs may limit access to these services (McCormick & Richardson 1995). One recent analysis from California indicates substantially lower mortality and no greater costs among high risk births in hospitals with the best neonatal intensive care technology (Phibbs et al 1996), providing evidence that any limitations in access to this care in California could result in increased infant deaths. The rapid changes occurring in the organization of health services in the United States provide important opportunities to examine the sociology of access to these services—and corresponding health consequences—in the decades ahead.

Prenatal Risks and the Potential for Intervention

Much of the public debate about infant mortality has focused on the potential for prevention via improved access to "prenatal care." While there are no definitive randomized controlled trials of the effectiveness of traditional prenatal medical care (for obvious ethical reasons), the preponderance of evidence supports the effectiveness of prenatal care in reducing the risk of low birth weight and in influencing the outcomes of pregnancy (Institute of Medicine 1985), particularly among high-risk populations (Gortmaker 1979b, Murray & Bernfield 1988). A wide variety of clinical circumstances make clear the benefits of prenatal medical care (Chalmers et al 1989). Careful monitoring during pregnancy means that high-risk deliveries and premature labor can be identified quickly and referred to the appropriate tertiary center for care, and this can lead to reduced mortality.

In spite of this evidence, the past few decades have demonstrated that improvements in prenatal health care have not substantially affected infant mortality rates. We have already noted that little of the decline in the infant mortality rate has been due to improved birth-weight distribution (the presumed outcome of improved of prenatal care) (Buehler 1987). It seems clear that expansion of access to the existing system of prenatal care will not solve the infant mortality problem, even though prenatal care can have greater impact as better outreach and delivery systems are devised (Institute of Medicine 1988). The development of more effective prenatal medical care, however, is for the most part contingent on a much better scientific understanding of the causes of preterm delivery, a phenomenon of largely unknown etiology (Paneth 1995).

In spite of these limitations, a variety of health-related behaviors of women increase the risks of infant mortality, including cigarette smoking, alcoholism, drug use including cocaine, poor weight gain during pregnancy, sexually transmitted diseases, and inadequate nutrition. These behaviors in turn are influenced

by social and economic context, and hence intervention strategies focused on these risks can take many forms, ranging from clinical interventions (e.g. smoking cessation during the prenatal period) to state policy (e.g. cigarette taxation). Many of the interventions focused on these risks reside at least in part outside of the medical care system.

The evidence for the effects of cigarette smoking as a determinant of low birth weight (less than 2500 g) (Kramer 1987, Kleinman & Madans 1985) and on infant mortality (Kleinman et al 1988) is particularly striking and strong. Attributable risk estimates indicate that elimination of smoking among white married women could reduce rates of low birth weight by 19% (Kleinman et al 1985). Low-cost smoking cessation programs for pregnant women are effective (Windsor et al 1993) but not widely implemented. One barrier to this implementation is the fact that insurance carriers and Medicaid in general do not pay for these programs. An area of state policy with potentially substantial impact is increased excise taxes on tobacco, which can reduce cigarette consumption and discourage initiation of smoking among youth (Lewitt & Coate 1982, Manning et al 1991). Furthermore, bans on advertising and sales (Warner et al 1992), restriction of smoking in public places, and restricted sales of cigarettes to minors all significantly affect smoking rates in the United States.

Recent concern has focused upon the effects of cocaine and crack—a smokeable form of cocaine—in increasing the risk of premature labor. However, the estimated effects of cocaine and marijuana use upon fetal growth appear to be less than those estimated for the effects of cigarettes, even when valid measures of marijuana and cocaine use are applied (Zuckerman et al 1989). Given the lower prevalence of cocaine and marijuana use in the population, the attributable risks of poor birth outcomes associated with cigarettes appear much greater than those associated with cocaine.

Also operating outside the medical care system but producing higher birth weights is the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). A series of studies from the United States indicate that participation in WIC produces higher birth weights (Kotelchuck et al 1984, Rush 1986). There is also evidence that FDA regulations concerning the nutritional content of food can improve birth outcomes: Supplementation of diet with folic acid, for example, can reduce the population risk of neural tube defects, which are major birth defects (Milunsky et al 1989).

Other prenatal risks and possible effective interventions have been identified. For example, studies of women's work have identified physically demanding work as contributing to prematurity and low birth weight (Naeye & Peters 1982, Homer et al 1990) as does environmental pollution (Mushak et al 1989) and toxic substances in worksites (Hemminiki et al 1983). Stress also increases risk of low birth-weight and preterm birth (McClean et al 1993), and social and

psychological support produce positive effects during pregnancy (Elbourne et al 1989). One intriguing intervention study finds evidence for the effectiveness of nurse home visiting during pregnancy in improving birth outcomes among disadvantaged women (Olds et al 1986).

However, this evidence concerning risk and intervention does not necessarily help explain some of the more persistent disparities in infant mortality. For example, smoking behavior is not a likely explanation for observed racial disparities in birth-weight distribution because black women smoke cigarettes at rates roughly comparable to those of white women (Prager et al 1984). Studies controlling for smoking, alcohol use, and other social and economic characteristics fail to eliminate black/white differences in rates of low birth weight (Shiono et al 1986, Kramer 1995). This case illustrates the reality that an analysis of risks for infant mortality may not necessarily provide the best focus for an analysis of causes of disparity in infant mortality among population groups. This is the case with another often cited "cause" of high infant-mortality rates among black infants: high rates of teenage childbearing. Data clearly indicate that teenage pregnancy is associated with only a small minority of infant deaths, and so such data do little to help explain racial disparities in rates (Wise 1993).

These prenatal risks and interventions, therefore, remain an important arena of social and technical influence on infant outcome. However, prenatal effects, viewed in isolation, do not explain much of the differentiation in infant mortality rates over time or between different social groups. Rather, prenatal influences are perhaps best understood when viewed in a broader context that includes social and clinical mechanisms that operate over the continuum of a woman's reproductive life.

A Focus on Women's Health Status

The impact of neonatal intensive care in concentrating infant mortality into the most premature group of newborns holds important implications for continued progress in reducing overall levels of, as well as disparate, infant mortality rates. Perhaps the most crucial need is to reconsider the current preoccupation with tightly focused efforts to intervene during the prenatal period. While our review has indicated evidence for effective strategies during the prenatal period, we have also noted that a large proportion of infant deaths occur to infants born before 25 weeks gestation. This is a very narrow window in which to concentrate prevention efforts. A more rational strategy would focus on linking improved parental care with broader initiatives to improve the health of women regardless of pregnancy status (Wise et al 1995).

Unfortunately, trends in the social, economic, and health status of women of childbearing age in the United States are not encouraging. The proportion of children living in poverty and of single-headed female households has increased

over past decades. The proportion of children living in poverty in the United States declined during the 1960s and then increased during the 1970s and 1980s (Select Committee on Youth and Families 1989). Rates of children living in poverty in the United States are higher than those of the other industrialized countries (Smeeding & Torrey 1988).

A variety of health characteristics among women indicate a risk for poor pregnancy outcome, including elevated blood pressure, older age at childbirth (due mainly to improved fertility treatment—associated with increased risks of multiple births and prematurity), cigarette smoking, infections, sexually transmitted diseases, and alcohol and drug use. A review of trends in these factors over the past decades indicates no substantial evidence for improvement in women's health status (Gortmaker & Wise 1994). These issues may be particularly important for poor and minority women in the near future, in light of recent "welfare reform" legislation in the United States that will reduce future federal spending on poor households. One hypothesis concerning maternal health status is that optimal maternal health for childbearing may occur at different ages for African-American women, compared to non-Hispanic white women, in the United States, because health status declines with age among minority women due to the continuing impact of difficult socioeconomic environments (Geronimus 1992).

In light of these facts, reframing the infant mortality problem as an issue of women's health suggests that broader initiatives to address the health and well-being of women are essential. A focus on improving the health status of all women in the United States will require more than the provision of a right to health services. Changes include legal protection under the law, the right to choose abortion, support for work, maternity leave, and child care. Attention to the provision of cost-effective health promotion programs, including nutrition, smoking cessation, drug addiction treatment, and other services that typically fall outside the health care system.

While there is some evidence for intergenerational effects of deprivation (Emanuel 1986), the strongest evidence is that a woman's health prior to pregnancy is a substantial predictor of outcome and therefore should be the focus of research and intervention. In many ways the continuing focus on prenatal care as a preventive strategy epitomizes a strategy that comes too late to make a large impact on birth outcomes such as low and very low birth weight (Kempe et al 1992).

Race, Ethnicity, and Infant Mortality

We have described the persistent racial and ethnic disparities in infant mortality rates in the United States. Despite much speculation, no evidence suggests that social, economic, or racial/ethnic disparities in the risk of death in infancy

are caused by genetic differences. Any discussion of racial and ethnic differences in birth outcomes needs to acknowledge the limited extent to which social and economic variables—including racial discrimination—can be disentangled from crude proxies for biologically determined pathologic pathways (Krieger et al 1993, Herman 1996). The racial and ethnic categorizations used in most research on infant mortality in the United States should be seen as "proxies for specific historical experiences and a powerful marker for current social and economic conditions" (Williams & Collins 1995). Because of the unclear definition and measurement of "race" and "ethnicity" (Jones et al 1991) in virtually all large studies of infant outcomes and the confounding with a multitude of environmental differences, the potential causal role of "racial" and "ethnic" differences in the generation of disparate infant mortality rates is an issue that may be poorly served by current analytic approaches.

The pervasive effects of racist attitudes and beliefs and the legacy of slavery in the United States can often be difficult to measure, but the historical evidence is quite clear in documenting the profound influence of these forces upon the life chances of minorities (Krieger et al 1993, Williams 1996). It is important to remember that the racial differences noted for infant mortality are similar to differences documented for virtually all causes of mortality in the United States.

We have noted continuing black/white disparities in infant mortality in the United States. Other studies document the elevated rates of infant mortality among Native Americans (VanLandingham & Hogue 1994) and Hispanics (Bacerra et al 1991), and the important errors and inconsistencies in coding racial and ethnic categories that occur (Hahn et al 1992).

The roots of biologically determined explanations for disparities in infant mortality lie in both technical and political arenas. For example, technical arguments concerning black/white differences are based on evidence indicating that blacks experience a lower mean birth weight than do whites, while at the same time blacks experience lower birth weight–specific infant mortality among small infants (Buehler et al 1987). Some analysts have argued that a lower mean birth weight among blacks should require an adjustment when compared with white birth-weight distributions, thus reducing differences in low birth-weight rates (Wilcox & Russel 1983). This argument, while useful in some settings, has been widely misinterpreted as suggesting that the racial difference in mortality should similarly be adjusted and, thereby, technically reduced as well. This is flawed in two respects. First, the focus on mean birth weights ignores the fact that mean differences are not closely related to risk; rather, it is extreme birth weights (particularly extremely low birth weight) that are most closely related to the risk of infant death. Furthermore, black infant mortality is higher than white infant mortality because of the frequency of extremely low birth weight and associated prematurity (Rowley 1995). It is useful

to remember here that the mean birth weight of blacks in the United States is similar to that for the Japanese, the population with the lowest infant mortality rate in the world; extreme low birth weight in Japan is relatively rare.

Second, this interpretation does not recognize that any adjustment in birthweight distribution that reduces racial differences requires a compensatory adjustment in birth weight–specific mortality that increases racial differences. Adjustment for mean birth weight, therefore, can never reduce the actual excess mortality that occurs in blacks. The political utility of "biologically" determined racial disparities in infant mortality is derived from its potential exculpatory character in assessing the role of social and policy-based influences. To the extent that "biology" can be said to determine the scale of racial disparities in infant mortality, the role of social factors and health care provision is to that same extent removed from practical consideration. Together, the technical and political aspects of this issue have generated considerable confusion concerning how the social epidemiology of racial disparities in infant mortality has been understood in the deliberation of ameliorative public policies.

Because of a long-standing interest in the complexities of race, ethnicity, and social stratification in the United States, sociologists can contribute significantly to a more accurate understanding of racial and ethnic inequities in infant outcomes. The conceptual and daily dimensions of racial and ethnic differences, including discrimination and racism, their definition and measurement, and how risks and interventions can operate within different populations are all issues that demand greater study. The analysis of racism (Williams 1996), migration (Cabral et al 1990), and social and economic risks within populations (see e.g. Schoendorf et al 1992) and the outcomes of an expanding population of mixed racial and ethnic children (Collins & David 1993) constitute promising avenues of research.

SUMMARY

Current patterns of infant mortality in the United States provide a useful illustration of the dynamic interaction of underlying social forces and technological progress in determining trends in health outcomes. Sociological research concerning infant mortality in the future needs to acknowledge the power of both social and economic forces and health care technology in the generation of disparities in infant mortality.

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