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ABSTRACT

This quarterly publication presents scholarly developmental research results pertaining to social and public policies which affect children. The first issue in the 1994 volume examines "Children's Changing Access to Resources: A Historical Perspective" (Donald Hernandez). This report focuses on changes in the American family's finances, structure, and educational attainment, as well as the effects of these changes on children and policies affecting children. This report contains 30 references. The second issue examines "Children in Poverty: Designing Research to Affect Policy" (Aletha Huston). This report examines the interplay between policy and childhood poverty and how to effect change to further children's interests. It contains 43 references. The third 1994 issue examines "Developmental Effects of Lead Exposure in Children" (Johanna Tesman and Amanda Hills). Focusing on the history and prevalence of lead exposure levels, and examining policy and educational issues, this review presents research findings on neurobehavioral effects, behavioral effects, and methods for determining exposure levels. This report contains 68 references. The fourth 1994 edition examines "Resiliency Research: Implications for Schools and Policy" (Marc Zimmerman and Revathy Arunkumar), and focuses on early and recent research on resiliency as a coping mechanism. Three models of resiliency are detailed, and seven possible future policy research areas are presented. The report contains 70 references. (SD)

SOCIAL POLICY REPORT
Society for Research in Child Development

Volume VIII, Number 1 Spring 1994

Children's Changing Access to Resources: A Historical Perspective

Donald J. Hernandez

Children's lives have been completely transformed during the past 150 years by revolutionary changes in the American family, society, and economy. Only within the past two decades, however, have substantial numbers of sociologists, demographers, and economists begun to conduct national studies focusing on children. This report discusses results of the first national study using census and survey data to describe the profound changes that have characterized the lives of America's children over the last 50 to 150 years (Hernandez, 1993a).[1]

This research involved conducting original analyses of microdata files for the 1940, 1950, 1960, 1970, and 1980 censuses, and for the 1980 and 1989 Current Population Survey (Census of Population and Housing, 1990). The analyses are the first to use children as the unit of analysis in charting a wide array of family and economic changes from the 1930s through the 1980s. Additional analyses of previously published data were conducted to supplement and extend these results back 150 years.

The concept of the life course provided the central organizing principle for this research. Children's lives were conceived as trajectories distinguished by the specific order, duration, and timing of the particular events and resources experienced in life, and by the number, characteristics, and activities of the family members with whom they live. Historical, social, and economic events have profound implications not only for the family, but also for the well-being and development of children, because the developmental path of children depends greatly on their life course trajectories. To enrich our understanding of how historic trends in the lives of children affect the nation's ability to produce healthy and successful adults, the study also reviews the rapidly developing social science literature on the consequences of family and economic changes for children.

Children's lives have undergone a revolutionary shift in the past 150 years as a result of increased nonfarm work by fathers, a drastic constriction in family size, and an enormous expansion in schooling. A more recent and continuing transformation of children's lives has been associated with dramatic increases in mothers' labor force participation and in the incidence of mother-child families with no father present in the home. A fundamental force driving these seemingly dis-

parate changes has been and continues to be parents' desires to improve, maintain, or regain their relative social and economic status in the face of changing, often uncertain, or precarious social and economic conditions.

Changes in family income and poverty for children since the Great Depression have been linked to changes in parents' work and family composition. This report introduces an important innovation, that of making children the primary unit of statistical analysis. It also explicitly suggests why statistics on children are essential to the development of effective public policies for children. The report closes by describing plans of the U.S. Bureau of the Census for a new survey, the Survey of Program Dynamics, designed to measure the developmental status and well-being of children and the effects of current welfare and health care reforms on their lives.

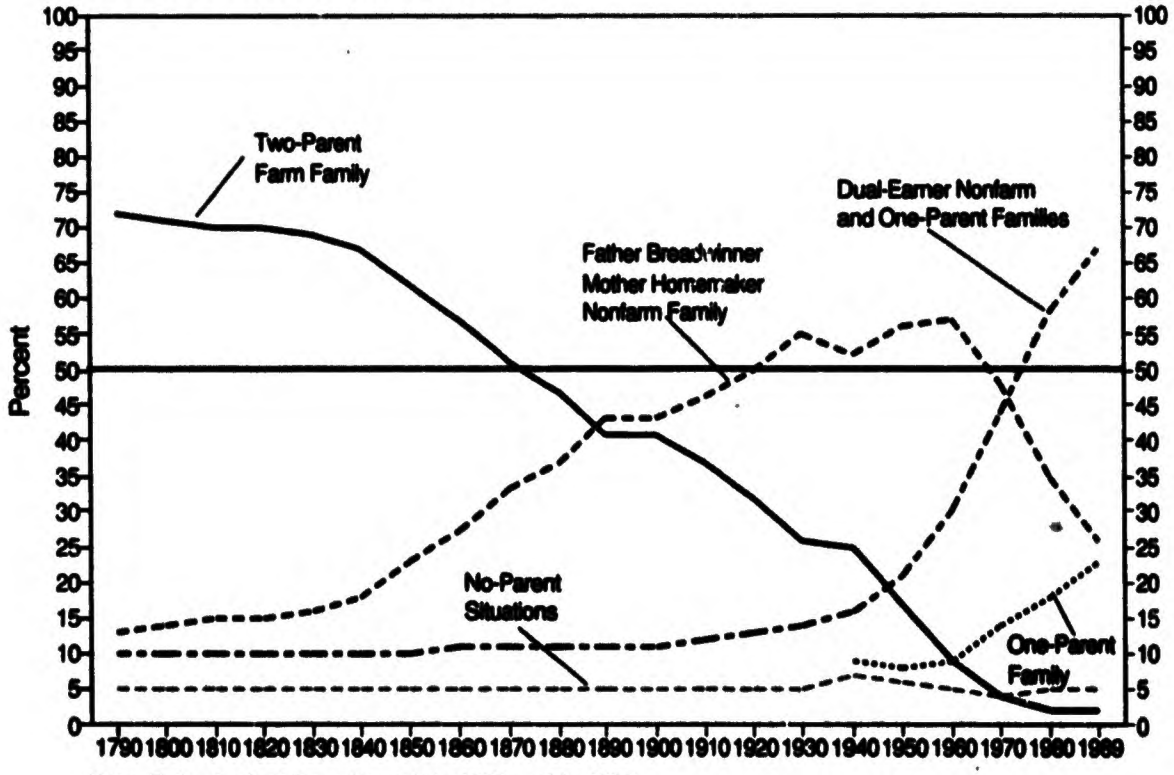
Three Revolutionary Changes

The Rise in Fathers' Nonfarm Work

For hundreds of years, agriculture and the two-parent farm family have represented the primary forms of economic production and family organization in Western countries. However, the shift away from farming to the nonfarm father-as-breadwinner, mother-as-homemaker system of family organization was very rapid. A large majority of children, nearly 70%, lived in two-parent farm families in 1830, but by 1930 this proportion had dropped to a minority of less than 30% (Figure 1). During the same 100 years, children living in nonfarm families with breadwinner fathers and homemaker mothers grew from only 15% to a majority of 55%.

This represented a historically unprecedented

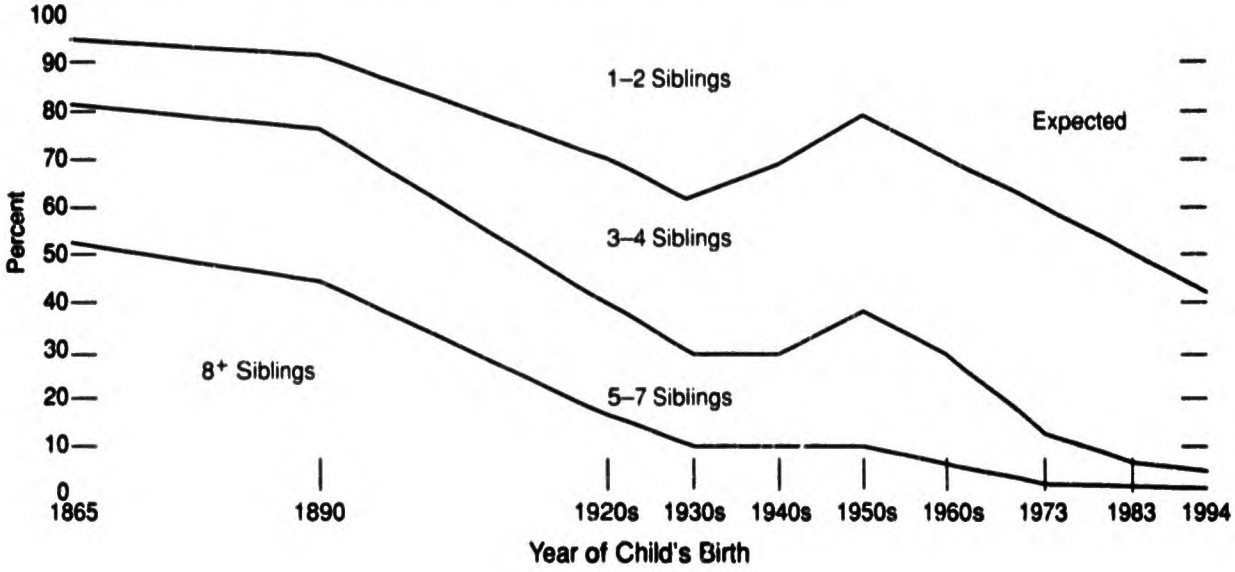
Figure 1. Children Aged 0-17 in Farm Families, Father-as-Breadwinner Families, and Dual-Earner Families: 1790-1989

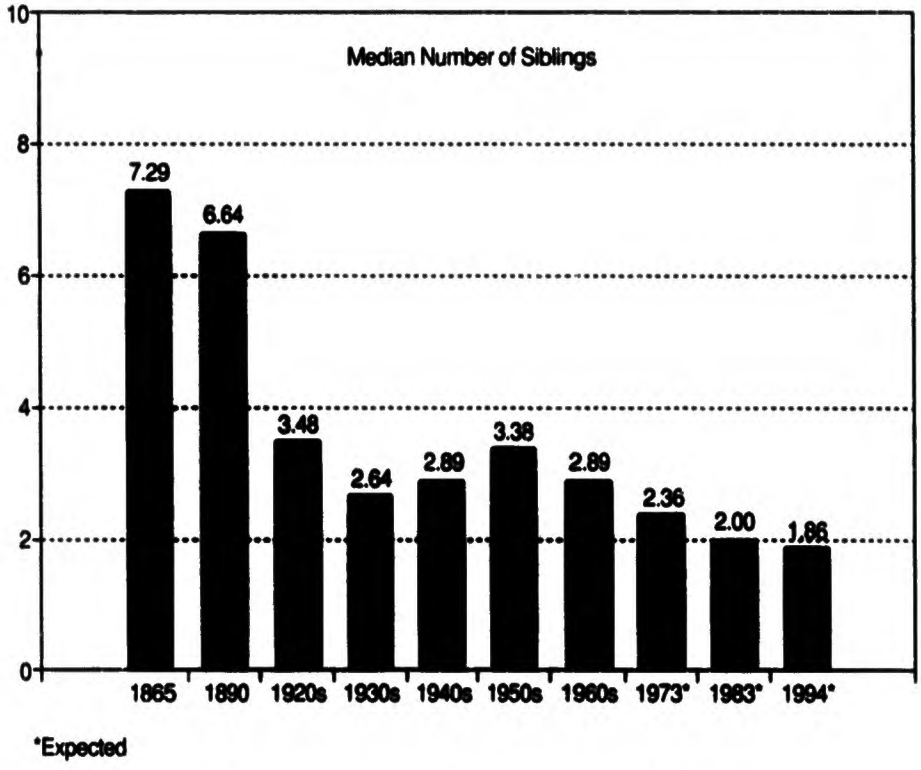


Note: Estimates for 10-year intervals to 1980, and for 1989.

Source: Hernandez, 1993a, p. 103, copyright by Russell Sage Foundation. Reprinted by permission.

Figure 2. Actual and Expected Sibsizes for Adolescents Born 1865–1994





Source: Hernandez, 1993a, p. 29, 34, copyright by Russell Sage Foundation. Reprinted by permission.

transformation in the nature of childhood. In two-parent farm families, family members worked side by side to sustain themselves in small communities. In contrast, two-parent urban families consisted of fathers who spent their workday away from home earning the income required to support the family, and mothers who remained in the home to care for their children and perform domestic functions.

The Decline in Large Families

This enormous shift away from farming to an urban life with fathers as the sole family breadwinner was accompanied by a dramatic decline in large families. Among adolescents born in 1865, 82% lived in families with 5 children or more, but this fell to only 30% for those born in 1930. During these same 65 years, smaller families with only 1 to 4 children more than tripled, from 18% to 70%. As a result the median number of siblings in the families of adolescents dropped by almost two-thirds, from 7.3 siblings to only 2.6 siblings per family (Figure 2).

This represented a drastic change in the level of competition for resources that children might experience within families. Whereas formerly a majority of children were competing with at least 7 other siblings for their parents' time and economic resources, by 1930 nearly 60% of children were either only children or had only 1 or 2 siblings in the home.

The Rise in Educational Attainment

A third revolutionary change in children's lives occurred during the same era. School enrollment increased greatly, producing corresponding increases in educational attainments for children and for parents. Between 1870 and 1940, school enrollment rates increased sharply from about 50% for children aged 5–19, to 95% for children aged 7–13, and to 79% for children aged 14–17. During the same time, among enrolled students, the number of days spent in school doubled, expanding from 21% of the total days in the year in 1870 to 42% of the days in the year in 1940. By 1940, then, school days accounted for 59% of all the nonweekend days in the year.

As more and more children 6 years old and older spent larger portions of the year in school—that is, in a formal educational setting—they were also spending less time at home with their parents. By 1940, 95% of children aged 7–13 were spending 5 to 6 hours per day in school, or 59% of all their nonweekend days.

Since the children of today are the parents of tomorrow, this enormous increase in schooling also led, in due course, to large increases in parents' education (Figure 3). For example, comparing adolescents born in the 1920s to those born two decades later, the proportion with fathers completing 8 or more years of schooling increased from 56% to 77%, and the proportion with fathers completing at least 4 years of high school increased from 15% to 39%. Similarly, the proportion of adolescents with mothers completing 8 or more years of schooling increased from 61% to 83%, and with mothers completing at least 4 years of high school, from 17% to 44%. Today, 95% of adolescents have parents who completed at least 8 years of schooling, and more than 80% have parents who completed at least 4 years of high school.

Explaining the Changes

Why did these revolutions in fathers' work, family size, and schooling occur between the mid- to late-1800s and 1940s? The use of children and their parents as the central organizing feature of analysis helps provide an explanation. First, why did parents move from farms to urban areas where fathers could obtain jobs outside the farm sector of the economy? Second, why did parents drastically restrict their childbearing? Third, why did parents send their children to school to achieve ever increasing levels of education? The underlying force motivating parents to pursue all three courses of action can be seen as the desire to alter their family's relative social and economic status.

Why the Shift Away from Farming?

The shift from farming to urban occupations was typically necessary to achieve an improved relative economic status or to keep from losing ground compared to others. The incomes provided by urban jobs were higher than the incomes that many people could earn through farming. And in some cases, the economic situation of families in rural areas was extremely precarious; in such situations even poorly paid or dangerous jobs in urban areas can appear attractive compared to a rural situation with no employment and no other source of economic support. In short, a fundamental cause of the massive migration from farms to urban areas was the comparatively favorable economic opportunities in urban areas.

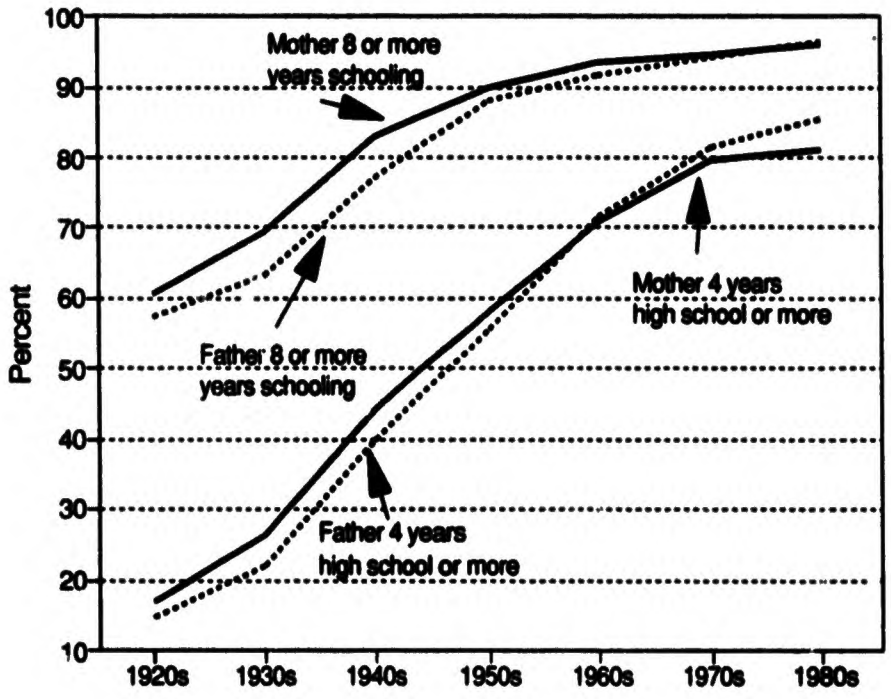
Why the Constriction in Family Size?

This shift from farm to urban work meant that housing, food, clothing, and other necessities had to be purchased with cash, making the costs of supporting each additional child the more apparent. At the same time, children's potential economic contribution to their parents and families was sharply reduced by the passage of laws restricting child labor and mandating education.

Economic growth led, moreover, to increases in the quality and quantity of available consumer products and services. Expected standards of consumption rose, and individuals were required to spend more money simply to maintain the new "normal" standard of living. Hence, the costs of supporting each additional child at a "normal" level increased over time.

Finally, newly available goods and services competed with children for parental time and money. Since each additional child in a family requires additional financial support and makes additional demands on parents' time and attention, the birth of each child reduces the time and money parents can devote to their own work or careers as well as to recreation and to older children. As a result, more and more parents limited their family size to a comparatively small number of children so that available income could be spread less thinly.

Figure 3. Proportion of Children Born Between 1920s and 1980s Whose Parents Have Specified Educational Attainment

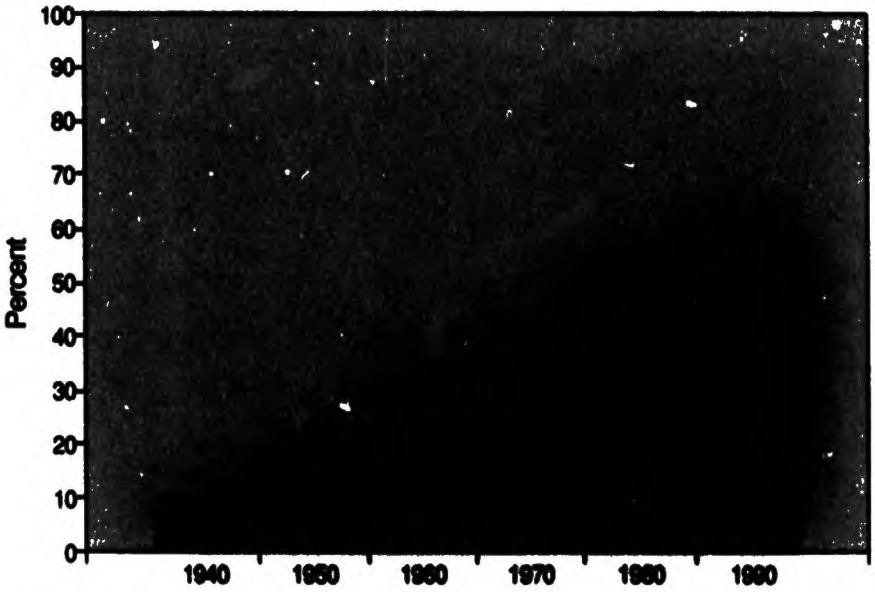


Source: Hernandez, 1993a, p. 197.

Why the Increase in Educational Attainments?

When farming gave way to the industrial economy and family size was shrinking, school enrollment increased as labor unions sought to ensure jobs for adults (mainly fathers) by limiting child labor, and the child welfare movement obtained the passage of laws protecting children from unsafe and unfair working conditions. These movements also achieved corresponding success in gaining the passage of compulsory education laws through which the government both mandated and paid for universal schooling.

Figure 4. Proportion of Children with Mothers in the Labor Force: 1940-1990



Source: Hernandez, 1993a, p. 109; 1993b, p. 9.

In addition, as time passed, higher educational attainments became increasingly necessary to obtain jobs that offered higher incomes and greater prestige. Hence, parents encouraged and fostered higher educational attainments among their children as a path to occupational and economic success in adulthood. Once again, their motivation was to improve their children's relative social and economic standing, compared to others in their generation.

Two Other Revolutionary Changes and Their Explanation

The Rise in Mothers' Labor Force Participation

After 1940 two additional revolutions in children's families began. First was the explosion in mothers' employment outside the home. In 1940 only 10% of children lived with a mother who was in the labor force (Figure 4). This increased by 6 percentage points during the 1940s, and then by at least 10 percentage points during each of the next four decades. By 1990 nearly 60% of children had a working mother, a six-fold increase in 50 years.

Just as children in an earlier era experienced a massive movement by fathers out of the family home to work at jobs in the urban-industrial economy, children since the Great Depression have experienced a massive movement by mothers into the paid labor force. Both of these revolutions in parents' work brought enormous changes in the day-to-day lives of children. As fathers entered the urban labor force, children aged 6 and over entered schools and spent increasing proportions of their lives in formal educational settings. Now, as mothers are entering the labor force, children under age 6 are spending increasing amounts of time in the care of someone other than their parents.

This revolution is occurring twice as fast in mothers' work as in fathers' work, however. The decline for children in the two-parent farm family from 60% to 10% required the 100 years from

1860 to 1960. But the corresponding rise in the proportion of working mothers from 10% to 60% required only 50 years, from 1940 to 1990.

Why the Increase in Mothers' Labor Force Participation?

What caused this revolutionary increase in mothers' labor force participation? Much of the answer lies in the historic changes that occurred in the family and economy. As suggested earlier, between the early days of the Industrial Revolution and about 1940, many parents had three major avenues for maintaining, improving, or regaining their relative economic standing compared with other families. First, they could move off the farm and have the husband work in comparatively well-paid jobs in the growing urban-industrial economy. Second, they could limit themselves to a smaller number of children, compared to other families, so that available family income could be spread less thinly. Third, they could increase their educational attainments.

By 1940, however, only 23% of Americans lived on farms, and 70% of parents had only 1 or 2 dependent children in the home. Consequently, for many parents, these two historical avenues to altering their relative economic standing had run their course (Elder, 1974). Further, since most persons complete their education by age 25, attaining additional schooling beyond age 25 is often difficult or impractical.

With these avenues to improving their family's relative economic status effectively closed for a large majority of parents after age 25, a fourth major avenue to increasing family income emerged between 1940 and 1960, namely, paid work by wives and mothers. The traditional sources of female nonfarm labor, that is, unmarried women, were either stagnant or declining, while the demand for female workers was increasing (Oppenheimer, 1970).

Meanwhile, wives and mothers were becoming increasingly available and well-qualified for work outside the home. By 1940 the unprecedented increase in children's school enrollment had effectively released mothers from personal child-care responsibilities for a time period equivalent to about two-thirds of an adult workday for about two-thirds of a full-time adult workyear, except for the few years before children entered elementary school. In addition, many women were highly educated, since the educational attainments of women and mothers had increased along with those of men. By 1940 young women were more likely than young men to graduate from high school, and they were about two-thirds as likely to graduate from college.

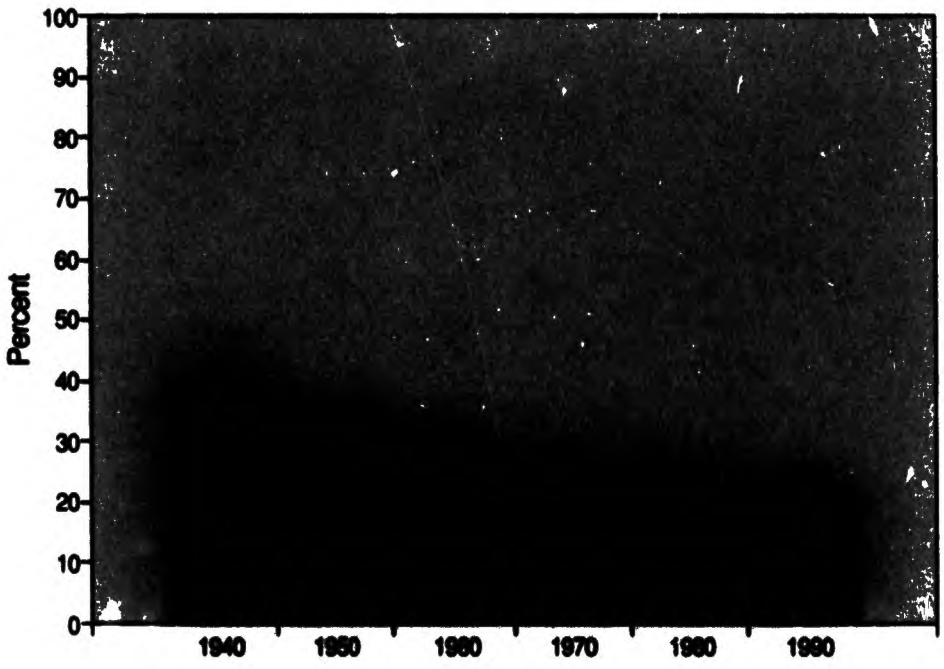
Paid work outside the home for mothers was becoming increasingly attractive in our competitive, consumption-oriented society for another reason. Families in which the husband's income was comparatively low could, by virtue of the wife's work, move economically ahead of families in which the husband had the same occupational status but lacked a working wife. This placed families with comparatively well-paid husbands at a disadvantage, making their wives' work more attractive (Oppenheimer, 1982).

In addition, with the historic rise in the divorce rate, paid work became increasingly attractive to mothers as a hedge against the possible economic disaster of losing most or all of their husbands' income through divorce. This trend is discussed below.

More immediate economic insecurity and need, associated with fathers' lack of access to full-time employment, also made mothers' work attractive. In the Great Depression year of 1940, 40% of children lived with fathers who did not work year round, full time (Figure 5). While this proportion declined after the Great Depression, it has continued at high levels. In 1950 and 1960, 29% to 32% of children lived with fathers who did not work year round, full time.

Even with the subsequent expansion in mother-only families with no father present in the home, discussed below, the proportion of all children living with fathers who did not work year round, full time was 22% to 25% during the past two decades. Throughout the era since the Great Depression, then, at least one-fifth of American

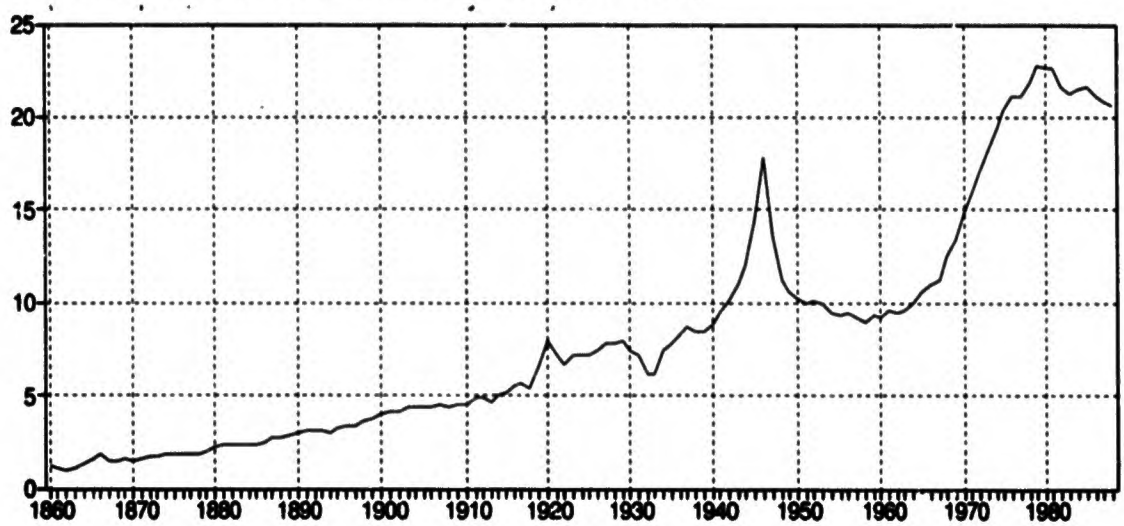
Figure 5. Proportion of Children Living with a Father Who Works Less Than Full Time Year-Round: 1940-1990



Source: Hernandez, 1993a, p. 108.

children have lived with fathers who, during any given year, experienced part-time work or joblessness. This has been a powerful incentive for many mothers to work for pay. The importance of sheer economic necessity in fostering growth in mothers' employment is reflected in the following fact: in 1988, 1 of every 8 American children in two-parent families was either living in official poverty despite the

Figure 6. Divorce Rate 1960 to 1988
(Divorces per 1,000 married women 15 years of age and over)



Source: Jacobson, 1959; and U.S. National Center for Health Statistics, 1991.

mother's paid employment or would have been living in official poverty were the mother not working.[2]

Of course, the desire to alter their family's relative social and economic status is not the only reason that wives and mothers enter the labor force. Additional reasons to work include the personal nonfinancial rewards of the job itself, the opportunity to be productively involved with other adults, and the satisfactions associated with having a career in a high-prestige occupation. Nonetheless, for many mothers it is economic insecurity and need that provide a powerful incentive to work for pay. Finally, all these inducements for mothers to enter the labor force after 1940 existed in the presence of the fact that at age 25 young women still have a potential of about 40 years when they might work for pay in the labor force.

Thus, a revolutionary increase in mothers' labor force participation occurred during the past half century for the following reasons. By 1940 many mothers were potentially available for work, and mothers' work had become the only major avenue available to most couples over age 25 seeking to maintain, improve, or regain their relative social and economic status compared to other families. After 1940, not only did the economic demands on married women increase, but work held a greater attraction.

The Rise in Mother-only Families

Twenty years after the beginning of the sharp increase in mothers' work, yet another marked change in family life began, namely, an unprecedented increase in mother-only families where the father was not present in the home. Between the 1860s and 1960s, there was a remarkably steady eight-fold increase in the rate of divorce (Figure 6). Three noteworthy, but short-lived interruptions occurred in conjunction with World War I, the Great Depression, and World War II.

Why the Increase in Mother-only Families?

Why did this sustained increase in divorce occur? Preindustrial farm life compelled the economic interdependence of husbands and wives; fathers and mothers had to work together to maintain the family. But with a nonfarm job, the father could, if he desired, depend on his own work alone for his income. He could leave his family, taking his income with him. Similarly, the post-1940 mother with a job could separate or divorce and keep her own income.

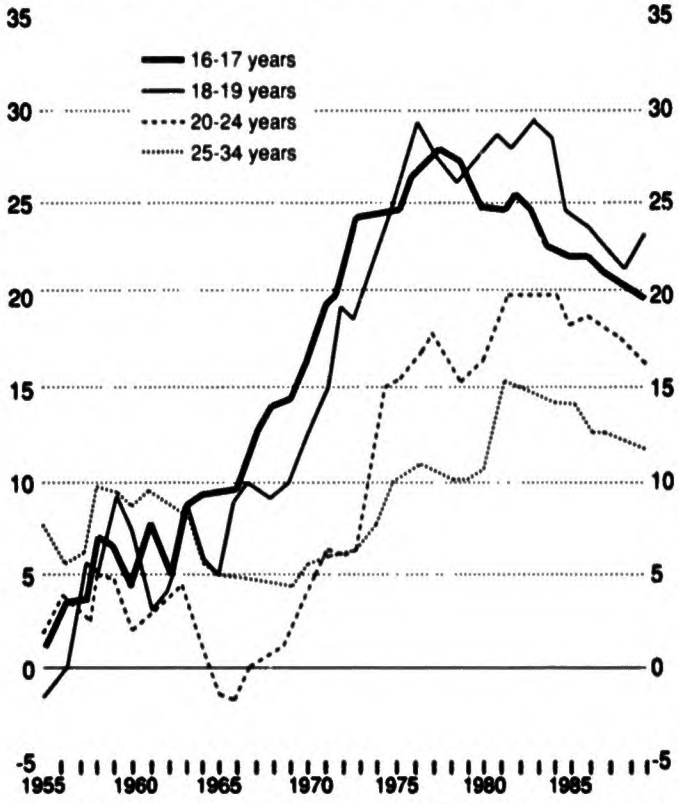
At the same time, in moving to urban areas, husbands and wives left behind the rural small-town social controls that once censured divorce. In addition, economic insecurity and need associated with erratic or limited employment prospects for many men also contributed to the increasing divorce rate, as well as to out-of-wedlock childbearing.

Studies of divorce have shown that instability in husbands' work, declines in family income, and a low ratio of family income-to-needs lead to increased hostility between husbands and wives, decreased marital quality, and increased risk of divorce (Conger, et al., 1990; Conger & Elder, 1994; Elder, Conger, Foster, & Ardelt, 1992; Liker & Elder, 1983). In fact, each of the three economic recessions between 1970 and 1982 led to intensified increases in mother-only families compared to each preceding nonrecessionary period.

A rough estimate of the size of this recession effect for children has been developed by assuming that, without each recession, the average annual increase in mother-only families would have been the same during recession years as during the immediately preceding nonrecessionary period. The results suggest that recessions accounted for about 30% of the overall increase in mother-only families between 1968 and 1988, or for about 50% of the increase in mother-only families with separated or divorced mothers (Hernandez, 1993a).

Since 70% of the increase in mother-only families for white children between 1960 and

Figure 7. Percentage Points by Which White Male Employment Exceeds Black Male Employment: 1955-1988



Source: Hernandez, 1993a, p. 403, copyright by Russell Sage Foundation. Reprinted by permission.

1988 can be accounted for by the rise in separation and divorce, this trend explains much of the rise in mother-only families for white children during these decades. In the case of black children, the explanation is more complicated. Between 1940 and 1960, the proportion of children living in a mother-only family with a divorced or separated mother increased much more for black children than for white children. But, especially since 1970, black children have also experienced markedly large increases in the proportion living in mother-only families with a never-married mother.

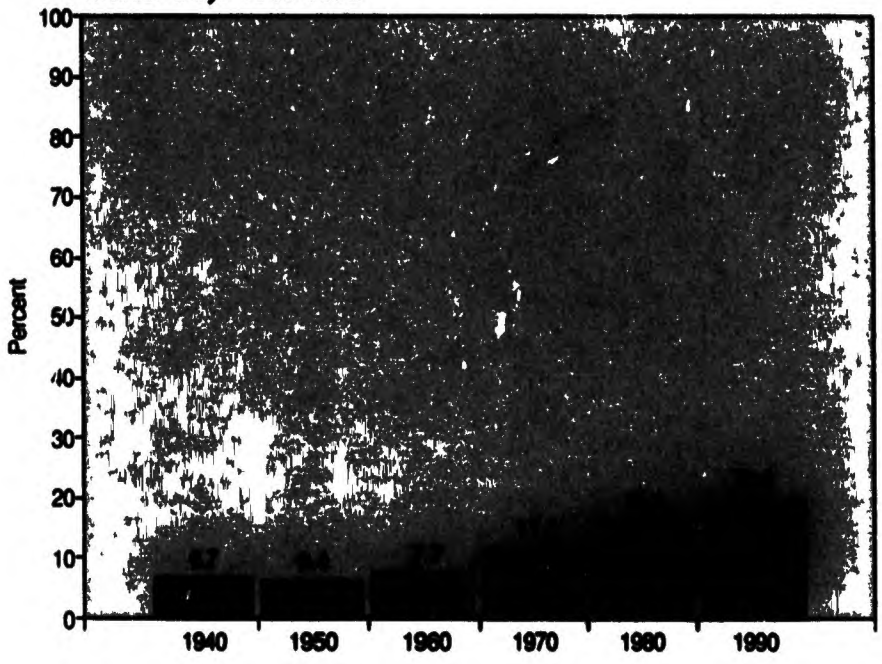
Hernandez (1993a) argues that those factors which led to increased separation and divorce among whites were also important for blacks. As further explanation, however, the startling drop in the proportion of blacks living on farms between 1940 and 1960 and the extraordinary economic pressures and hardships faced by black families may account for much of the higher proportion of black children living in mother-only families.

In addition, drawing upon the work of Wilson (1987), Hernandez calculated that the extent to which joblessness of young black men aged 16–24 exceeded joblessness among young white men expanded from an almost negligible difference in 1955 to 15 to 25 percentage points between 1975 and 1989 (Figure 7). Faced with this large and rapid reduction in the availability of black men of family-building age who might provide significant support to a family, many young black women appear to have decided to forego a temporary and unrewarding marriage—a marriage, in some cases, in which a jobless or poorly paid husband might act as a financial drain.

The size of this racial gap in joblessness is at least two-thirds the size of the 23 percentage-point increase that occurred between 1960 and 1988 in the comparative proportions of black and white children living in mother-only families with never-married mothers. Thus, the increasing racial gap in joblessness may well be the major cause of the increasing racial gap in the proportion of children living in mother-only families with never-married mothers.

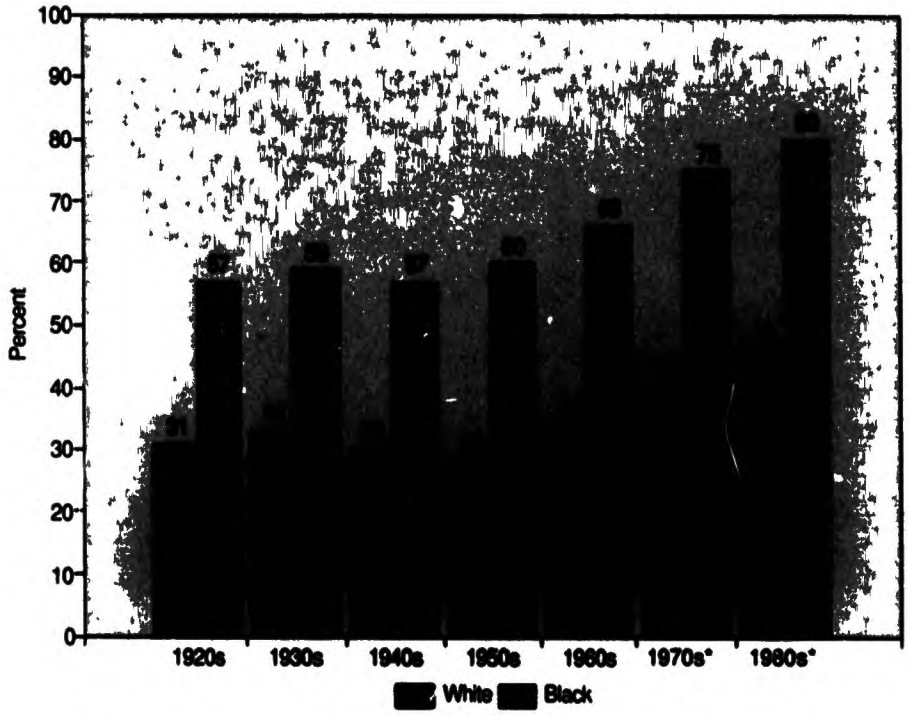
As a result of sharp rises in divorce and out-of-wedlock childbearing, the proportion of children living with their mother, with no father in the home, about tripled from 6% to 8% between 1940 and 1960, and to 20% by 1990 (Figure 8). By 1990 children in mother-only families were about twice as likely to live with a divorced or separated mother as with a never-married mother. Hence separation and divorce account for about two-thirds of children living in mother-only families, and out-of-wedlock childbearing accounts for the remaining third of children living in mother-only families.

Figure 8. Proportion of Children Living with Mother Only: 1940-1990



Source: Hernandez, 1993a, p. 65; 1993b, p. 4.

Figure 9. Percent of White and Black Children Ever Living with Fewer than Two Parents by Age 17: 1920s-1980s Cohorts



*Projected.
Source: Hernandez, 1993a, p. 86.

The Consequences for Children

Historic Experience with One-Parent Families

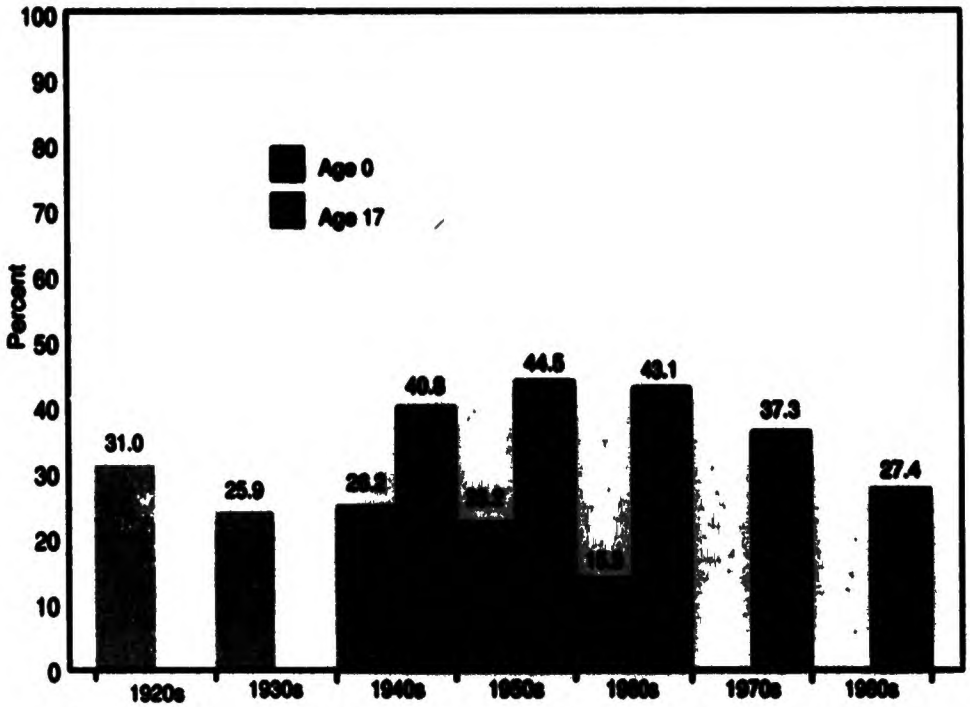
It was not until after 1960 that increases in divorce led to increases in children living with one parent. Until then increases in divorce had simply counterbalanced the declining rate at which children formerly lost parents through death. Both historically and today, however, large proportions of children spend, or have spent, at least part of their childhood with fewer than two parents in the home, because of their parent's death, divorce, or out-of-wedlock childbearing.

Among white children born between 1920 and 1960, for example, a large minority of 28% to 34% spent part of their childhood living with one parent or no parent in the home (Figure 9). In addition, this proportion was nearly constant for white children born between the late 1800s and 1920, since the historic decline in paren-

tal mortality was counterbalanced by the historic increase in divorce during the 100 years spanning the mid-1860s to the mid-1960s. Projections indicate, however, that the proportion of white children born since 1980 ever spending time in a family with fewer than two parents will increase to about 50%.

Among black children born between 1920 and 1950, an enormous 55% to 60% spent part of their childhood living with one parent, and additional evidence indicates that this proportion was roughly the same for black children born since the late 1800s. Projections indicate that this proportion will rise to about 80% for black children born since 1980.

Figure 10. Children in "Ozzie and Harriet" Families at Ages 0 and 17: 1920s–1980s Cohorts



Source: Hernandez, 1993a, p. 113, copyright by Russell Sage Foundation. Reprinted by permission.

Myth of the "Ozzie and Harriet" Family

In the 1950s the U.S. television program called *Ozzie and Harriet* idealized the urban American family in which the father was a full-time, year-round worker, the mother was a full-time homemaker without a paid job, and all the children were born after the parents' only marriage. In reality, however, never since at least the Great Depression has a majority of children lived in such a family—largely as a consequence of the changing patterns of fathers' and mothers' employment and the instability in parental presence in the home.

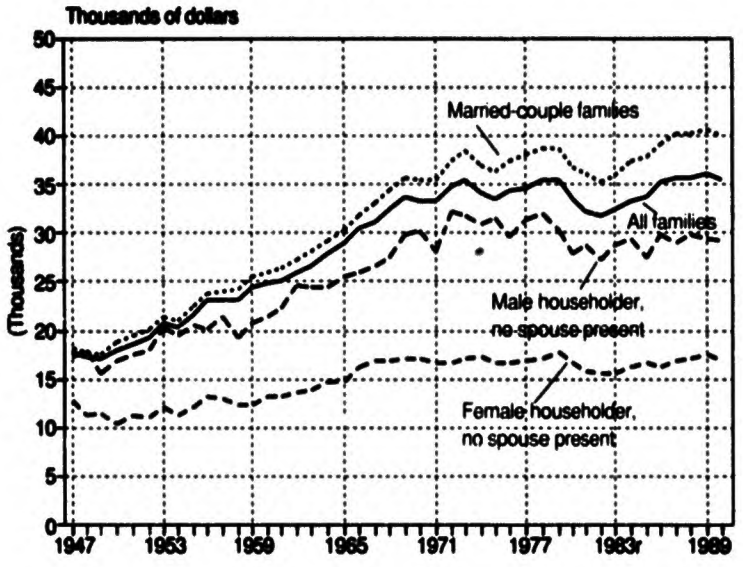
This contradiction to the "Ozzie and Harriet" myth holds even for newborns and very young children up to age 1 (Figure 10). Since at least the Great Depression, for any single year, more than one-half of children were born into families that did not conform to this ideal, either because the father worked less than full time, year round, the mother was engaged in paid employment, or not all of the children were born after the parents' only marriage.

Family Income and Poverty

As the historic changes in fathers' work, family size, and men's educational attainments drew to a close in the early 1970s, and as the post-1940 revolutions in mothers' work and mother-only families proceeded, what were the consequences for family income and poverty rates?

Changes in Income since World War II. During the 26 years from 1947 to 1973, median family income more than doubled (Figure 11). During the next 17 years, however, between 1973 and

Figure 11. Median Family Income, by Type of Family: 1947 to 1990 (in 1990 dollars)



Source: U.S. Bureau of the Census, 1991.

1990, median family income barely increased, by a tiny 6%, despite the enormous growth in mothers' labor force participation.

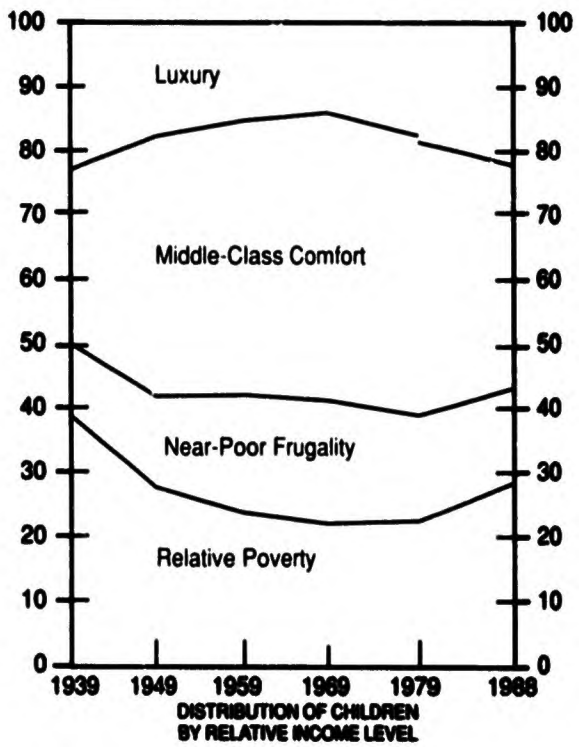
Defining and Measuring Poverty. Because real income and living standards rose dramatically between 1940 and 1973, social perceptions about what income levels were considered "normal" and "adequate" changed substantially. That such judgments are relative has been noted for at least 200 years. Adam Smith emphasized in the *Wealth of Nations*, for example, that poverty must be defined in comparison to contemporary standards of living. He defined economic hardship as the experience of being unable to consume commodities that "the custom of the country renders it indecent for creditable people, even of the lowest order, to be without" (cited in U.S. Congress, 1989, p. 10).

More recently, John Kenneth Galbraith also argued that

> . . . people are poverty-stricken when their income, even if adequate for survival, falls markedly behind that of the community. Then they cannot have what the larger community regards as the minimum necessary for decency;and they cannot wholly escape, therefore, the judgment of the larger community that they are indecent. They are degraded, for, in a literal sense, they live outside the grades or categories which the community regards as respectable. (1958, pp. 323-324)

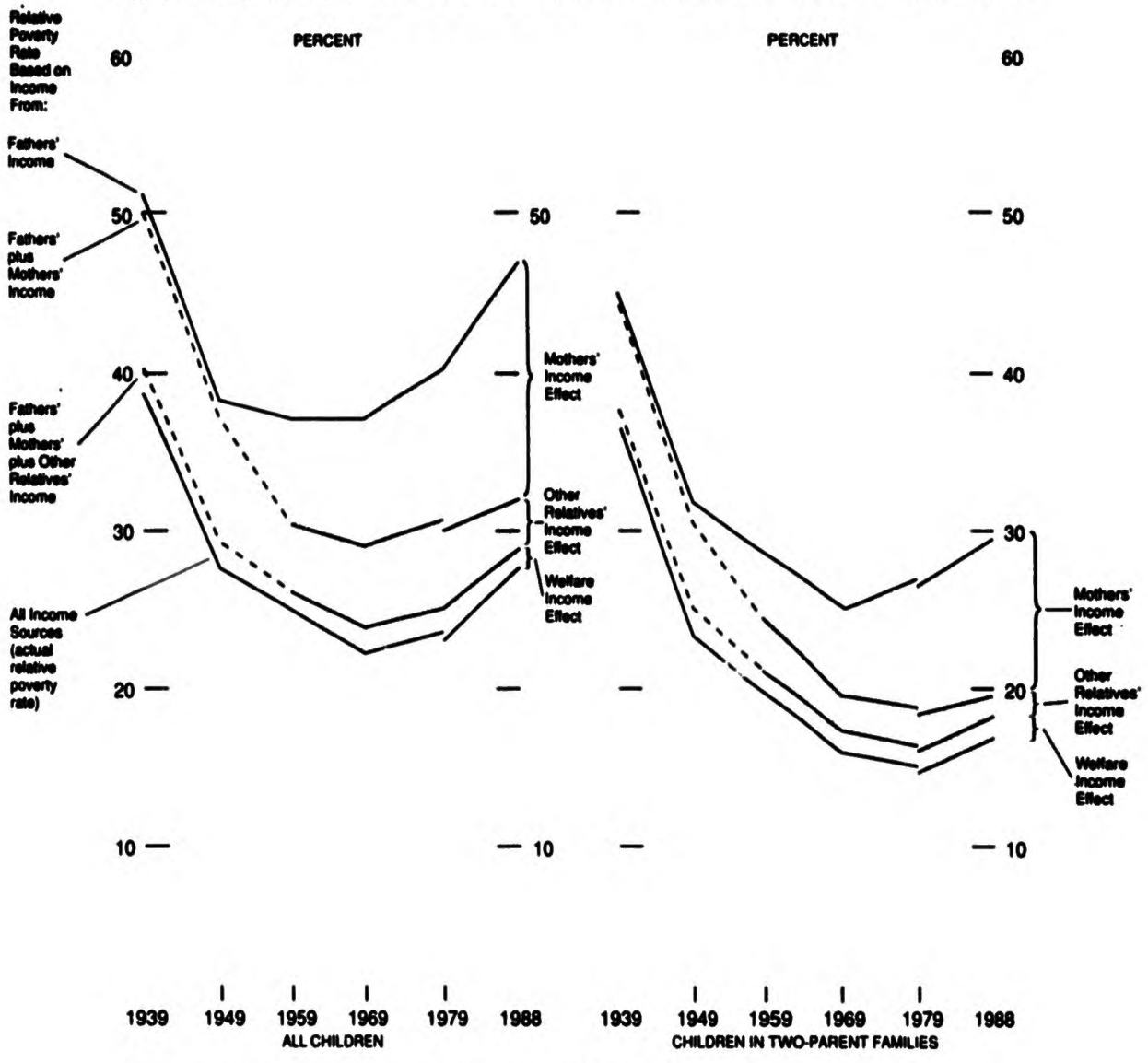
Based on these insights, additional literature (Expert Committee on Family Budget Revisions, 1980; Fuchs, 1965), and a comprehensive review of existing U.S. studies and original research by Rainwater (1974), Hernandez (1993a) developed a measure

Figure 12. Children by Relative Income Levels: 1939–1988



Source: Hernandez, 1993a, p. 245, copyright by Russell Sage Foundation. Printed by permission.

Figure 13. Relative Poverty Rates and Effects of Parent's Income and Government Welfare: 1939–1988



Source: Hernandez, 1993a, p. 339, copyright by Russell Sage Foundation. Printed by permission.

of "relative poverty" relying on poverty thresholds set at 50% of median family income in specific years and adjusted for family size.

The Fall and Rise of Child Poverty. The relative poverty rate among children dropped sharply after the Great Depression, between 1939 and 1949, from 38% to 27% (Figure 12); and the 1950s and 1960s brought an additional decline of 4 percentage points. But by 1988 the rate had returned to the comparatively high level of 27%, a rate that children had experienced in 1949, almost 40 years earlier.

Accounting for Poverty Change. To what extent can these changes in the rate of childhood relative poverty be accounted for by changes in income provided by fathers, mothers, and other family members? To what extent can they be accounted for by changes in income received from government welfare programs?

Figure 13 shows, for children overall and for children in two-parent families, several hypothetical trends in child poverty, based on the

availability of different sources of income. If, for example, only the income of fathers in the home had been available (shown by the top line in both graphs), the relative poverty rate of children would have fallen sharply during the 1940s, fallen much more slowly or not at all during the 1950s and 1960s, and risen substantially during the 1970s and 1980s.

The addition of mothers' income to that of fathers over the same period (shown in both graphs by the second line from the top) acted to speed the decline in child relative poverty that occurred during the 1940s, 1950s, and 1960s, and to slow the subsequent increase in relative poverty that occurred during the 1970s and 1980s. In fact, by 1988, 14% of all children and 11% of children in two-parent families depended on their mother's income to lift them out of relative poverty.

Next, additional income from relatives other than parents in the home (shown by the third line)—except during the Great Depression year of 1939—served to reduce the relative poverty rate by a nearly constant and comparatively small 4 to 5 percentage points for children overall, and by a nearly constant and even smaller 1 to 2 percentage points for children in two-parent families.

Finally, both for children overall and for children in two-parent families, Aid to Families with Dependent Children (AFDC) and Social Security acted to reduce the relative poverty rate for children by a stable and small 1 to 2 percentage points in any given year (shown by the bottom line). Hence, the role of these welfare programs in reducing child relative poverty—as an addition to all other income sources—has been quite limited throughout the era since the Great Depression.[3]

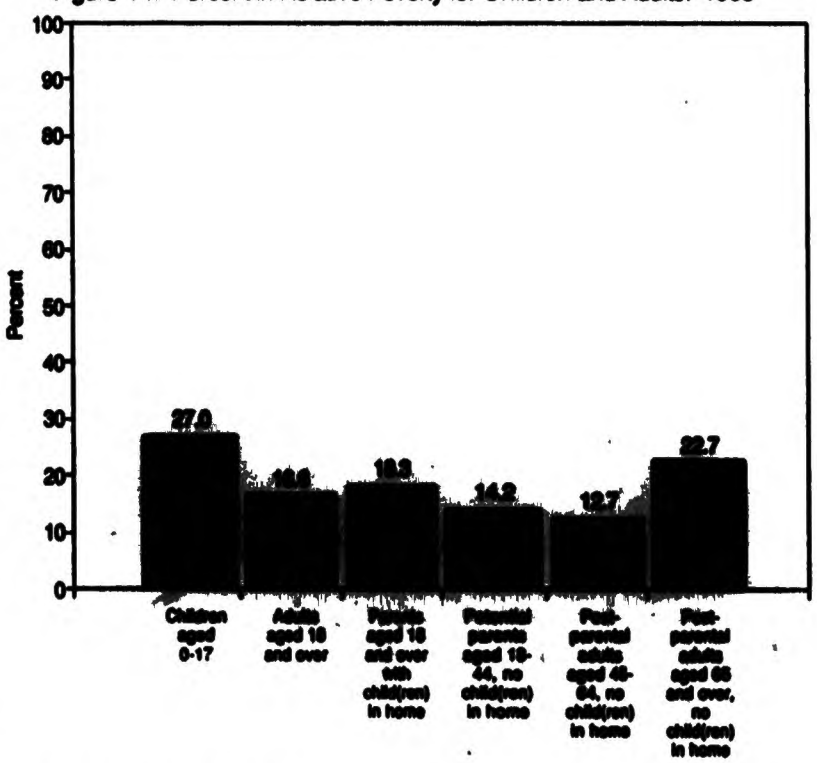
Children's Economic Status and Public Policy

Children as the Unit of Statistical Analysis

Throughout this report children have been used as the unit of analysis. Although it may seem obvious that research on children should be conducted in this fashion, most national statistical studies involving children, until recently, have actually used parents or adults as the unit of analysis. The next three figures (14, 15, and 16) show how such an approach can be misleading if children are meant to be the focus.

Figure 14 shows the relative poverty rates in 1988 for (1) children aged 0–17, (2) adults aged 18 and over, (3) parents with at least one child aged 0–17 living in the home, (4) adults aged 18–44 with no children in the home,

Figure 14. Percent in Relative Poverty for Children and Adults: 1988



Source: Hernandez, 1993a, p. 248.

(5) adults aged 45–64 with no children in the home, and (6) adults 65 years old and older with no children in the home. As indicated, 27% of children lived in relative poverty, compared to only 18% of parents.[4] For most other adults, the relative poverty rate was still lower, at 13 to 14% for adults aged 18–64 with no children in the home.

At the opposite extreme, Figure 15 shows the proportions of children and adults living in luxury (with family income at least 50% greater than the median and adjusted for family size). In 1988, 22% of children lived in luxury, compared to 30% of parents and 45% to 50% of adults aged 18-64 with no children.

Figure 16 shows, for families with children and for children themselves, the proportions of each living in homes with increasing numbers of children (from 1 to 3 or more). In 1993, 41% of families with children had just one child in the home, but only 22% of children lived in families where they were the only child. At the other extreme, only 20% of families with children had 3 or more children present, but 37% of children lived in families with a total of at least 3 children.

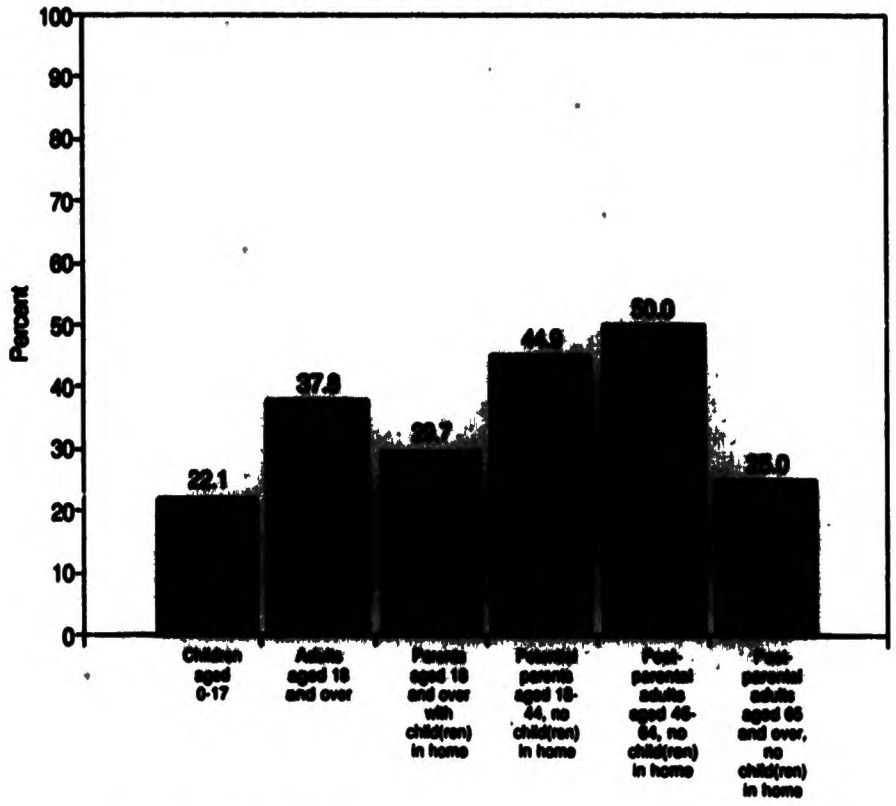
These three figures show clearly that the distribution of children's economic status can be quite different from that of parents and other adults. Thus, whether the unit of analysis is children or an adult-based measure can make a critical difference in measuring and interpreting the actual status of children vis à vis the families in which they are living.

International Comparisons

International comparisons serve to demonstrate the importance of public policy for children. It is not only in the U.S. that children's well-being is being jeopardized by social and economic change. Other developed countries have been experiencing similar trends in the growing proportions of children living in single-parent families (Figure 17; see also Burns, 1992). The percentage of births occurring to unmarried mothers is also increasing in other countries along with the U.S.—although the rates vary across countries (Figure 18).

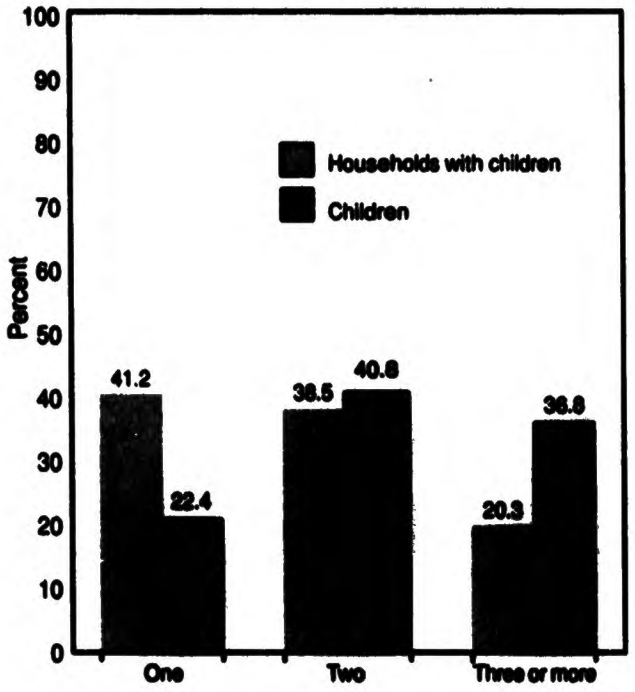
There are, however, enormous differences in poverty across countries (Figure 19).[5] For example, children in the U.S. around 1980 were more than three times as likely as Swedish children to be living in poverty (17% versus 5%), and U.S. children in single-parent families were more

Figure 15. Percent With Luxury Level Income for Children and Adults: 1988



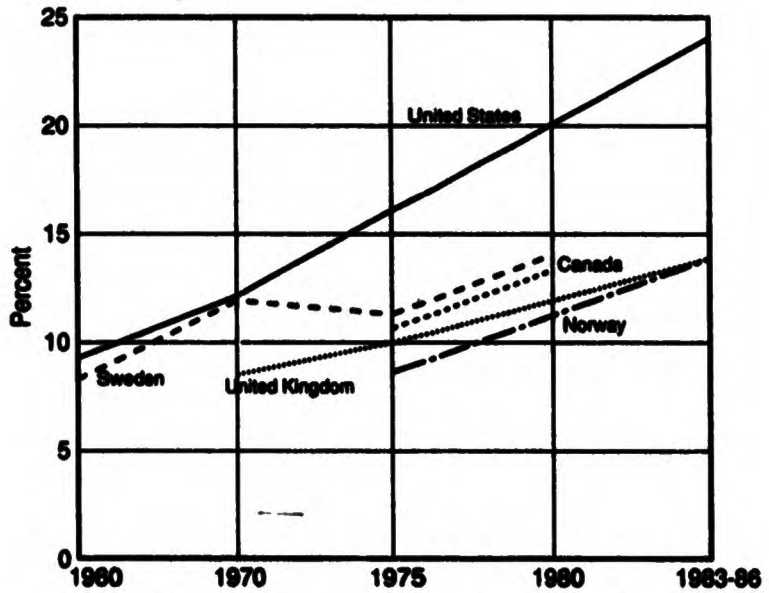
Source: Hernandez, 1993a, p. 247.

Figure 16. Percent with One, Two, and Three or More Children in the Home for Children and for Family Households with Children: 1993



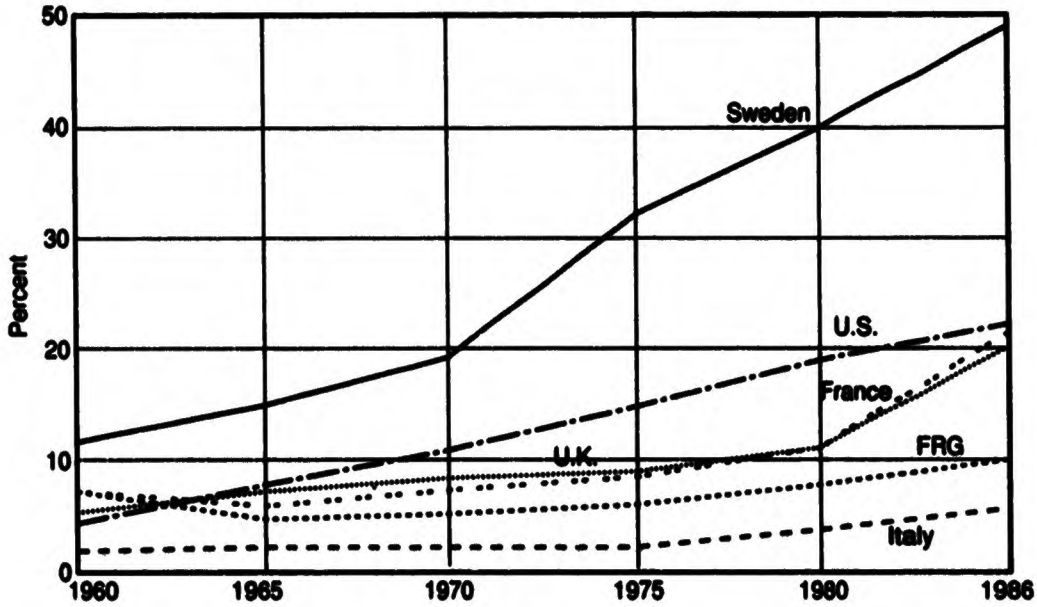
Source: U.S. Bureau of the Census, 1994.

Figure 17. Percentage of Children in Single-Parent Families, 1960–1986



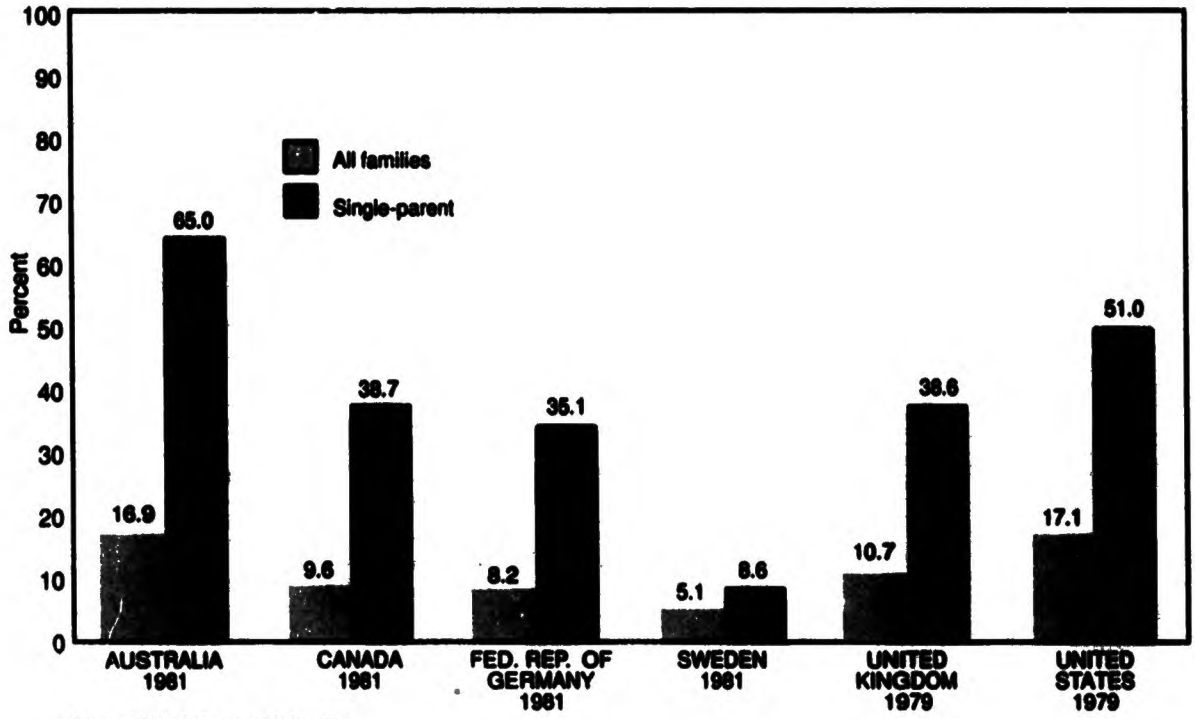
Note: All data for the United Kingdom refer to Great Britain. Data for 1983 to 1986 for the United Kingdom refer to 1985, to 1983 for Norway, and to 1986 for the United States. Children are defined as follows: Canada—age 0 to 24 years; Norway—under age 20; Sweden—18 years and under for 1960, 1970, and 1975, and 15 years and under for 1980; United Kingdom—under age 16 or age 16 to 18 and in full-time education; United States—under age 18.
Source: Hobbs & Lippman, 1990, p. 35.

Figure 18. Percentage of Total Births to Unmarried Women, 1960–1986



Source: Hobbs & Lippman, 1990, p. 49.

Figure 19. Poverty Among Children by Family Type, c. 1980

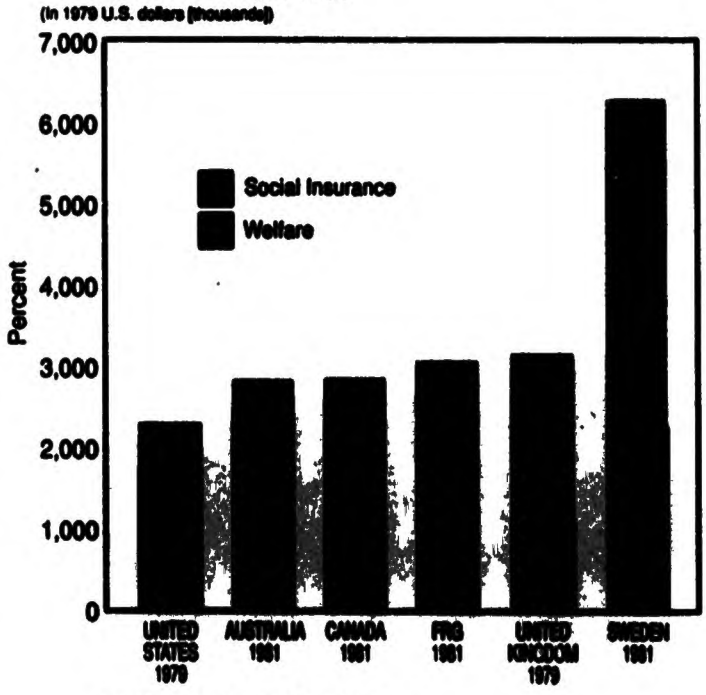


Source: Hobbs & Lippman, 1990, p. 36.

than five times as likely as corresponding Swedish children to be living in poverty (51% versus 9%).

What accounts for these differences in poverty rates? Part of the difference is no doubt due to the low level of support provided by U.S. government transfers (e.g., welfare payments, and housing and child-care subsidies), compared to that provided in Sweden. In the U.S., around 1980, the average poor family with children received only about $2,400 per year in government transfers compared to $6,400 in Sweden (Figure 20). In addition, fewer poor families with children in the U.S. receive any government transfers. Only 73% of poor families in the U.S. receive government transfers—27% receive none—while in all the other countries shown, 99 to 100% of poor families with children receive government transfers (Figure 21).

Figure 20. Government Transfers to Poor Families with Children, c. 1980



NOTE: Poverty determined before taxes
Source: Hobbs & Lippman, 1990, p. 36.

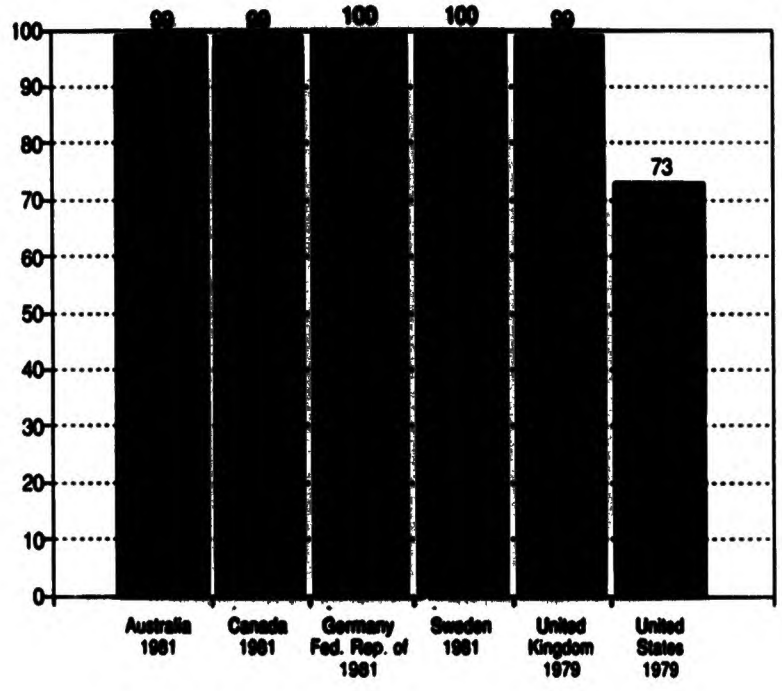
Social Policies and Evaluation

These selected comparisons illustrate how crucial social policies can be to the economic welfare of children. It is not difficult to imagine that a wide range of other policies may also have important consequences for children's economic well-being and thereby their intellectual, physical, and socioemotional development and functioning. Tax laws, for example, and the degree to which they are progressive or regressive, have major implications for the economic situation of children. Minimum wage laws and a wide range of other economic policies influence how much parents can earn and how equal or unequal the income distribution is. Still other government policies concerning the quality and cost of housing, the time allowed for parental or family leave, the quality and cost of preschool education, and the quality, cost, and access to health care all affect children's physical and interpersonal living situations.

Such policies can have important consequences for children's well-being and development, but little attention has been devoted to studying their effects on children. Many public policies target families, workers, or parents, with the result that policy analyses typically evaluate consequences not for children but, instead, for families, workers, parents, or the economy as a whole. The living conditions of children may, however, be quite different from those of families, parents, or adults in general, as shown in the preceding section. Hence, many public policies designed to enhance the welfare of families, parents, or adults may have quite different effects for children.

To the extent children's needs are not met by policies for families, workers, or parents, it will be necessary to design public policies explicitly directed toward fostering their development and well-being. This suggests that statistics concerning children are essential to both scholars

Figure 21. Percent of Pre-Tax and Pre-Transfer Poor Who Receive Transfers



Source: Hobbs & Lippman, 1990, p. 36.

and policymakers who share an interest in tracking the consequences of public policies and understanding how policy interacts with other social and economic change.

A child-centered approach to the design, implementation, and evaluation of public policies can be justified in at least two distinct but important ways. The first justification focuses on humanitarian, moral, human rights, or social equity principles (e.g., Huston, 1991). Here the principle is that children have basic rights because they have inherent value as individual persons. The U.N. Convention on the Rights of the Child (adopted by the General Assembly of the United Nations on November 20, 1989) asserts, for example, the responsibility of national governments to foster, and the rights of children to include (1) a standard of living adequate for physical, mental, spiritual, moral, and social development; (2) education aimed at developing the child's personality, talents, and mental and physical abilities to the fullest extent; and (3) the highest attainable standard of health and health services.

The second justification focuses on children as the human capital upon which rests the future of America (e.g., Hamburg, 1992; Lerner, 1993; National Commission on Children, 1991). Here the tenet is that children are the parents, workers, and citizens of the future. Hence, public investments in children today can yield valuable returns to America's future as an economic power, a democratic nation, and a world leader. But the failure to invest in children can lead to economic inefficiency, loss of productivity, shortages in needed skills, high health care costs, growing prison costs, and a nation that will be less safe, less caring, and less free.

Focusing New Research on Children

One important implication of this discussion is that the effects on children of specific public polices can be known only through direct study, that is, only through research that explicitly measures child outcomes (e.g., Huston, 1991). What is needed is child-centered analyses in domains such as cognitive and intellectual development; school motivation and progress; nutrition; physical and mental health; social development and behavior problems; the quality of day care; parent-child activities and interaction; and housing, school, and neighborhood quality.

Collecting and Analyzing Statistics on Children

As a practical matter, how are statistics on children obtained? Many important questions about children can be answered by reanalyzing

existing databases (censuses, registration systems, and surveys) using children as the unit of analysis. This is how the research for *America's Children* (Hernandez, 1993a) was conducted. It could not have been done 10 years ago, before the advent of microdata files for the 1940 and 1950 U.S. censuses, but with improved data files and computer capabilities such analyses could now be conducted in many countries.

The Survey of Program Dynamics

Analysis of existing data, while valuable, has its limits; it is dependent on the quality and nature of data already collected, and little data are collected regularly on children. To address this situation and provide a basis for assessing future welfare and health care reforms, the U.S. Bureau of the Census is planning a new Survey of Program Dynamics (SPD) that will collect panel data for all persons in a 20,000-household national sample on an annual basis for the period 1993 to 2002.

Highly detailed data will be collected on the timing of and income received from participation in government welfare programs, on the timing of and income received from paid work by parents and other household members, and on changes in family composition. Most important for this present report, preliminary plans call for data on a wide range of child variables, including school enrollment, progress, and academic difficulties; math and reading skills; social development; positive behaviors and behavior problems; parent-child, family, and peer relationships, activities, and time use; access and exposure to TV, computers, magazines, and books; health status and access to health care; and housing, school, and neighborhood quality.

If major welfare and health care reforms are implemented during the coming years, these data can be invaluable to assessing the success of the reforms along a variety of dimensions, including their consequences for the development and well-being of children. With data collection beginning in 1993, this survey can provide baseline data for 2 or 3 years before major reforms occur. It can thus provide a "moving picture" of dynamic changes as they occur in parental employment, welfare program participation, and children's outcomes, and it can serve as the basis for assessing short-term and medium-term consequences of such changes for the well-being and development of children.

Conclusion

The past two decades have brought rapid and widespread increases in social science interest and research regarding the circumstances of children and the nature of childhood (Hernandez, 1986; Qvortrup, 1993). This blossoming of children and childhood as an object of scientific study goes hand in hand with increasing interest in the consequences for children of a wide range of social, economic, and demographic changes, and of social welfare policies.

In closing, then, it seems appropriate to highlight two reasons for policymakers and researchers to intensify their attention on children. Insofar as policymakers and researchers are interested in human welfare, not only adults but children should be an explicit focus of their deliberations. Second, the children of today are the adults of tomorrow. Hence, in that research and social policy are concerned with the effectiveness of future citizens, future workers, and future parents, studies should focus explicitly on the development and well-being of today's children.

Notes

[1]For those interested in detailed results from *America's Children* (Hernandez, 1993a), a 20% discount is available by obtaining a publisher's order form from the author or by calling the publisher at (800) 666-2211.

[2]The poverty threshold varies with the number of adults and children in a family. It is also adjusted for inflation, in accord with the consumer price index (U.S. Bureau of the Census, 1993). In 1992, for example, a family of 4 (with 2 parents and 2 children) was classified as officially poor if its annual income was less than $14,288. A family with a mother and 2 children was classified as officially poor if its annual income was less that $11,304.

[3]For a discussion of the additional effects of noncash benefits, health insurance, and taxes, see Hernandez, 1993a, pp. 253-259.

[4]That children experience higher rates of poverty than parents may seem counterintuitive. However, poverty rates are calculated across all households. If, for example, there are 2 households, the first poor with 2 parents and 4 children, the second nonpoor with 2 parents and 2 children, the poverty rate for parents is 50%, since 2 out of 4 parents are poor, but the poverty rate for children in this instance is 67%, since 4 of 6 children are poor.

[5]The method of measuring poverty used here differs somewhat from the official U.S. approach, but the difference is slight.

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Donald J. Hernandez, Ph.D., is Chief of the Marriage and Family Statistics Branch in the Population Division at the U.S. Bureau of the Census. He is leading the development of the new Survey of Program Dynamics, designed to assess the consequences of welfare and health care reform for child development, and an international effort to develop cross-nationally consistent statistics on the family living arrangements and economic conditions of children.

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SOCIAL POLICY REPORT
Society for Research in Child Development

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Children in Poverty: Designing Research to Affect Policy

Aletha C. Huston

Children and Poverty

The United States faces a social problem of epidemic proportions: more than 20% of our children live in poverty. The problem is not new; with few exceptions it has been with us for many years. In 1960 almost 27% of children under 18 years of age in the United States lived in families with incomes below the official poverty level. In the 1960s both media and political leaders discovered poverty, and the country launched a war against it. By the end of the decade, the poverty rate for children was reduced to 14%, but the war was not won. Children's poverty began to increase during the 1970s, and intensified during the recession of the early 1980s. Since that time, it has remained stubbornly high around 20%. In 1992, 21.9% of the nation's children lived in families with cash incomes below the poverty threshold, and many more lived near the poverty line (U.S. Bureau of the Census, 1992; see Figure 1, p. 2).

The increase in children's poverty is especially striking in view of the fact that incomes of the wealthiest families increased at the same time, creating a wider income disparity between the richest and poorest families by the end of the 1980s; the rich got richer and the poor got poorer. Many families maintained their standard of living only by having two earners (Congressional Budget Office, 1988).

Poverty rates in the U.S. are about twice as high as most other industrialized nations. For example, in 1986–87, when 20% of American children were poor, the child poverty rate was 9% in Canada and 2% in Sweden (Danziger & Danziger, 1993).

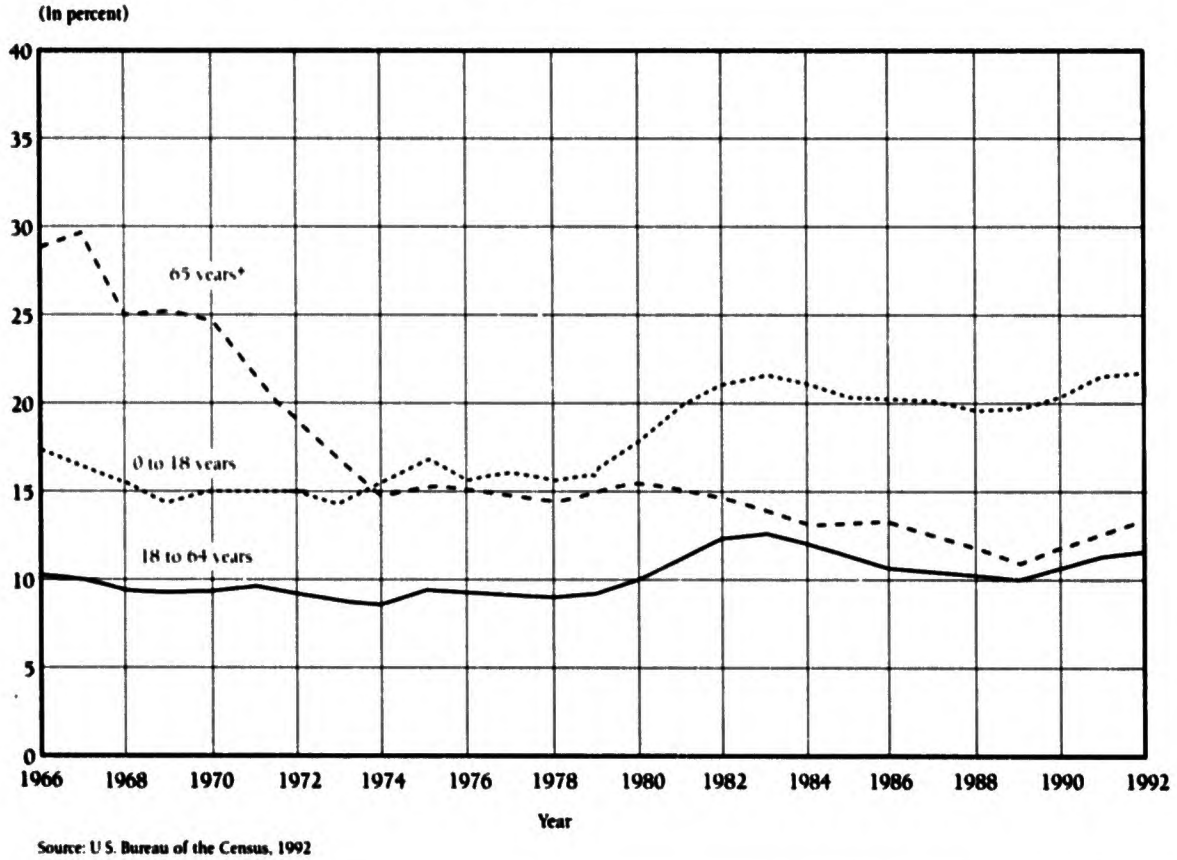
Reasons for High Levels of Child Poverty

Why has poverty among American children increased, and why does it seem so intractable? At least three reasons are clear (Hernandez, 1994; Huston, 1991):

First, economic changes have eliminated many well-paying blue collar jobs. Half the jobs created in the 1980s paid wages at levels below the poverty line for a family of four (Garbarino, 1992). The economic recession of the early 1980s hit poor families hard, and the "recovery" excluded them.

Second, the percent of children living in single-mother families has increased, and the risk of poverty in these families is high; 40% of European-American and 60% of African-American and Latina single-mother families were poor in 1991 (U.S. Bureau of the Census, 1992). Con-

Figure 1. Poverty Rates by Age: 1966 to 1992



Source: U.S. Bureau of the Census, 1992

tributing to the high poverty rates of single-mother families are the lower wages of women overall, unfavorable economic conditions, the low educational attainment of many single mothers, and the fact that many single mothers are adolescents who tend to have low earning power.

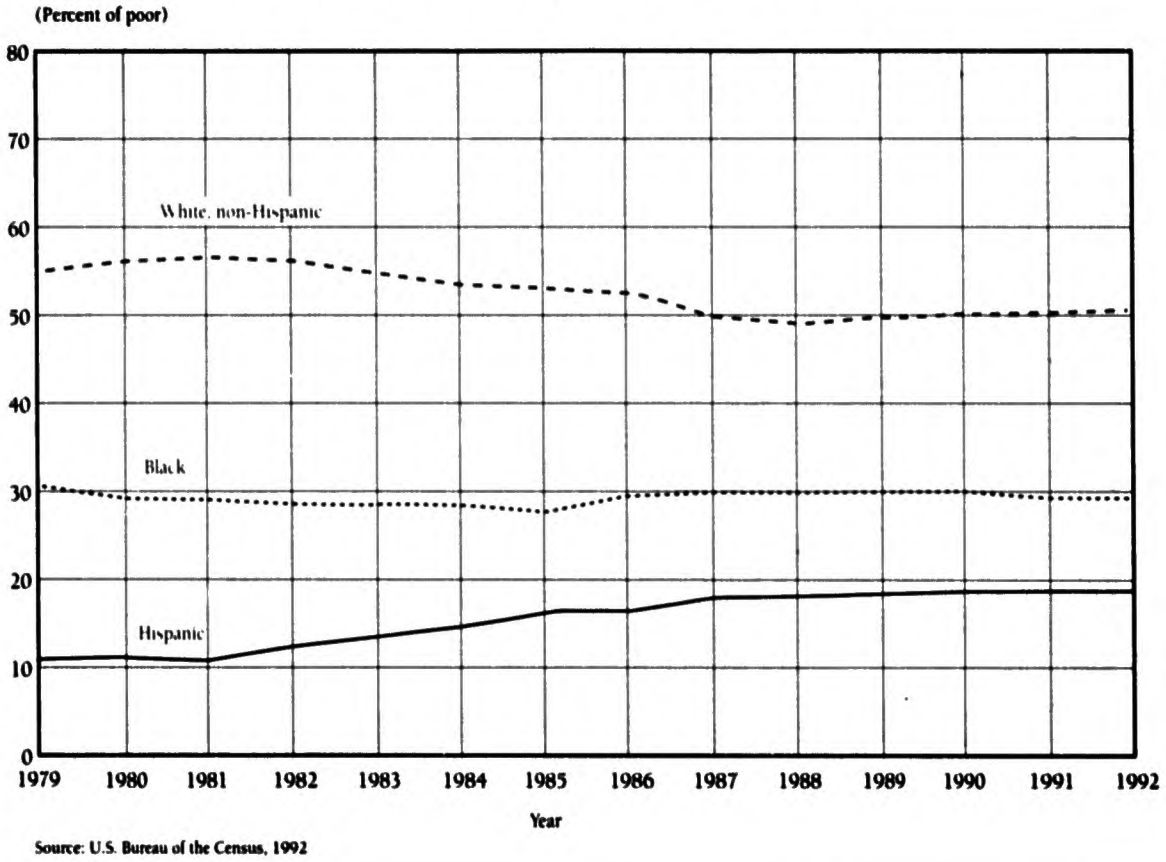
Third, government benefits declined during the 1970s and 1980s. Unlike Social Security, cash benefits for poor families with children do not increase automatically with inflation, so the real value of benefits decreased considerably during the 1970s and 1980s. In addition, the policy changes of the Reagan and Bush administrations in the 1980s further reduced both the size of benefits and the number of children eligible for them (Huston, 1991).

Dimensions and Contexts of Poverty

The distribution of poverty in the U.S. reflects our racial and ethnic cleavages. Although the majority of poor children in the U.S. are of European ancestry (see Figure 2), African-American and Latino children have a higher probability of living in poverty. In 1992, 47% of African-American children and 40% of Hispanic children were poor compared to 17% of all European-American children (U.S. Bureau of the Census, 1992).

Duration. Chronic or persistent poverty that goes on for years has different correlates than transitory poverty that may last for a relatively short time. Longitudinal data from the Michigan Panel Study of Income Dynamics, begun in the 1960s, show that many people move into and out

Figure 2. Distribution of poor by race and Hispanic origin: 1979 to 1992



Source: U.S. Bureau of the Census, 1992

of poverty from year to year (Duncan, 1984; 1991). People whose poverty is transitory, lasting only a year or two, are demographically similar to the rest of the population. Certainly, income loss can cause stress, and in some families it leads to negative parenting (McLoyd, 1989), but these are not typically the families that are living in conditions of chronic material hardship.

Persistent poverty, lasting over several years, is another matter. In the Panel Study of Income Dynamics, the great majority of people in persistent poverty were African-American (see Table 1); many were single mothers and their children. Only 13.3% of the African-American children in that study escaped poverty throughout their developing years. Over one quarter of them lived in poverty for most of their childhood and adolescence.

Table 1. Fifteen-year poverty experiences of children who were under age 4 in 1968 (from Duncan, 1991)

	Always above 150% of poverty line	Poor 1-4 years	Poor 10+ years	Mean number years poor
Nonblack	55.7%	19.8%	0.6%	0.9
Black	13.0%	32.3%	28.9%	5.5

People who live in chronic poverty are not only demographically distinct, but they are likely to live in impoverished environments marked by poor health conditions, inadequate housing, homelessness, environmental toxins, violent neighborhoods, and poor schools.

Location. In the 1990s the popular image of the poor finds them in a northern urban ghetto. But the rate of poverty is as high in rural areas as it is in urban settings. Moreover, the southern

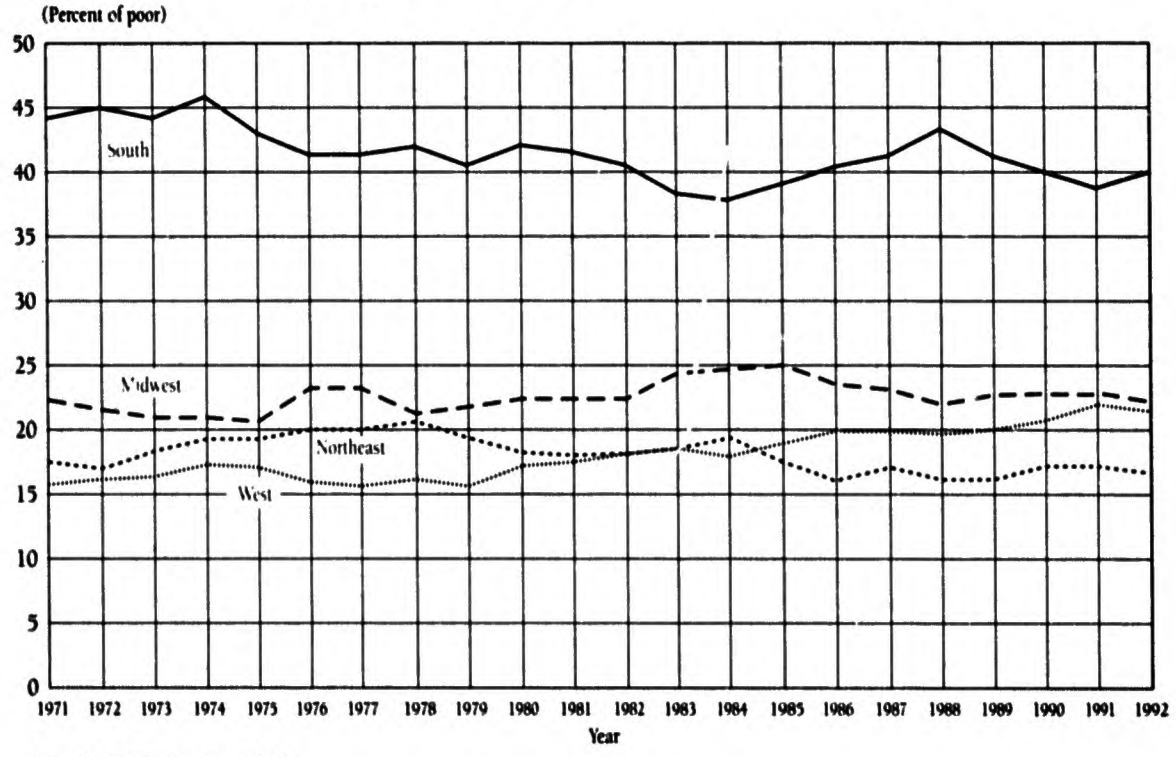
United States still accounts for more than its share of the poor (see Figure 3). Ironically, when poverty was "discovered" in the 1960s, the popular image was a gaunt, white family in an Appalachian shack. The context of poverty is different in rural areas than in large cities, but rural poverty has received much less attention from researchers and policymakers in recent years.

The rural poor receive fewer services and benefits, e.g., Aid to Families with Dependent Children (AFDC), than the urban poor, in part because many of them live in southern states with low tax bases that have poorly funded public programs for the poor. People in rural areas also tend to resist accepting aid because it conflicts with their values and because services are often difficult to obtain. They are more often married and have a working head of family, but the available jobs pay lower wages than those in urban areas (Huston, 1991).

Effects of Poverty on Children's Development

It goes without saying that poverty is bad for children and other living things—notwithstanding an American myth that deprivation leads to strength. For the great majority of children, poverty poses risks to development. Poverty among children is associated with an array of problems, including low birthweight, infant mortality, contagious diseases, and childhood injury and death (Klerman, 1991). Poor children are at risk for developmental delays in intellectual development and school achievement. Beginning in preschool, they tend to have lower average levels of school-related skills than nonpoor children; their progress through school is slower and more subject to termination from dropout (McLanahan, Astone, & Marks, 1991; Ramey & Campbell, 1991). Poor children also have relatively high rates of social/emotional and behavioral problems, including anxiety, social withdrawal, ag-

Figure 3. Distribution of poor by region: 1971 to 1992



Source: U.S. Bureau of the Census, 1992

gression, and delinquency; lack of self-esteem and self-efficacy; and psychological distress (McLoyd, 1991). By adolescence, these problems can impinge on the larger society in the form of juvenile crime, early pregnancy, and school dropout (Garbarino, 1992).

This depiction should not be taken to mean that all children in poverty are doomed to poor outcomes. Although poor children are at risk for problems, not all succumb. Many are healthy, intellectually productive, and socially well-adjusted. Poverty is a risk factor, but we do a disservice to the people living in poverty if we fail to keep in mind that many of them survive and flourish against considerable odds. Moreover, from studying those resilient children, we can learn what kinds of environmental supports and conditions enable them to become productive adults (Bradley et al., 1994; Werner, 1989).

Making Research More Useful for Informing Policy

Many developmentalists interested in poverty want to do more than understand its effects; they want their research to have social impact—to help in reducing the negative effects of poverty on children. Those with policy interests are living in the right era. Funding policies of the federal government and private foundations have shifted toward emphasizing research that addresses social problems and has social applications.

Most policy studies, however, are centered in other disciplines—political science, economics, sociology, and social welfare. Several years ago, thanks to an internal sabbatical program at the University of Kansas, I spent a year in the Department of Political Science learning about public policy analysis. That experience made me acutely aware of the fundamental differences in perspective arising from the fact that psychologists conceptualize human behavior at the level of the individual, while political scientists, economists, and sociologists conceptualize it at an aggregated, societal level. Although Bronfenbrenner's (1979) ecological model has gained some influence in the field of child development, psychologists concentrate for the most part on individual children and families, with little consideration of the larger social and economic contexts in which they live.

Equally important was the realization that, although children are central to developmentalists' interests, they are of relatively little interest within most other disciplines that influence public policy. They are rarely discussed in studies of policy, for instance; and public policy texts do not typically include an entry for "child policy" or even for "family policy" in their table of contents. Rather, policy goals are defined in economic terms. Children may sometimes be mentioned in connection with welfare policy, but primarily as economic burdens who interfere with their parents' participation in the labor force. By contrast, the developmental research community takes for granted that the goal of public policy is health and psychological well-being for children; the issue is how to attain it. If child development research is to have an impact on public policy for children, it needs to be conceptualized and framed in terms that can be communicated to policymakers and translated into policies and programs. In what follows, I suggest a few considerations that may be helpful in reaching that goal.

Broadening the Definitions of Poverty

Cash income. Poverty is usually defined as the absence of sufficient income to meet basic needs. The most common operational definition is based on *cash income* using the federal poverty threshold as a marker. The poverty threshold is based on the estimated cost of food for a household (a very basic diet) multiplied by 3. Calculations are based on family size and age of family members, and are adjusted annually for inflation, but not for geographic region or noncash benefits (e.g. food stamps, Medicaid). The poverty threshold is an absolute dollar amount, not a percent of median income or a percentile. It is, therefore,

theoretically possible for everyone to be above the poverty threshold.

The poverty line cut-off does not reflect how far below (or above) the threshold people fall (the poverty gap). As a better measure of the intensity of poverty, many researchers use an income-to-needs ratio—the ratio of a family's income to the income defined as the poverty threshold for that family's composition (Duncan, 1984). An income-to-needs ratio of 1.0 denotes a family income at the poverty line; a ratio of 2.0 means income is twice the poverty threshold; a ratio of 0.5 means it is half the poverty threshold. The income-to-needs ratio is often a better predictor of child outcomes than income per se (see Huston, McLoyd, & Garcia Coll, 1994).

Socioeconomic status. Psychologists often use the terms poverty and low SES interchangeably, but these are not the same. "Socioeconomic status" refers to access to or control over wealth, power, and social status (Mueller & Parcel, 1981). Its indicators, such as occupational status, educational attainment, prestige, and power, are clearly related to, but distinct from, income level, which is the measure of poverty. Perhaps most important, income is considerably more volatile than SES because it tends to shift more rapidly and more often than educational attainment and occupational status (Duncan, 1984). People who lose a job or get divorced often experience a serious drop in income without any immediate change in SES.

Material hardship. Poverty is defined conceptually as the absence of resources to meet basic needs, but measures based on cash income only partially describe literal material hardship. For example, Mayer and Jencks (1988) surveyed a large representative sample of adults in Chicago about whether they had gone without food, medical and dental care, or housing during the past year because of inability to pay. Cash income predicted about 25% of the variance in material hardship. Other indicators of SES (e.g., education level) added modestly to this level of prediction. Moreover, the poverty threshold *underestimated* hardship for families with children, especially large families. That is, the poverty thresholds for large families are too low. They do not adequately reflect the costs of raising children.

Subjective poverty. Still another aspect of poverty is the subjective experience of deprivation. When my daughter was younger, she sometimes asked me if we were poor. When I was a first-year college student, I went to a vocational counseling session at the Veteran's Administration (required because I received educational benefits as a result of my father's death in the Second World War). I was amazed when the counselor told me that my family income was in the top 10% in the country. In contrast, one also hears about people who have grown up in objectively impoverished circumstances, yet did not feel poor. Such anecdotes suggest that most children (and many adults) have very little idea where their family income falls relative to national statistics, and that family income alone does not define a child's subjective experience of deprivation or affluence.

One would think that psychological researchers would consider subjective experience an important mediator of the effects of poverty on children and families, but studies that address the subjective reaction to being poor are scarce. One exception is a study of single-mother, African-American families. The negative effects of poverty on children's sense of well-being were mediated in part by adolescents' subjective experience of economic hardship (McLoyd, Jayaratne, Ceballo, & Borquez, 1994). In an earlier study, one source of distress for adolescents was, not surprisingly, the extent of mothers' communications about money worries to their children (McLoyd, 1991).

The point of this excursion into definitions is that we have failed to conceptualize the independent variable, poverty, very well. As researchers begin more rigorous investigations of the impact of poverty on children's development, we need to go beyond the bare bones of monetary definitions of income to find out how proximal environments vary with family income and what other variables associated with "poverty" are the important determinants of outcomes for children.

Making Research More Multidisciplinary

In order to play in the policy game, research must be multidisciplinary. Specialists in health, child development, social welfare, family development, economics, and other disciplines each have a contribution to make. It is especially important to incorporate economic analyses, because economic considerations often drive policy decisions. For example, there is a strong body of research showing that early educational child care and intervention programs (e.g., the Abecedarian project) have positive and lasting effects on children's school achievement (Campbell & Ramey, 1994; Haskins, 1989). But that knowledge alone is insufficient, because policymakers must consider cost. They tend to dismiss demonstrably effective interventions as too expensive for large-scale application (e.g. Haskins, 1989).

Cost-effectiveness and cost-benefit analyses of early childhood intervention programs *have* been conducted. Economists have collaborated with developmentalists to determine the short- and long-term economic benefits of infant and preschool programs (Bryant & Peisner-Feinberg, 1994). For instance, a cost-benefit analysis of the Perry Preschool Project, a preschool program designed to promote the intellectual development of poor children, demonstrated that, by the time the children in the study were 19 years old, the estimated value of the program was $9500 per child in 1981 dollars (Barnett, 1992).

Developmentalists are only just beginning to collaborate in another stream of research—the study of welfare reform. Until recently this research was dominated almost entirely by an economic orientation. Social science evaluations played an important role during the 1980s, for example, in guiding the formulation of federal welfare policies that culminated in the Family Support Act of 1988. Reform efforts were (and still are) focused on education and training programs designed to help AFDC recipients become self-supporting, and several carefully designed large-scale experiments showed that women achieved modest gains in work hours and income as a result of demonstration education and training programs (Greenberg & Wiseman, 1992; Gueron & Pauly, 1991). But, though technically sound, these studies suffer from one major weakness: the indices of success are limited to economic effects—changes in income, employment for mothers, and reductions in AFDC costs.

Job training programs in some states require participation by mothers of children as young as 1 year of age, and some current federal proposals would set mandatory participation for adolescent mothers at 12 weeks after an infant's birth. Yet, there is little or no information about the consequences for the children in participating families.

A few developmental researchers have recently forged connections with field experiments testing welfare-to-work programs. In three current studies, for example, videotaped observations of mother-child interaction are being collected to evaluate the effects of participation in education and job training interventions on mothers' parenting behavior. Some measures of children's development are being collected as part of these studies (Zaslow, Coiro, & Moore, 1993).

The work of Zaslow et al. (1993) is especially important because it is guided by a theoretical model. Pathways by which maternal education and employment might affect children either positively or negatively are proposed: (1) child care—high or low quality of the child care received by children while mothers are working could enhance or endanger healthy development; (2) income—increasing income could improve family circumstances for children; (3) cognitive stimulation—education for mothers could lead them to provide more cognitive stimulation for their children; (4) stress—employment could increase or reduce maternal stress which would, in turn, affect interactions with children.

Developmentalists have also changed the conceptualization of the problem from training mothers to be self-sufficient to providing a two-generation intervention affecting both short- and long-term probabilities of continuing poverty

(Smith & Zaslow, in press). The work on two-generation approaches is just beginning and provides exciting opportunities for policy-related research.

Policy Research is More Than Applied Research

Psychologists sometimes assume that making research "applied" is sufficient to contribute to policy, but applied research may have little impact unless it addresses policy issues directly. Policy research, more narrowly defined, is "research on, or analysis of, a fundamental social problem in order to provide policymakers with pragmatic, action-oriented recommendations for alleviating the problem" (Majchrzak, 1984, p. 12). Policy research explicitly investigates factors that are amenable to public policy influence.

For example, there is now a body of literature showing a relationship between quality of child care and cognitive and social development (e.g., Hofferth & Phillips, 1991; Scarr & Eisenberg, 1993). Psychologists like to measure child care quality directly by observing the child care environment and the human interactions experienced by the children there. But one goal of the research is to inform policies about the regulation of child care; other indices of quality that are "regulatable," like ratios, group size, or caregiver training, should be included along with the more direct, observable indices of quality. One group of investigators studied this relationship between observed quality and the regulatable quality indicators within child care centers serving different income groups. Centers serving low-income children were similar to high-income centers on indices like ratios and group size, but the index based on observed adult-child interaction indicated lower quality (Phillips, Voran, Kisker, Howes, & Whitebook, 1994). This study raises questions of how quality can be evaluated and regulated equitably for different groups in the society.

Another example comes from research on educational television for children. Developmentalists tend to focus on what children can learn from television, but policymakers need information about how programs reach their intended audience. As more preschool children are in out-of-home child care, educational viewing has declined, in part because children are away from home during the daytime hours when the programs are broadcast (Pinon, Huston, & Wright, 1989). In response, both *Sesame Street* and *Mr. Rogers' Neighborhood* have developed curriculum materials to encourage child care providers, especially those in family child care settings, to use educational television in conjunction with print and other materials.

Using Appropriate Design and Analysis

Social science researchers continually face two risks—either that they will show an effect that is spurious or unreal (a false positive, or Type I error) or that they will fail to document an effect that indeed exists (a false negative, or Type II error). Unfortunately, much of our professional training in research design and statistics focuses more on the former than the latter. We learn that a result is not taken to be real, or "significant," unless it passes muster below some stringent level of statistical probability (commonly less than 0.05); a result above that level is dismissed as a chance occurrence. And when multiple tests of a phenomenon are involved, still further cautions are taken to protect against the possibility that one, or more, among many tests might be "significant" by chance (i.e., at probability < .05).

In policy research, however, Type II error poses at least as much danger as Type I. There can be serious consequences when research fails to demonstrate a phenomenon that does exist. A classic example is the Westinghouse evaluation of Head Start, which concluded that the program's beneficial effects washed out by about third grade (Cicirelli, 1969). These findings led many people to conclude that Head Start had no lasting effects; the program was saved from elimination only because there were strong advocates who fought for its continuation, with little help from researchers.

More recent evidence suggests that the early studies of Head Start were subject to Type II error. Many studies combined all programs called Head Start with little or no information about the duration or quality of the individual programs. Comparison groups were made up of children who were in the same elementary school or who had been on Head Start waiting lists. Recent analyses have demonstrated that children in these *ad hoc* comparison groups were on average less deprived than those in Head Start programs, which may have militated against finding effects of Head Start (see Lee, Brooks-Gunn, & Schnur, 1988). These flaws in design led to faulty conclusions that may have caused more harm than good in the early years of Head Start.

How can research be made more informative? How does one reduce Type II error?

Taking care in sampling. Psychologists are sometimes criticized for their casual approach to sampling. They too often rely on samples of convenience rather than of design, making it difficult to generalize from findings. We stand to learn from our colleagues in sociology and economics about identifying more representative samples.

Moreover, because psychologists tend to focus on more intensive measurement of individuals within groups, samples are often, of necessity, small. This probably cannot be avoided, but researchers must recognize the danger of concluding that no effect exists when a sample is small. Routine inclusion of analyses of power estimates, as well as tests of significance, can help protect against this type of error.

Establishing appropriate comparison groups. In applied research in the field, random assignment is often impractical. Evaluation research methods often include quasi-experimental designs and other substitutes for true experiments in which it is crucial to evaluate the comparability and adequacy of control groups. Cook and Campbell (1979) provide excellent methodological suggestions for such designs.

Choosing adequate measures. Although psychologists are supposed to be experts on measurement, they often use measures with unknown validity and reliability, or measures that have been standardized on populations other than the one of interest. Whenever we undertake to measure a construct that does not yet have a well-tested measure, we must be alert that nonsignificant results may be due to large measurement error rather than an actual absence of effect.

Integrating Research with Policy

For research to be more useful to policymakers, it needs to be integrated and presented in a form that a busy, well-educated nonspecialist can understand. Policymakers and their staffs do not typically read journal articles in *Child Development* or other highly technical writing. They can benefit, however, from reviews and integrations of research findings. Some of the best examples are the volumes summarizing studies conducted by the National Research Council (e.g., Hayes, 1987, on adolescent pregnancy, and Hayes, Palmer, & Zaslow, 1990, on child care). These NRC publications organize the research in a scientifically responsible way while making it accessible to nonspecialist readers.

Researchers can also attempt to translate technical findings into terms a nonspecialist can understand. It is not very helpful to discuss the "R^2" and "percent of variance accounted for" in reporting research findings. Instead, results should be expressed in concepts that are accessible. In one recent paper, for example, the results of a regression of IQ on parent income was presented as the number of points on an IQ scale by which chronically poor children differed on average from nonpoor children (Duncan, Brooks-Gunn, & Klebanov, 1994.

In a report to Children's Television Workshop describing a longitudinal analysis relating *Sesame Street* viewing to tests of school readiness, my colleague John Wright and I compared the variance accounted for by viewing, after all appropriate controls were entered, with that accounted for by the HOME, a measure of the overall quality of the home environment. Those who were disappointed that viewing accounted

for just 4% of the variance found it considerably more impressive when they discovered that the HOME also accounted for about 4% (Wright & Huston, 1993).

One can discuss the social significance rather than the statistical significance of results. A widely used set of guidelines suggests, for instance, that differences of 0.20 standard deviation units are a "small" effect; more than 0.50 S.D. units is a large effect, and anything in between is "medium" (Rosenthal & Rosnow, 1984).

Preparing for Policy Issues in the Future

One classic concept in policy studies is the so-called "policy window," or time-limited opportunity, when advocates of a proposal can push their solution to a policy question. One metaphor is the notion that policymaking is a running stream; advocates wait beside, ready to jump in when an opening occurs (Kingdon, 1984). Because producing good research takes time, a set of investigations initiated on an issue from the current year's policy agenda will not produce results in time to have an effect. Policy researchers must, therefore, plan their research around issues that are likely to have enduring importance, and they should be ready to produce that research when the window opens. For example, television violence reached a visible point on the national policy agenda of the Congress this year; the research bearing on that issue is a culmination of many years of study, conducted because funding agencies and researchers thought it was important.

Conclusion

Poverty among children is a persistent, serious problem in the U.S. Children living in chronic poverty are especially at risk for problems in health, cognitive development, social behavior, and psychological well-being. Although there are many reasons for the high rates of children's poverty in the United States, government and public policy are at least one important influence. Of the three reasons explaining the increase in children's poverty in the 1970s and 1980s—economic changes, single-mother families, and public policy—policy is the most subject to change.

As researchers studying human development we can contribute to well-designed public policy that addresses children's needs, not just economic goals. Research can be most useful for policy when (1) it is multidisciplinary and multilevel; (2) it explicitly includes variables that can be translated into policy; (3) it protects against Type II error (false negatives) as well as Type I error (false positives); (4) it provides results that are integrated and translated into terms that are comprehensible to nonspecialists; and (5) it is oriented to future policy issues as well as those of most concern in the present. In many domains of public policy affecting children, developmentalists have left the field to other players. We have a contribution to make and a responsibility to be sure that children are considered in major policy decisions affecting their welfare.

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Developmental Effects of Lead Exposure in Children

Johanna Rich Tesman
Amanda Hills

The past few decades have witnessed a dramatic interest in the effects of childhood lead poisoning. Although the toxic effects of lead have been acknowledged for generations and the production of lead dates to ancient civilizations, only recently has it been known that even low levels of lead exposure may have serious effects on children's development. In 1991, driven by accumulating research findings, the Centers for Disease Control (CDC) published new guidelines regarding the treatment of children exposed to lead. In these guidelines the blood lead level of intervention was lowered from 25 to 10 micrograms per deciliter (µg/dL).

Low levels of lead exposure have been associated with a broad array of childhood problems ranging from cognitive and behavioral problems in preschool through high school (see Environmental Protection Agency [EPA], 1986, and Needleman, 1992, for a summary of findings) to hearing problems (Fox, 1992). New insights regarding the effects of lead have come from many sources. In particular, evidence from animal research has been greatly influential, and many recent, well-designed and carefully conducted cross-sectional and longitudinal studies carried out in several countries have added to our understanding of the effects of lead on development.

Sadly, in the end it appears that there may be no safe level of exposure to lead and that some neurotoxic effects may be irreversible (American Academy of Pediatrics, 1993).[1] However, lead poisoning continues to be entirely preventable: remove the source of lead from the child's environment, and remove the problem; never expose the child to lead, never have a problem. Unfortunately, removing the sources of lead from children's environments has proved to be a much more difficult and costly procedure than once thought, although there may be some success stories, as in the case of restricting leaded gasoline.

This report presents an overview of childhood lead exposure and poisoning, and the related social issues. The first section briefly summarizes the history of lead poisoning and its prevalence in the U.S., and discusses the basis for recent changes in the CDC guidelines. The next section reviews the animal and human literature on lead poisoning. The purpose of this review is to highlight current findings and to illustrate some of the mixed results and methodological issues relevant to studies of children, not to provide exhaustive coverage of the extensive literature on lead effects. A third section proposes strategies for future research. Finally, policy is-

sues and legislative action related to managing lead hazards in the home and community are discussed, and conclusions are drawn.

Background

Ancient History

Lead was one of the original metals used by man. It was utilized by ancient civilizations as a source of silver and in the production of items as diverse as dishes, pigments, sling shots, weights, and coins. In the Roman Empire, lead was an integral part of the aqueduct system which supplied the drinking water for the city. Some have speculated that the fall of Rome resulted from the widespread use of lead (Gilfillan, 1965). Others point out that it is difficult to ascertain how much lead was actually in Roman drinking water because the waters came from springs in and around as Rome as well as from the aqueducts. It has been suggested that more problematic was the use of sapa, a sweetening agent made from grapes cooked in lead pots (Nriagu, 1993).

Nicander, a Greek poet-physician in the second century B.C., theorized that exposure to white lead and the sugar of lead resulted in what are now recognized as the classic signs of lead poisoning—palsy, pallor, colic, and constipation. During the Middle Ages the effects of lead poisoning apparently received little attention; not until the Industrial Revolution was an interest in lead revived (Cory-Slechta, 1984).

Modern History

Australia was one of the first countries to recognize and treat lead poisoning. In the 1890s a physician named Turner identified children with symptoms ranging from headache to vomiting and foot- and wrist-drop which he attributed to a leaded water tank. Gibson, another Australian physician, published a paper in 1904 titled *A Plea for Painted Railing and Painted Walls as the Source of Poisoning Among Queensland Children* (for further historical details, see Lin-Fu, 1992). He argued that the source of lead poisoning for the majority of Australian children was the leaded paint that covered railings and porches. Moreover, he determined that exposure was greatest during the warmer months when children were playing outside and had opportunities to have their hands coated with lead dust and engage in hand-to-mouth activities.

Physicians in the U.S. were initially skeptical of the Australian findings, but by the 1920s were forced to confront the issue because reports of lead poisoning had become more prevalent. One significant outbreak of lead poisoning occurred in the Baltimore area, during the Depression, and was found to be due to the burning of battery casings for domestic fuel (Williams, Schultze, Rothchild et al., 1933, cited in Lin-Fu, 1992). This was only one source of lead exposure; others appeared in the years following the Depression. In particular, leaded paint and leaded gasoline have been, and continue to be, the predominant sources of lead poisoning in the U.S.

Concern about lead poisoning and exposure increased slowly in the 1940s and 1950s. This was in part because most lead poisoning was thought to be primarily a problem of slum-dwelling children and the result of pica, whereby children consume nonfood items, in this case peeling and chipping lead paint (Lin-Fu, 1992). It wasn't until the 1960s that lead poisoning was recognized as an important pediatric problem (Griggs, Sunshine, & Newill, 1964).

In 1967 Jane Lin-Fu, writing for the Department of Health, Education, and Welfare (now the Department of Health and Human Services [DHHS]), published a paper entitled *Lead Poisoning in Children* that spelled out for the first time that lead poisoning was a serious threat to children's health causing neurological problems, mental retardation, and even death. Following this publication, efforts to educate the general population regarding the threat of lead poisoning increased dramatically.

In 1971 federally assisted screening of chil-

dren for lead poisoning began. From these screenings it was determined that 20% to 45% of children tested had blood lead levels over 40 µg/dL. It was also discovered that lead-poisoned children did not just reside in inner-city slums, nor did they all suffer from pica. Hence, the importance of lead dust in the environment coupled with typical infant hand-to-mouth activity was confirmed (Lin-Fu, 1992).

Since the mid-1960s the incidence of lead poisoning has decreased significantly due to mass education and the reduction of lead in both gasoline and food processing (lead solder used in canning; Lin-Fu, 1987). Despite these efforts, however, childhood lead poisoning remains one of the most prevalent preventable childhood health problems in the U.S. today.

There have been great improvements since the early 1970s in the technology of measuring lead in microsamples of blood and in other sources. Advances in the past decade, including the introduction of improved instrumentation for the atomic absorption spectrometry and anodic stripping voltammetry, have made it possible to obtain highly accurate and precise measures of lead in microsamples of blood. Prior to 1970 venous samples of 5–20 µL of blood, usually obtained from children by external jugular or femoral vein puncture, were required for the older colorimetric procedures. At that point, a single technician could process only 8 to 10 samples per day. Currently, a technician can test up to 80 samples per day. Without these technologies the research of the past 20 years would not have been possible (Julian Chisolm, personal communication, July, 1994).

Prevalence

In October 1993, during National Child Safety Month, DHHS cited lead poisoning as the most hazardous health threat to children under the age of 6. In 1992 the EPA had estimated that approximately 3 million children in the United States had blood lead levels greater than 10 µg/dL, levels high enough to possibly affect intelligence and development. Recent evidence suggests that lead levels above 10 µg/dL may occur more frequently in urban than suburban areas (Harvey, 1994; Nordin, Rolnick, & Griffin, 1994).

Despite efforts to reduce the level of lead in the environment through prohibition of lead in residential paint (a ruling made in 1977 by the U.S. Consumer Product Safety Commission) and reductions of lead in gasoline, there is still a considerable environmental threat. The EPA (1992) has estimated that dust and soil in many parts of the country continue to be contaminated by leaded gasolines and paints and that 74% of all housing units built before 1980 contain lead-based paint. Faced with this information on prevalence and other accumulating evidence on the effects of lead poisoning, the CDC changed its lead policies in 1991 (CDC, 1991).

CDC Policy Changes

In its 1991 revised policies, the CDC made several recommendations, including that the blood lead level of "concern" be lowered to 10 µg/dL and that virtually all children be screened for lead exposure and poisoning. It is notable that the American Academy of Pediatrics supported the CDC's policies, stating that "pediatric care providers should increase their efforts to screen children for lead exposure. Blood lead screening should be a part of routine health supervision for children" (1993, p. 181). These recommendations have proven to be somewhat controversial (Harvey, 1994).

Requiring screening. On the question of screening, some physicians have argued that selective rather than universal screening would be less costly. By carefully questioning patients, using a lead poisoning questionnaire developed by the CDC (1991) or similar questions, the physician can determine the extent of risk and the need for further blood testing.

Selective screening has been shown to be a cost-effective procedure in several studies (see

Harvey, 1994). However, a recent study found that only 12% of the 556 physicians surveyed were currently testing for the blood lead levels of their patients and that their knowledge of the effects of lead exposure and poisoning was limited (Bar-on & Boyle, 1994). Thus, how feasible it might be to institute selective screening on a broad scale is unclear.

Lowering the blood lead level of concern. The CDC's decision to lower the blood lead level of concern was based on several important research findings (CDC, personal correspondence, 1993). For example, two meta-analyses of relevant studies indicated that lead exposure, even at low levels, does affect the intelligence of children (Bellinger & Needleman, 1992; Needleman & Gastonis, 1990). Moreover, findings of long-term effects of lead poisoning in a group of 132 predominantly Caucasian children also influenced the CDC decision (Needleman, Schell, Bellinger, Leviton, & Allred, 1990). In this study adolescents who had been exposed to lead in early childhood were more likely to drop out of school, be absent more, have reading disabilities, have lower class standings, and have lower vocabulary and verbal reasoning scores, poorer hand-eye coordination, longer reaction times, and slower finger tapping.[2]

In 1986 the EPA estimated that with each raised level of blood lead there is an associated decline in IQ points: 1 to 2 points at levels of 15 to 30 µg/dL; 4 points at levels of 30 to 50 µg/dL; and 5 points at levels > 50 µg/dL. This loss of IQ points was seen as problematic by the CDC because of the potential for increased numbers of children in the severe deficit category and decreased numbers in the above-average category.

It should be noted that some researchers (see, for example, Ernhart, Landa, & Wolf, 1986) have claimed that the effects of lead on IQ are minimal. Ernhart has argued that when the confounding variable of parental IQ was controlled for, the apparent effects of lead on intelligence were reduced (Ernhart, Landa, & Schell,1981). Ernhart's work has been criticized by researchers in the field, however, for not controlling for another confounding variable, namely that some of her research subjects had alcoholic mothers; the effects of prenatal exposure to alcohol on cognitive functioning are well documented.

Other research supporting the CDC changes included findings on the effects of lead on hearing (Fox, 1992) and on physical stature and several biochemical indices (CDC, 1991). Finally, animal research also contributed to the CDC decision. For example, the CDC (personal correspondence, 1993) was concerned about findings from primate studies showing that low levels of lead interfered with cognitive and behavioral functioning.

Review of Research

Neurobehavioral Effects of Lead Poisoning

Animal Studies

Animal studies provide important evidence on lead exposure effects. The fact that the genetic make-up of research animals as well as their environments, unlike those of typical lead-poisoned children, can be more carefully controlled makes it easier to pinpoint whether deficits are the result of lead rather than some other source.

Mice and rats. Many studies of rats and mice have documented the effects of lead poisoning in several areas of development. In one study, for example, mice that were chronically exposed to lead were slower to open their eyes (thought to indicate delayed CNS development) and had reduced body weights throughout their lives (Donald, Cutler, & Moore, 1987). Interestingly, children who are prenatally exposed to lead have been found to have low birthweights or to be small for gestational age (Schwartz, 1992).

The male lead-exposed rats in this same study exhibited significantly shorter latencies to aggression than their nonexposed counterparts, and the lead-exposed rats overall demonstrated

an increase in exploratory behavior. Aggressive behavior in lead-exposed mice has been documented by other researchers as well (Engellenner, Burright, & Donovick, 1985; Holloway & Thor, 1986). Many human studies have found that lead increases activity level and aggressive behavior (e.g., Marlowe, Stellern, & Errera, 1982).

The effects of lead exposure on the cognitive functioning of rats and mice have also been well documented. These deficits have been found to be particularly apparent in learning paradigms. Deficits range from problems with the acquisition of brightness, spatial, auditory, and tactual stimulus control to differential patterns of responding to contingencies of reinforcement, which have been found to be sensitive indicators of neurological toxicity (for a critical review, see Cory-Slechta, 1984).

Monkeys. Findings reported in the primate literature have also helped clarify the effects of lead on behavior and development. One review states that "behavioral impairments have been observed in every group of primates tested with no evidence for a threshold " (Rice, 1992, p. 150). Deficits, with seemingly irreversible effects, have been found in monkeys with blood lead levels as low as 11 µg/dL. Included are attentional difficulties, learning problems, and decreased memory capacities.

Other researchers have documented behavioral and learning problems in primates similar to those observed in lead-exposed children. Lead exposure in monkeys has been found to result in decreased muscle tone, increased agitation, and reduced visual attentiveness (Levin, Schneider, Ferguson, Schantz, & Bowman, 1988).

Human Studies

Decrements in IQ. The effects of lead exposure and poisoning on intellectual functioning have received a great deal of attention, and, as already mentioned, evidence is mixed. Many studies have shown decreases in overall IQ scores as well as specific deficits in verbal and performance areas to be associated with lower ranges of lead exposure, but such deficits have been absent in some other studies.

In one study, for instance, of a clinical group consisting of children with lead levels > 15 µg/dL, and controls with levels < 15 µg/dL, children were administered the WISC-R and WRAT (Yule, Lansdown, Millar, & Urbanowicz, 1981). The clinical group showed deficits in the verbal section of the WISC-R but not on the performance scale. In addition, the clinical group had lower reading and spelling achievement scores.

A more recent study also found an inverse association between lead exposure and verbal IQ interacting with the child's age at exposure (Bellinger, Stiles, & Needleman, 1992). Elevated lead level at 24 months, only, was associated with lower IQ scores at age 10 years. In this study 249 children were tested for lead exposure and placed in one of three groups (low = < 3 µg/dL, below the 10th percentile; medium = 6.5 µg/dL, approximately the 50th percentile; and high = > 10 µg/dL, above the 90th percentile). Blood lead levels were measured at 6, 12, 18, 24, and 57 months. Cognitive assessments were conducted using the Bayley Scales of Infant Development at age 24 months and the WISC-R and K-TEA at age 10. Controlling for possible confounds, i.e., family social class, maternal education and IQ, life events, and blood lead history, analyses showed that children's blood lead level, at age 24 months, was significantly associated with children's verbal IQ at age 10 years. Performance IQ was unaffected at all assessment periods. Regarding the K-TEA scores, only blood lead level at 24 months of age were significantly associated with decreased scores, predominantly in the area of spelling and mathematics. The composite score at age 10 decreased 8.9 points for each increment of 10 µg/dL measured at 24 months.

It should be noted that Bellinger et al. (1992) did not carry out any blood lead measurements between 24 and 57 months of age. However, blood lead is known to rise steadily from 16 to 24 months and peak at approximately 24

months and then very slowly decline (Julian Chisolm, personal communication, July, 1994). Thus the 24-month blood lead levels were most probably representative of the peak lead level of the subjects.

In yet another study (Bellinger, Leviton, Waternaux, Needleman, & Rabinowitz, 1987) umbilical cord blood lead measures from 249 fetuses were used to assign subjects to three prenatal exposure groups: the low group < 3 µg/dL, the medium group 6–7 µg/dL, and the high group > 10 µg/dL. Postnatal lead exposure was determined by further blood lead measures. The child's postnatal development was first assessed at age 6 months and then semiannually, utilizing the Mental Development Index (MDI) of the Bayley Scales of Infant Development. Only infants in the high prenatal exposure group scored lower on the MDI during the first 2 years of life.

International studies. Studies conducted outside the U.S. have further substantiated the ill effects of lead on children's intellectual development, although not without some mixed results as to the specific pattern of deficits created by lead poisoning. In a study examining 494 infants born in South Australia (Baghurst et al.,1992), blood lead samples were drawn from umbilical cord at birth, and then lead level was further assessed at ages 6 and 15 months, at 2 years, and annually thereafter. Blood lead levels ranged from a mean lifetime average concentration of 7–11 µg/dL (low) to 18–28 µg/dL (high). The children were tested for intellectual abilities using the McCarthy at ages 2 and 4 years. At age 7, they were tested with the WISC-R. The IQ scores of lead-exposed children whose lead levels had risen from 10 to 30 µg/dL (across their lifetimes) were between 4.4 to 5.3 points lower than those of nonexposed children; and those who performed poorly at age 4 on the McCarthy did not improve their performance at age 7, suggesting that IQ decrements due to early lead exposure may persist.

A study of a group of British children ages 2 to 5 (Harvey, Hamlin, Kumar, & Delves, 1984) did not find a relationship between blood lead level and measures of intelligence. In this study the assessment included four cognitive tasks from the British Ability Scales, psychomotor tasks from the Stanford-Binet, and behavioral ratings based on observations made in testing. Blood lead levels ranged from 6 to 30 µg/dL. Maternal IQ was assessed with the Ravens Progressive Matrices and Mill Hill Vocabulary Scales. Health and marital information was also obtained from the parents. Although blood lead level and intelligence measures were found to be unrelated, it should be noted that nearly half the children (53 of 133) had incomplete data, making the findings inconclusive.

In Germany, an assessment of 1,879 school-aged children between 6 and 11 years of age with blood lead levels ranging from 5 to 60 µg/dL revealed blood lead level associated with some skills and not others (Winneke, Brockhaus, Ewers, Kramer, & Neuf, 1990). A neurobehavioral battery included assessments of IQ (WISC), visual motor integration skills (Bender-Gestalt and the Trail Making Test–TMT), reaction performance abilities (Delayed Reaction Time–DRT and Vienna Reaction Device–VRD), and general behavior (as rated by parents and teachers). No differences were found in general intellectual performance or in less standardized measures of neurobehavioral function such as behavioral ratings. Higher lead levels were related, however, to disrupted performance on the visual-motor integration and reaction performance tasks. These results replicated findings from an earlier study showing that lead-exposed children exhibited deficits in perceptual motor tasks (Winneke & Kramer, 1984).

Interestingly, another recent study found blood lead levels (in this case neonatal levels) to be associated with deficits in motor skills at age 6. Specifically, lead level related to visual-motor control, fine-motor skills, and upper-limb speed. The researchers point out that "motor developmental outcomes may be more sensitive indicators of lead's adverse effects on the central nervous system, as they are probably less con-

founded by social factors" (Dietrich, Berger, & Succop, 1993, p. 301).

In an investigation of the relationship between low lead exposure and children's learning disabilities and need for special education (Lyngbye, Hansen, Trillingsgaard, Beese, & Grandjean, 1990), 177 children, aged 6 to 7, were selected from a variety of public and private schools in Aarhus, Denmark. Dentine lead levels were used to divide the children into a high-lead group (> 18.7 µg/dL) and a comparison group (< 5 µg/dL). At the end of the second grade, children's intellectual performance was assessed using the WISC-R. Children in the high-lead group scored significantly lower on the verbal skills domain than did the comparison group. No performance effects were noted.

Overall these studies conducted in both the U. S. and abroad support the idea that intellectual performance varies with lead exposure. However, what specific areas of functioning are affected remains unclear. Is it verbal, performance, or both areas of functioning that are affected? The mixed results may be explained in part by a study conducted by Shaheen (1984) comparing 18 children aged 4 to 6 with histories of lead exposure to a nonexposed comparison group on a six-factor cognitive neuromotor battery that measured language/linguistic skills, visual-motor integration, rapid learning and attention, motor skills, spatial reasoning, and visual analysis. The clinical group was divided into subgroups representing early exposure to lead (before 24 months), middle exposure (24 to 36 months), and late exposure (after 36 months). The early exposure group's deficits were in the linguistic/language area, whereas the mid-exposure group exhibited poor performance on spatial tasks. The clinical late-exposure group showed no performance decrement relative to the comparison group and the other exposure groups on either spatial or linguistic tasks. These results suggest that early exposure to lead is associated with deficits in the verbal domain, while late exposure is associated with deficits in the performance domain. These findings may help explain the inconsistency of some other research.

Discrepant findings may also relate to socioeconomic factors. For example, the subject population of the Bellinger et al. study (1992), in which effects on functioning in the verbal realm were found, consisted of middle- and upper-middle class subjects. Dietrich et al.'s study (1993) was of low-income black children and found differences in the performance areas. As Dietrich et al. point out, these differences may well reflect that functioning in the performance domain is less susceptible to cultural effects than functioning in the verbal area.

Behavioral Effects

Hyperactivity. Perhaps the most compelling findings of lead research are repeated reports of behavioral problems linked to lead exposure and poisoning. Investigators have found that lead appears to be related to children's irritability, distractibility, lethargy, emotional underreactivity, disciplinary problems, hyperactivity, classroom overactivity, impulsivity, and decreased attentional skills.

For example, a recent study conducted in Scotland of 501 children documented a relationship between lead exposure and children's behavior (Thomson et al., 1989). Behavioral assessments of the children were provided by both teachers and parents, using the Rutter behavioral scales. Multiple regression analyses showed a significant relationship between measures of lead and teachers' ratings on the total Rutter behavior index, the aggressive/anti-social index, and the hyperactivity score. These results suggest an association between low-level lead exposure (mean blood lead level = 10.4 µg/dL) and antisocial behavior and hyperactivity in children.

In another study of school-aged children (Yule, Urbanowicz, Lansdown, & Millar, 1984), it was reported that teachers' ratings of the children's hyperactivity, impulsivity, time spent daydreaming, ease to frustration, and inattention all increased with higher lead levels. The 166 children, aged 6 to 12 years, were measured for

blood lead level. Lead levels were grouped into four categories ranging from low (7–11 µg/dL) to high (17–32 µg/dL). Teachers completed a behavior rating battery consisting of an 11-item questionnaire (Needleman et al., 1979); the 26-item Teacher Rating Scale B(2), which is widely used in Britain to screen general behavior and emotional difficulties; and the 40-item Conners measure, which is used in studies of hyperactivity. The questionnaire results showed an association between lead exposure and higher ratings of hyperactivity, overactivity, and ease to frustration. The Rutter ratings showed children in the upper 50% of lead levels exhibiting more squirmy behaviors, fighting, inertness, disobedience, and overactivity. On every subscale of the Conners scale, children with higher blood lead values were rated as more deviant, with scores statistically significant for hyperactivity, conduct problems, and inattention.

A further study found a significant relationship between blood lead level in children and an increase in frequency of hyperactive behavior ratings (Silva, Hughes, Williams, & Faed, 1988). This study, conducted in New Zealand, assessed a sample of 579 11-year-old children with mean blood lead level of 11 µg/dL, with range 4 to 50 µg/dL. The assessment was composed of the WISC, the Burt Word Reading Test, the Rutter Parent and Teacher Behavior Questionnaire, and teacher and parent reports. Correlations were found between children's lead level and ratings of hyperactive behavior and inattention.

Attention span. A 3-year follow-up study (Bellinger, Needleman, Hargrave, & Nichols, 1981) investigated the relationship between lead level and children's off-task behavior in the classroom. Using a random subsampling of children from an earlier study (Needleman, Davidson, Sewell, & Shapiro, 1974), researchers observed the classroom behavior of children divided into dentine lead-level groups, with low-lead < 10 µg/dL, mid-lead < 13 µg/dL, and high-lead > 20 µg/dL. The children were observed at quiet academic study for four 4-minute periods. At 7-second intervals, the children were scored by the examiners as either on- or off-task. Dentine lead level was found to be significantly related to distracted off-task behavior, i.e., looking at peers, looking at the observer, and looking away from work.

Another study followed 1,923 children from an advantaged white, middle- and upper-middle class population from birth to age 6 (Leviton et al., 1993). Parents completed a questionnaire and provided a sample of the child's shed teeth. The children's teachers completed a questionnaire assessing seven aspects of classroom behavior and academic performance across seven clusters: behavior, hyperactivity, reading, arithmetic, following directions, daydreaming, and completing tasks. The mean umbilical cord blood lead level for this population was 6.8 µg/dL, and the mean dentine lead level was 3.3 µg/dL. Girls with an elevated dentine lead level exhibited a higher level of dysfunction in interactions with peers and completing tasks. Males with elevated lead levels suffered from an inability to attend to and follow directions.

Abuse. Lead-exposed children with behavioral problems may be more difficult to teach and also more difficult to parent. In fact, a recent study found that children suspected of being physically abused had significantly higher blood lead levels (27 times higher) than a comparison group matched for race, sex, income, and housing status (Bithoney, Vandeven, & Ryan, 1993).

Methodological Issues

Role of Environmental Factors in the Development of Lead-Exposed Children

While lead poisoning does appear to affect children's behavior, as well as their learning, the contribution of negative environmental factors cannot be discounted. Several studies have pointed to differential effects of lead exposure related to socioeconomic status. For example, in a study in Germany (Winneke & Kramer, 1984)

only lower-class children who had been exposed to lead showed difficulties with reaction time and visual-motor integration tasks. In their study of British children Harvey et al. (1984) found IQ to be inversely related to blood lead level only in a group of children whose parents were manual workers; no relationship was found for the comparison group whose parents were nonmanual workers. Yet another study (Dietrich, Krafft, Bornschein, Hammond, & Hoffman, 1987) found differences in performance on the Bayley to be related to SES. Thus, there appears to be an interaction between lead exposure and SES, with children of lower SES status being more vulnerable to effects.

Other factors associated with low SES may put these children at greater risk for deficits due to lead exposure. Families in poverty may be less able to maintain stable homes for their children and less able to provide opportunities for their intellectual development. Also, low-income parents are likely to have greater difficulty in providing for their children's medical and nutritional needs.

Poor nutrition is a serious issue, particularly in the case of lead exposure and poisoning. Foods high in fat are problematic because they tend to increase lead absorption in humans, whereas foods high in calcium and iron help the body absorb less lead (Pennsylvania Department of Health, 1991). To reduce the risk of lead poisoning, children should consume fresh fruits and vegetables, dairy products, and lean meats, all of which are difficult to provide on a tight budget.

Methods of Determining Lead Levels

There are several methods for monitoring the amount of lead in the body: these include measuring the lead levels in blood, teeth, urine, hair, and bone. Each offers advantages and disadvantages that must be carefully weighed in evaluating research findings.

Blood. Probably the most commonly used method of monitoring the presence of lead in the body involves testing for lead in the blood. To obtain samples of blood lead, two methods are used: the capillary sample and the venous puncture. The capillary sample is obtained from a heel stick, typically used with children under age 1, and a finger stick for older children. The advantage of capillary samples is that this method is a quick, expedient, and simple procedure for trained medical personnel. Capillary samples are easily contaminated, however, because lead can lodge in the grooves of the fingerprint and elevate the amount of lead detected in the sample (CDC, 1991). To minimize these drawbacks, the CDC has prescribed guidelines for obtaining capillary specimens. And in response to the problems with capillary sampling, the CDC recommends that the "venous blood is the preferred specimen for analysis and should be used for lead measurement whenever practical" (CDC, 1991, p. 45). Current procedure commonly involves testing initially using a finger stick, and then performing confirmatory venous puncture if an elevated lead level is found.

Blood lead level is often a short-term reflection of recent changes in exposure to lead (Mushak, 1992). If a child consumes a large quantity of lead, for example, his or her level rises quickly over a period of several hours, and a very high blood lead measure can be obtained if testing is done during this time.

While low-level lead exposure in adults is thought to be reflected in a stable blood lead level, this is not the case for developing children (Rabinowitz, Leviton, & Needleman, 1984). Particularly in infants and young children up to age 2, blood lead levels may be extremely labile due to developmental changes as well as shifts in environmental lead. Blood lead levels in children may change by as much as 5 µg/dL in a week (Ernhart, 1992). For this reason serial, rather than single, blood measurements are the most informative.

These instabilities in children's blood lead level create an obvious research problem, calling for study designs that control for dramatic shifts in blood lead levels in young children. One common method is to obtain several samples and

average them into a "mean lifetime lead exposure."

Teeth. Some researchers have chosen to avoid the problems of blood lead altogether in favor of measuring lead in teeth, generally in shed deciduous, or "baby," teeth. The amount of lead in these teeth reflects exposure across the entire time the tooth is in the mouth. In that researchers can simply request that parents save the teeth their children lose, this method has proven to be extremely efficient. Its main drawback is that the amount of lead in teeth varies depending on position (e.g., eye tooth versus molar) and the amount of decay (Mushak, 1992). Bellinger et al. (1992) also note that dentine levels may not prove to be good markers of lead when the research questions pertain to very low levels of lead.

Urine and hair. Research designs have utilized measures of lead in urine as well as in hair. Both have proved unreliable and disappointing; assessments vary greatly within individual and between individuals (Mushak, 1992).

Bone. A fourth method, which is strictly a research procedure at this point, involves examining lead in the bone. Because lead is ultimately deposited in bone, this method may provide a more accurate picture than the others. Interestingly, the XRF (a special type of low-energy X-ray) measurement of lead in the tibular bone of children has been found to provide an accurate measure of lead (Rosen et al., cited in Mushak, 1992), but the routine use of this method is unfortunately too costly at this point.

In sum, there appear to be pluses and minuses to each type of sampling. At this point, it appears that serial blood lead measurements are probably one of the best options. Research that uses some of the more controversial methods should be interpreted with caution.

Directions for Future Research

While the effects of lead exposure and poisoning have been extensively studied, questions remain. One has to do with the effects of low-level lead exposure (i.e., 10 to 15 µg/dL) on development. While some of the studies discussed showed delicits at lower levels, additional data are sorely needed. More studies are needed to specify the impact of low-level exposure on cognitive functioning and neurodevelopment. Studies must also isolate the effects of lead from the effects of other factors in the environment, such as poverty, lack of environmental stimulation in the home, and family history of learning problems.

Another important issue is raised by Shaheen's study (1984). As discussed previously, this study found differential effects of lead related to the age at which the child was exposed. While these findings are very exciting, it should be noted that this study utilized a very small sample, and lacked a non–lead-poisoned group for comparison. A large scale replication of the Shaheen design could prove very informative.

One way to address some of these questions may be through animal studies, which utilize methodologies that are freer of "cultural bias" than studies of humans. For example, lead exposure in monkeys has been found to result in reduced visual attentiveness (Levin et al., 1988). Habituation paradigms like those used in this study have been used in studies of children, with interesting results. For example, Ross, Tesman, Auld, and Nass (1992) found that premature infants with mild intraventricular hemorrhage differed from those without hemorrhage on a visual attention task. Assessing the performance of lead-exposed children, using a similar habituation paradigm, could be informative.

While the effects of lead exposure on attention behavior are well documented at this point, children may be experiencing other types of behavior problems yet to be identified. In our laboratory we are currently exploring this issue through a study of 45 children (ages 7 to 10) who

have been treated and or followed by the Polyclinic Medical Center's Childhood Lead Poisoning Prevention Program. Preliminary analyses of data obtained through the Achenbach Child Behavior Checklist, completed by teachers, indicate that the problems exhibited by lead-exposed children are wide ranging (Tesman, Morrow, & Varma, 1994). For example, male children were found to exhibit attentional problems and delinquent behaviors, which is consistent with other research (Wicks-Nelson & Israel, 1991), but surprisingly they were also above the mean in the withdrawn, somatic complaint, and anxious/depressed categories. A significant portion of the boys were also unexpectedly classified as internalizing (i.e., fearful, inhibited, and overcontrolled).

Another surprise came from the female subjects. Although girls are typically less prone to behavior problems, teacher ratings of the female subjects in our study showed a wide range of difficulties, including attention and aggressive behavior problems and behaviors categorized as withdrawn. The girls were often found to fall in the externalizing category (i.e., aggressive, antisocial, and undercontrolled). These preliminary data suggest that lead-exposed children, of both genders, are at risk for a range of behavioral problems—problems that may have lifelong implications.

Policy

Whatever deficits are documented, or yet to be documented, the troubling fact remains that lead exposure continues to be an entirely preventable problem. Children who never come in contact with lead are free from exposure; if exposure is minimized so will their risk be. Unfortunately, the removal of lead from children's environments has proven to be a more expensive, complicated, and time-consuming process than once thought.

Abatement

Congress and government agencies are not unaware of the need to address the lead hazard and the issue of its removal. In 1988 the Agency for Toxic Substance and Diseases Registry estimated that 42 to 47 million houses in the U.S. contained lead paint (cited in Lin-Fu, 1992). According to the 1991 CDC guidelines, "eradicating childhood lead poisoning requires a long-term active program of primary lead-poisoning prevention, including abatement of paint hazards in homes, day-care centers, and other places where young children play and live" (1991, p. 65).

In 1990 the U.S. Department of Housing and Urban Development (HUD) published a comprehensive guide to abatement titled *Lead-based Paint Interim Guidelines for Hazard Identification in Public and Indian Housing*. These guidelines outline proper abatement procedures, complete with time frames for investigations and interventions; emergency and long-term measures for abatement; descriptions of the three categories of abatement and the procedures to follow with each; and specific standards for the amount of allowable lead following abatement procedures.

Three different abatement procedures can be followed in removing lead paint from buildings: replacement, encapsulation, or paint removal. Replacement involves totally removing a lead paint-covered part of a building, such as a window, and replacing it with a new part. While this method is very efficient, it can be costly; it is also impractical for certain parts of buildings, such as the walls.

Encapsulation is the process whereby lead-painted surfaces are covered with a material that prevents any access to lead paint or lead dust. Unfortunately methods of encapsulating have been difficult to locate and develop. Ordinary paint does not lend itself to encapsulation, nor does any other material that peels or flakes over time—as does paint.

Paint removal is perhaps the most dangerous process, because these procedures create large amounts of lead residue, usually in the form of lead dust. HUD has suggested that machine sanding, chemical stripping, and removal of paint with a heating device are hazardous to both workers and building occupants. Because of the risks, lead abatement done improperly can create even more trouble than leaving the lead paint intact. Obviously the need for skilled workers in the case of removal is crucial.

Abatement must continue to be a central goal. Even though it is costly, fully abated housing will allow *generations of children* to grow up protected from lead poisoning. Abatement is not a simple task, however. Each procedure has its disadvantages, and ultimate effectiveness is in question. Even after abatement is completed, further testing is needed to determine if lead remains—once again requiring skilled workers, expensive equipment, and laboratory facilities. Finally, recent monitoring of some instances of abatement has revealed that even when abatement is carried out following current guidelines, the goal of lowered blood lead levels sometimes remains elusive (e.g., Lin-Fu, 1992; Weitzman et al., 1993).

Parent Education

One promising approach to reducing children's blood lead levels without relying on abatement was reported in a study of 490 children, aged 6 to 71 months, who lived in the vicinity of a defunct lead smelter in homes built before the 1920s (Kimbrough, LeVois, & Webb, 1994). A program of parent education was found to be effective in lowering blood lead levels.

The parents in this study underwent extensive training in how to cope with the environmental presence of lead. They were instructed to wash their children's hands before meals and before bed, to keep their fingernails clipped short, and to provide a well-balanced diet. Parents were shown housekeeping techniques, including how to carefully remove chipping and peeling paint and how to put up barriers to keep children away from heavily leaded areas. Parents were also instructed to seek expert guidance before conducting any renovations.

The result of this intensive program was dramatic. The children's mean blood lead level decreased over a 4-month period from 15 µg/dL to 7.8 µg/dL; and a follow-up 1 year later found that blood lead levels continued to be low (mean = 9 µg/dL). Interestingly, the Illinois Department of Public Health has had similar success with a counseling intervention (Kimbrough et al., 1994).

While these results are promising, it should be noted that the subjects in this study were a motivated group of parents with children with elevated blood levels. The families had limited access to health care and lead abatement resources and were "at a loss as to what to do." Also, the counseling provided was intensive, consisting of several 30- to 45-minute sessions conducted with the whole family (Kimbrough et al., 1994). Further research with matched controls who do not receive counseling is needed.

Current Legislative Action

It is obvious that the most important step to preventing lead poisoning is abatement. On October 28, 1992, Congress passed the Residential Lead-based Hazard Reduction Act of 1992 (P.L. 102–550). Probably the most comprehensive legislation on lead to be passed in the last two decades, this Act stands to have far-reaching implications. Among the many provisions, the EPA is required to set up regulations and to establish centers to train professionals in the handling and removal of lead-based paint. The sale of homes is also regulated, such that sellers have to notify prospective home buyers regarding the presence of lead paint, and prospective buyers will have the option of conducting their own inspections.

HUD abatement demonstration grants have been awarded to several cities, with initial funding of $150 million provided by the House Ap-

propriations Committee. The committee has also appropriated $37 million for the CDC's lead poisoning prevention grants.

The need for monies for abatement is pressing. In March 1993 the Health Subcommittee of the House Ways and Means Committee approved a health care reform bill (H.R. 2479) that includes elements of the Lead Abatement Trust Fund legislation. It remains to be seen if this bill will pass through both houses of Congress. The proposed funding source for this bill is a tax on the lead industry. The lead industry is arguing that taxing lead will cost jobs.

On May 25, 1994, the Senate passed the Lead Exposure Reduction Act of 1994 (S. 729) sponsored by senators Reid and Lieberman. The bill includes provisions for (1) establishing limits for particular products that contain unsafe amounts of lead; (2) setting up programs to reduce and restrict lead in several items, e.g., plumbing fixtures, ink, curtain rods, etc.; (3) requiring the EPA to maintain an inventory of all uses of lead sold and distributed commercially, and to devise labeling procedures for new and already marketed products; (4) providing mandatory recycling of batteries and a method to link retailers and smelters; (5) setting up a federal program to fund inspections for lead paint at schools and day-care centers built prior to 1980; and finally (6) establishing a National Center for the Prevention of Lead Poisoning (*Congressional Record*, 1994a, 1994b). It should be noted that a companion bill is yet to be introduced in the House.

Conclusions

The effects of lead poisoning and exposure on the development of children have been documented for almost 100 years and certainly suspected centuries before that. Lead poisoning, especially at higher levels, causes serious, perhaps irreversible deficits in biological functioning, cognition, and behavior, as supported by numerous studies.

The specific effects of lower levels of lead on children's development are somewhat less clear-cut. However, the data also seem to support that even low-level lead exposure causes cognitive and behavioral deficits. Apparently no level of lead in the body may be viewed as safe. But the need for further research is pressing. In particular, we must promote the use of good research design; animal models may continue to be helpful here.

Finally, the most urgent question is how to deal with the millions of homes and buildings in the U.S. that are contaminated by lead. In that current abatement procedures are both time-consuming and costly, and of questionable effectiveness, there is not going to be an easy solution to this problem. Other promising new avenues need further exploration.

[1]It should be noted that it is possible that some effects of lead may be reversible. A recent study (Ruff, Bijur, Markowitz, Ma, & Rosen, 1994) demonstrated that lowering the lead level of lead-poisoned children resulted in a modest improvment in cognitive functioning. One must question, however, how much of the IQ gains in this study were due to practice effects.

[2]The results of this study and other research conducted in the Needleman lab have been repeatedly questioned by Ernhart and Scarr. For a summary of this controversy, see Palca, 1991. In March 1994 the Office of Research Integrity, serving DHHS, cleared Needleman of any misconduct and ruled that although the research contained numerous errors and misstatements, these "did not necessarily alter the conclusion [of the Needleman 1979 article]" (Hilts, 1994, p. A22).

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Announcements

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Resiliency Research: Implications for Schools and Policy

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John and Paul were friends who grew up in the same run-down housing project in a large industrial city. Their neighborhood was plagued by drugs and violence. By the time the boys were 10 years old and each had experienced several years of family conflict, their respective parents divorced. Each was subsequently raised, along with an older sibling and two younger siblings, by a single mother. Their fathers played only a minor role in their lives after the divorce. They were below average students in school and got into some trouble with the police as they were growing up. Both older siblings dropped out of school and spent time in prison. John finished high school and received two years of training in a local trade school. He is now 30 years old, works at a local factory, and lives with his wife and two children. John is happy, healthy, and well adapted to his life in a nice neighborhood in the city. He hopes to help send his children to college so they might have opportunities in life he never had. Paul never graduated from high school. He has been in and out of prison over the last several years, is currently unemployed, and drinks alcohol excessively on a regular basis. He has two children he rarely sees, and he was never married to either mother. Paul has lived in several locations over the years, mostly in his old, unchanged neighborhood.

These brief biographies illustrate two very different developmental paths that began at the same place. Risk research would have predicted Paul's outcomes, and John would have simply been part of the unexplained variance in researchers' statistical analyses. Researchers know much about why people end up with detrimental and undesirable outcomes. Poverty begets poverty. Hopelessness breeds futility. Risks lead to problems. Unfortunately, we know much less about why some people, in the face of adversity and against the odds, develop into well-functioning and relatively healthy adults. This is John's story. People like him survive risky environments with their self-confidence, their coping skills, and their risk-avoidance behavior relatively intact. They have been able to fight off or recover from their misfortune. They have been *resilient*.

Over the last two decades the concept of resiliency has received increasing attention in

developmental psychology (Cicchetti & Garmezy, 1993). It has helped frame the study of development using a strengths model rather than a deficit and problem-oriented approach. Rutter (1987) and Garmezy (1991) have pointed out that more than half the children living in disadvantaged conditions do not repeat that pattern in their adult lives. Researchers, however, have typically emphasized the pathology of disadvantage by cataloguing risk factors and documenting their adverse effects on healthy adolescent development (Dryfoos, 1990; Hawkins, Catalano, & Miller, 1992; Newcomb & Felix-Ortiz, 1992). They have studied risk factors for psychopathology, alcohol and drug abuse, and delinquency. Problem behavior theory (Jessor & Jessor, 1977), stage theory of adolescent drug use (Kandel, 1975), and social influence models (Barnes & Welte, 1986; Dishion & Loeber, 1985; Huba & Bentler, 1980; Needle et al., 1986) have all focused on risk factors associated with negative outcomes for adolescents. This approach has led, in turn, to an interest in identifying vulnerable children.

Vulnerability refers to the individual's predisposition to develop varied forms of psychopathology or behavioral ineffectiveness. It reflects the susceptibility to negative developmental outcomes that can occur under high-risk conditions (Pelligrini, 1990; Werner, 1993). Rutter (1985) suggests that genetic make-up and temperament contribute to a child's susceptibility in high-risk environmental conditions. Vulnerability brings about a modification in the person's response to the risk situation such that the probability of a maladaptive response is heightened. In contrast, *resiliency* refers to fending off maladaptive responses to risk and their potential negative consequences. How is it that many children who face multiple risk conditions come through relatively intact? This is the underlying question posed by resiliency research.

Although an increasing number of researchers have begun to study resiliency, the research literature lacks a consistent vocabulary, conceptual framework, and methodological approach. It has also largely focused on variables associated with individual-level characteristics and has virtually ignored the role of community and social institutions (e.g., schools) in promoting or hindering resiliency. The literature includes a wide array of terms, research designs, analytic models, and content areas that fall under the rubric of resiliency (Stouthamer-Loeber et al., 1993). The purpose of this paper is (1) to integrate and differentiate this literature; (2) to identify conceptual and methodological issues that may help guide future research; (3) to illustrate how one institution, our schools, may promote resiliency; and (4) to offer policy suggestions for funding agencies, legislative bodies, and administrative audiences.

Background

Early Work on Resilience

The pioneering work of Garmezy, Rutter, and Werner has launched the study of resilience (Garmezy, 1991, 1993; Rutter, 1985, 1987; Rutter, Maughan, Mortimore, & Ouston, 1979; Werner, 1993; Werner & Smith, 1977, 1989, 1992). Garmezy and his colleagues undertook Project Competence in order to understand resiliency (Garmezy, Masten, & Tellegen, 1984). For more than ten years the focus of this project was on the cumulative effects of life stressors on various aspects of competence manifested in elementary school children. Approximately 200 children and their families participated in this study. Stress exposure was measured by a life events questionnaire. Competence was assessed by teacher ratings, peer assessments, and school record data. Parents were interviewed for 6 hours about their family interactions and their perspective about their child. Disadvantaged children, with lower IQ and socioeconomic status (SES) and less positive family qualities, were generally less competent and more likely to be disruptive. Yet, Garmezy and his colleagues found that some of the disadvantaged children were competent

and did not display behavior problems. This led them to raise the question about how some children come to beat the odds (Garmezy et al., 1984).

Rutter et al.'s early work (1979) involved investigations of the children of people diagnosed as mentally ill on the Isle of Wight and in inner-city London. He followed 125 of these children over a 10-year period. He found in this intensive interview study that offspring of mentally ill patients escaped relatively unscathed. They did not become mentally ill themselves or exhibit maladaptive behavior. He reasoned that if so many children did not succumb to deprivation, it was important to determine why this was so and to identify what protected them from the hazards they faced. Rutter (1987) began to look upon resilience as the manifestation of individual variations in response to a risk factor. He suggested that resiliency arises out of a belief in one's own self-efficacy, the ability to deal with change, and a repertoire of social problem-solving skills (Rutter, 1985).

Werner and her colleagues conducted a longitudinal study of a cohort of children born in 1955 in Kauai (Werner, 1993; Werner & Smith, 1977). Their study extended over three decades. One third of this cohort (n = 201) was designated as high-risk because they were born into poverty and lived in a family environment troubled by a number of factors such as biological and prenatal stress, family instability and discord, parental psychopathology, or other poor child-rearing conditions. One third of these high-risk children (n = 72) grew up as competent, confident, and caring adults. When these children were contrasted with those at risk who did develop serious problems, a number of differences were found. As babies the resilient children in this high-risk group were active and affectionate. In elementary school they had a number of interests other than academics. They had a positive self-concept and felt they had personal control over their lives. They were more nurturant, responsible, achievement-oriented, and autonomous. Most of the resilient boys and girls had grown up in families with 4 or fewer children. All of the children at risk who eventually developed into healthy adults had the opportunity when they were infants to establish a close bond with at least one caregiver from whom they received abundant positive attention. Resilient boys and girls also sought and found emotional support outside their own family. Thus, in spite of exposure to chronic stress, a core group of this cohort emerged in late adolescence as competent and able persons, capable of handling the problems that befell them.

Werner and Smith (1992) also found some interesting gender differences in a follow-up study when their sample was 31-32 years old. They found scholastic competence at age 10 was, for example, more strongly associated with successful transition into adult responsibilities for men than for women. On the other hand, factors such as high self-esteem, efficacy, sense of personal control at age 18 were more predictive of successful adult adaptation among the women than men. Similarly, the effects of different stressors in the youths' lives influenced their development into adulthood. Werner and Smith (1992) found that males were more vulnerable to separation from or loss of caregivers in the first decade of life (early to middle childhood) than girls, but in the second decade (adolescence) girls were more vulnerable to chronic family discord and disturbed interpersonal relationships than boys. They also found that more positive changes occurred among the women who had mental health problems as adolescents than among the men. These results provide compelling evidence that although many factors may help at-risk children overall to be resilient in the face of adversity, the resiliency process may differ for men and women.

Recent Work

Terms such as *invincibility* and *invulnerability* have come to be used synonymously with resiliency (Cowen & Work, 1988). Cowen and Work (1988) refer to invincibility as "unusual

resilience stemming from sources not yet fully understood" (p. 593). According to this view, invulnerable children are untouched by the stresses they face. Few children, however, exhibit such complete immunity to disorder in the presence of risk factors. Neither vulnerability nor invulnerability is an all-or-none phenomenon. The term invulnerability has largely been replaced by *resilience* (Werner & Smith, 1992). Resilience is preferred because it refers to the capacity of these children and adolescents to face stress without being debilitated; it does not mean they never experience distress.

Luthar and her colleagues (Luthar, Doernberger, & Zigler, 1993; Luthar & Zigler, 1991) have indicated that some of the children in their longitudinal study who managed to avoid negative behavioral outcomes in the face of risks that typically predict adolescent problems (e.g., drug use, delinquency) nevertheless reported feelings of anxiety. The resilient youth in their sample of 138 ninth-graders reacted to the stressful experience in an internalizing, rather than acting-out, fashion (e.g., aggressive behavior). They suggest that such youth may be incorrectly identified as resilient or invincible simply because their maladaptive responses have not become overt behavioral problems. Luthar and Zigler (1991) reported further that highly stressed children who showed impressive behavioral competence were highly vulnerable to emotional distress over time, and also that those who appeared to be resilient in one domain of social competence may have difficulties in other domains.

This research suggests that resiliency is not a universal construct that applies to all life domains. Rather, research on resiliency can only identify those particular risk circumstances when environmental conditions, individual factors, and developmental tasks interact to help children and adolescents avoid negative consequences (Rutter, 1987). They may be resilient to specific risk conditions but quite vulnerable to others.

Refining the Definition of Resiliency

The development of the resiliency concept has resulted in multiple meanings, ambiguous terminology, and what may appear to be inconsistencies. At the least, it is a multidimensional phenomenon that is context-specific and involves developmental change.

The term "resiliency" generally refers to those factors and processes that interrupt the trajectory from risk to problem behaviors or psychopathology and thereby result in adaptive outcomes even in the presence of adversity. Garmezy and Masten (1991) define resilience as "a process of, or capacity for, or the outcome of successful adaptation despite challenging and threatening circumstances" (p. 459). Werner (1993) uses the concept of resiliency to refer to those children who successfully cope with biological and social risk factors.

Resiliency and invulnerability are not equivalent. Resilience refers to the ability to spring back from adversity (Garmezy, 1993); it does not mean that one cannot be wounded—as the term invulnerability implies. Rutter (1985) suggests, moreover, that resistance to stress is (1) relative and not absolute, (2) the result of environmental as well as individual factors, (3) not a fixed quantity, and (4) dependent on context (e.g., psychopathology, substance use, school dropout). Thus, the relative concept of resilience is preferable to the absolute concept of invulnerability.

In addition, resiliency is not a monolithic construct that, once achieved, will always be present. It cannot be seen as a fixed attribute of the individual, because the circumstances in which it may occur are dynamic. When the situation changes, so may one's resiliency. Rutter stresses the individual's active role in the resiliency process. He suggests that resilience is not just a matter of constitutional strength or weakness, but that it includes taking action to address a stressful situation (Rutter, 1985, 1987). Kaplan (1994) further points out that resiliency may not be well defined because researchers often inter-

mingle resiliency and outcome. Resiliency, he argues, may be the functional equivalent of outcomes or the cause of outcomes.

Staudinger, Marsiske, and Baltes (1993) point out that the term resiliency has been used to refer both to the maintenance of healthy development despite the presence of threat and to the recovery from trauma. Poverty, on the one hand, can be looked on as a source of constant threat that increases the vulnerability of children. Being poor and thus vulnerable may lead to social deprivation, malnutrition, or an educational disadvantage, but not all children succumb to these risks. Many will maintain healthy development. The loss of one's parent through death or divorce, on the other hand, is not a chronic circumstance but a traumatic event. Some youth will, after an initial setback, recover from this stress, while others will remain discontented and troubled.

While a single definition may not adequately capture the complex meaning of resilience, varied definitions pose a problem for research and policy. Most definitions of resiliency nevertheless do encompass individual characteristics, the nature of the context, the risk factors, and the counteracting, protective, and compensatory factors of interest.

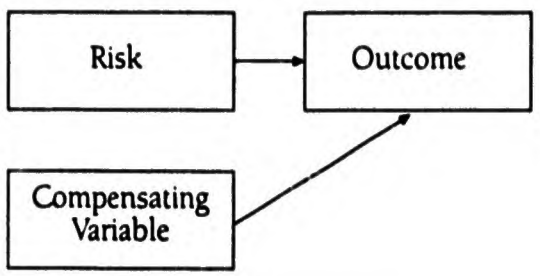
Models of Resiliency

Researchers have described several mechanisms by which environmental and individual factors help to reduce or offset the adverse effects of risk factors. While different researchers have sometimes suggested different models, many have also given the same mechanism different names. Garmezy et al. (1984) have proposed three models to describe the impact of stress and personal attributes on the quality of adaptation: (1) the compensatory model, (2) the challenge model, and (3) the protective factor, or immunity-versus-vulnerability, model. Rutter (1985) describes a model where the protective factors manifest their effect by virtue of their interaction with a risk factor to predict negative outcomes (e.g., psychopathology, drug use, delinquency). He also suggests "inoculation," or "steeling," as another model of resiliency. Each of these models is briefly described below.

Compensatory Model

A compensatory factor is a variable that neutralizes exposure to risk (Garmezy et al., 1984; Masten et al., 1988). It does not interact with a risk factor; rather it has a direct and independent influence on the outcome of interest (Figure 1). Both the risk and compensatory factors contribute additively in the prediction of the outcome (Masten, Garmezy, Tellegen, & Pelligrini, 1988). In this model, for example, stress (risk factor) and self-esteem (compensatory factor) are seen to combine additively in the prediction of competence (outcome). Thus, when one of the independent variables, stress or self-esteem, is held constant, competence changes with changing levels of the other independent variable. Higher levels of self-esteem compensate for higher levels of stress exposure; thus, children with high self-esteem maintain a level of competence comparable to other children who have less self-esteem but also less stress exposure (Masten et al., 1988). The direct effect of a compensating variable would predict less

Figure 1. Compensatory Model



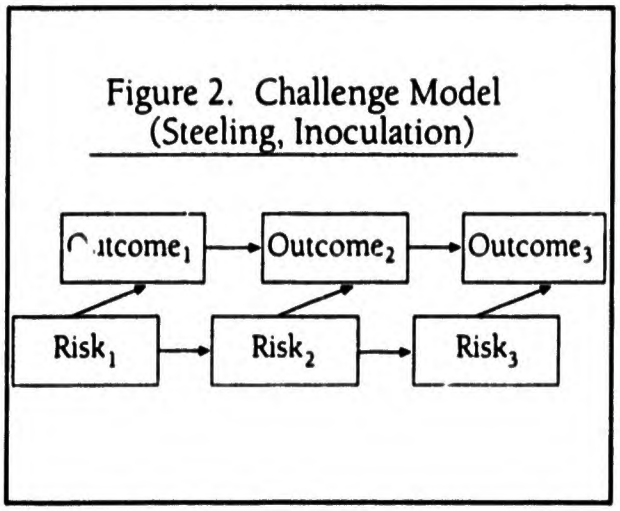
psychopathology, drug use, or delinquency. The analysis for this model involves examining the direct linear effects of the compensatory and risk factors in a linear regression.

As an example of compensation, one could examine parental interest (compensatory factor) and parental conflict (risk factor) as predictors of academic competence (outcome). Children may display academic competence at high stress levels (i.e., family conflict) because parental interests in their child's education offset the effects of conflict between the parents. These children may receive vital parental help facilitating success despite the conflict between parents.

Challenge Model

The challenge model of resiliency is one in which a stressor (i.e., risk factor) is treated as a potential enhancer of successful adaptation, provided that it is not excessive. In this model, too little stress is not challenging enough, and very high levels render the individual helpless, which may result in maladaptive behavior. Moderate levels of stress, however, provide the individual with a challenge that, when overcome, strengthens competence. If challenge is successfully met, this helps prepare the individual for the next difficulty (Figure 2). Rutter (1987) has called this process "steeling" or "inoculation." If efforts to meet the challenge are not met successfully, the individual may become increasingly vulnerable to risk. Thus, an optimal level of stress is one in which adaptation is strengthened as the person meets a given challenge. This model requires longitudinal data and would be assessed analytically using path or structural equation modeling (e.g., LISREL).

Figure 2. Challenge Model (Steeling, Inoculation)



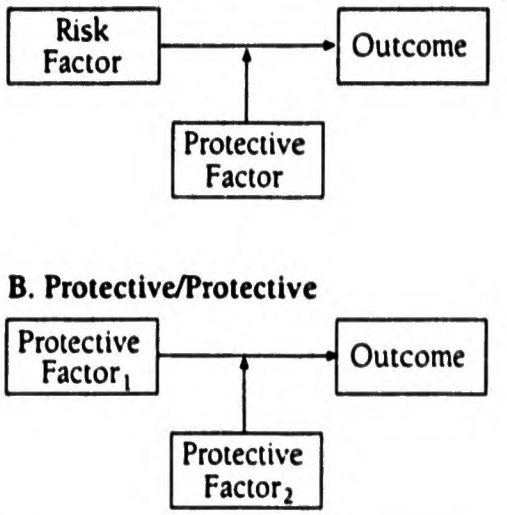
Protective Factor Model

A protective factor is a process that interacts with a risk factor in reducing the probability of a negative outcome. It works by moderating the effect of exposure to risk, and acts as a catalyst by modifying the response to a risk factor (Brook, Nomura, & Cohen, 1989; Cowen & Work, 1988; Garmezy et al., 1984; Pelligrini, 1990; Werner & Smith, 1989). A protective factor may have a direct effect on an outcome, but its effect is stronger in the presence of a stressor. Rutter (1987) describes a protective mechanism as an interactive process which helps to identify "multiplicative interactions or synergistic effects in which one variable potentiates the effect of another" (p. 601). Garmezy et al. (1984) refer to the protective factor model as an immunity-versus-vulnerability model. This model appears to be the most widely studied of resiliency models.

Brook, Brook, Gordon, and Whiteman (1990) propose two mechanisms for how protective effects may function: *risk/protective* or *protective/protective*. A risk/protective variable functions to mitigate the negative effects of a risk factor (Figure 3A). A protective/protective mechanism works by enhancing the protective effects of variables found to decrease the probability of negative outcomes (Figure 3B).

Risk/protective mechanism. Werner and Smith (1992) suggest that the interaction of risk and protective factors establish a balance between the individual's power and the power of his or her physical and social environment. Brook, Nomura, and Cohen (1989) found that assertiveness and high self-esteem protected adolescent girls from the negative influence of parental conflict (risk factor) on their depressive

Figure 3. Protective Factor Model



moods. Stacy, Newcomb, and Bentler (1992) found that liberalism (protective factor) significantly reduced the predictive effect of peer substance use (risk factor) on self-use.

Dubow and Luster (1990) studied 721 children, aged 8 to 15, and their mothers from the mother-child data set of the National Longitudinal Survey of Youth. They found that risk factors such as poverty status and mother's self-esteem affected the child's academic and behavioral adjustment. Protective factors such as intelligence and supportive home environment enhanced the prediction of adjustment beyond the contribution of risk factors alone. They also found that the presence of these protective factors reduced the child's vulnerability to academic and behavioral difficulties.

Brook, Nomura, and Cohen (1989) studied the interrelationship of neighborhood, school, peer, and family factors on adolescent drug use. A harmonious and organized school environment interacted with peer substance use (i.e., alcohol, cigarettes, and marijuana) to decrease the adolescent's use of all three substances.

Protective/protective mechanism. Zimmerman, Ramirez, Washienko, Walter, and Dyer (1994) found in a sample of 121 Native American youth that cultural identity enhanced the effects of self-esteem as a predictor of alcohol and substance use. Whereas cultural identity by itself had no independent effect on use, self-esteem predicted less alcohol and substance use for those youth who reported average or higher levels of cultural identity. Youth with the highest levels of self-esteem and cultural identity reported the lowest levels of alcohol and substance use.

Brook, Whiteman, Gordon, and Cohen (1989) found that low levels of early drug use in combination with conventional values resulted in the lowest probability of increased substance use. Brook, Whiteman, Gordon, and Cohen (1986) also describe an example of a protective/protective mechanism for predicting depressive moods among female college students. They found that time spent with father heightened the effects of the respondent's responsibility, assertiveness, and parental identification in predicting low levels of depression.

Both risk/protective and protective/protective factors may be evaluated by exploring the moderating relationships among predictors and outcome. The protective factor influences the relationship between either the risk or other protective factor and the outcome in an *interactive* fashion. The two factors combine effects to either offset or enhance each other. Baron and Kenny (1986) suggest that a moderating variable specifies when certain relationships will hold under different conditions of a third varialbe (i.e., the moderator). Newcomb and Feliz-Ortiz (1992) offer as illustration the finding that an adolescent's susceptibility to social influences (moderator) can interact with social influences to affect drug use. Peer drug use (risk factor), for example, may have a direct effect on the adolescent's drug abuse (outcome), but a strong social group sanction against drug use (moderator) may interact with the risk factor (peer drug use) to moderate the relationship between adolescent drug use and peer use.

The protective model of resiliency is different from the compensation and challenge models in that it operates indirectly to influence outcomes. Compensatory models examine the additive and direct effects of factors. Challenge models involve enhanced resilience through repeated exposure to stress regardless of the influence of any other factors. It is vital to point out, however, that the three models of resilience presented are not mutually exclusive. Thus, positive factors in youths' lives may act to compensate for some risks while also interacting with others to reduce negative outcomes. And some risk factors that ordinarily might be thought detrimental may provide a manageable level of stress so that future exposure to risk is less debilitating; the stress, in effect, becomes a resource to further strengthen the youth's capacity to deal with ever more intense stress.

Take John and Paul, the boys in our opening vignette, as an example. John may have succeeded in avoiding the risks associated with his life because a positive male role model compensated for his father's absence (compensatory model) and because the support he received from his network of drug-free and nonviolent friends helped to protect him from the risks associated with growing up in a poor and high-crime neighborhood (protective factor model). Successfully overcoming the experience of the stress and hurt of his older sibling's troubles may have made him better able to cope with the new stress of added family responsibilities in his brother's absence (challenge model). These three models provide us with a basis for exploring the positive outcomes experienced by youth considered to be in a high-risk environment. Several theoretical and methodological issues, however, hinder the advancement of research on resiliency.

Theoretical and Methodological Issues

Resiliency research is a relatively new area that has yet to see the benefit of either years of study or the attention of numerous researchers. Nevertheless, like most other psychological constructs, it faces several theoretical and methodological issues that must be addressed. Such issues do not, however, compromise the usefulness of the resiliency construct as a heuristic for understanding healthy child development achieved against seemingly insurmountable odds.

Theoretical Issues

Defining protective and risk factors. Protective and risk factors have been conceptualized as the opposite ends of a single continuum (Brook, Whiteman, Gordon, & Cohen, 1989; Newcomb & Felix-Ortiz, 1992; Rutter, 1987). High religiosity, for example, may be a protective factor against drug use, while low religiosity may be a risk factor associated with increased drug use. Whether a variable is called a risk factor or a protective factor seems to depend on which end of the continuum is emphasized (Newcomb, McCarthy, & Bentler, 1989; Stouthamer-Loeber et al., 1993). While Seifer, Sameroff, Baldwin, and Baldwin (1992) used low SES as a potential risk factor, others (e.g., Masten et al., 1988) include high SES as a potential protective factor. Socioeconomic status is one of the most commonly investigated indices of stress, but we have little consensus on whether SES generates vulnerability in children or acts as a protective factor against other risks (Masten et al., 1988).

Newcomb and his colleagues (Newcomb et al., 1989; Newcomb & Felix-Ortiz, 1992; Stacy, Newcomb, & Bentler, 1992) have used an innovative approach to explore the issue of risk and protective factors falling on the same continuum. They investigated the interactive influences of risk and protective factors on various drug use patterns, examining both the quantity and frequency of drug use. Protective factors had main effects but also interacted with the risk factors to influence drug use. Several variables were combined to create a Multiple Risk Factor Index and a Multiple Protective Factor Index (MPFI). Variables were made dichotomous by recoding them

as either a risk or protective factor based on which end of the continuum a respondent fell (e.g., high self-esteem was protective while low self-esteem was a risk). Composite scores were then created by summing the dichotomous variables. Researchers found the MPFI to be related to less drug involvement (Newcomb & Felix-Ortiz, 1992).

Felix-Ortiz and Newcomb (1992) used similar indices to study the risk and protective factors associated with drug use among Latino and white adolescents. They found that as the Protective Factor index increased, alcohol use among Latino males and white females decreased. As the Risk Factor index increased, protective factors were less effective buffers of hard drug use for both Latino and white adolescents.

Sameroff, Seifer, Baldwin, and Baldwin (1993) studied the influence of social and family risk factors on the stability of intelligence from preschool to adolescence. They found that the pattern of risk was less important than the total amount of risk present in the child's life. In other words, the burden of too many risk factors could not be remedied by the protective factors studied. The simultaneous consideration of multiple indices of risk and protection may help us to better understand resiliency, but it may also pose difficulties.

One problem with this approach is that more neutral middle scores of the recoded variables get mixed in with more extreme scores which may obscure information about either the risk or protective effect. We lack sufficient empirical evidence to determine what criterion to use to define a variable as a risk or protective factor (Hawkins et al., 1992; Seifer et al., 1992; Stouthamer-Loeber et al., 1993). It is also not clear when opposite ends of the continuum are actually opposites or simply less of one variable. While a high score on parental support, for example, may be a protective factor, a low score may not necessarily mean that a youth lacks adequate parental support. Rather, the low score may simply indicate lower levels of reported parental support. No parental support may be a risk factor, but it is not necessarily the opposite end of a parental support scale, because a low score on such a scale does not necessarily mean support is absent.

Multiplicity and specificity of protective factors. It may be very difficult, if not impossible, to specify for any given outcome which protective factors go with which risk factors. Similarly, it would be difficult to specify a one-to-one relationship between risk factors and protective factors; most negative outcomes do not directly relate to a single risk factor (Seifer et al., 1992).

Felix-Ortiz and Newcomb (1992) found that an individual's use of drugs was influenced by different predictors for different groups. Although their study highlights the importance of considering multiple factors of risk and protection, they also fail to specify the individual contribution of any one factor. It may not be critical to create a taxonomy of the linkages of risk factor, protective factor, and outcome, but future research would profit from organizing the information that is presently available.

Domain specificity. Luthar and Zigler (1991) point out that resiliency in one life domain may not translate to resiliency in other life domains. A child may show resiliency to parental conflict as it relates to school-related outcomes, for example, but not to social relationships. Luthar and Zigler (1991) have found that urban ninth graders considered to be academically resilient often show signs of emotional maladjustment. Students who were considered resilient within one domain of school competence were not necessarily resilient when other outcomes were considered.

Process versus trait. Rutter (1987) stressed the need to focus on the mechanisms by which youth maintain their self-esteem and self-efficacy in the face of adversity. While a protective factor *model* suggests a trait approach focusing on static relationships, a protective *mechanism* approach implies the processes by which factors interact over time to alter the individual's trajectory. Many researchers write about mechanisms, but they typically study only static protective factors. The accumulation of a body of research on these

factors could be helpful in identifying what mechanisms may be fruitful avenues for research. Vulnerability research went through a parallel evolution, first identifying risk factors and then studying the etiology of problems (e.g., drug use, delinquency, psychopathology).

Cross-sectional analysis of one-time behavioral assessments only gives us a snapshot of the resiliency process. Longitudinal research will be needed to establish any sort of causal relationships among risk factors, protective factors, and outcomes. Gest, Neemann, Hubbard, Masten, and Tellegen (1993) suggest that longitudinal research on resiliency will be most informative if (1) baseline measures are made of all constructs under consideration; (2) samples are large enough to detect the statistical interaction of interest; and (3) assessments are taken at three or more points spaced far enough apart in time to provide opportunity for the hypothesized process to occur.

Methodological Issues

Measurement. Measurement issues are critical for any psychological construct, but they pose a particular problem for resiliency. Multiple conceptualizations of this construct and the lack of a common approach to studying it make measurement a confusing task. While current technologies are adequate for developing psychometrically sound measures of specific variables (e.g., self-esteem, parental support, anxiety, drug use), methods are limited for assessing how variables interact over time to affect an outcome. This suggests that models must be well specified and made testable so they can be evaluated empirically. Etiologic models of problem behavior, for example, may provide a useful heuristic for formulating and studying the mechanisms by which youth succeed despite the odds. In addition, qualitative methodology (e.g., Glaser & Strauss, 1967) could be useful in developing relevant models that can be tested quantitatively in a larger study.

Variance explained. The amount of variance explained by the addition of interactive effects (i.e., protective effects) is typically small, which might mistakenly lead us to conclude the effects are inconsequential. Garmezy et al. (1984) report only a 4% increment (from 62% to 66%) in the amount of variance explained by the interaction effect of protective factors with risk factors on competence. Zimmerman et al. (1994) also found that the addition of an interaction term to determine the protective/protective effects of cultural identity only explained an additional 4% of variance of alcohol and drug use.

Several reasons may explain these seemingly limited results:

(1) The model may have specified variables incorrectly.

(2) Resiliency may sound like a feasible explanation but fail to engender meaningful empirical support.

(3) The small effects could be an artifact of the analysis procedure. Effects of the resiliency process are typically considered after all the risk variables have already been assessed in the analysis, and the interactive term is then introduced only at the last step. Little variance may be left to explain at that point, and the fact that any is explained in the final steps of the analysis may actually suggest fairly strong effects. Models that treat resiliency-related variables more prominently may be useful in clarifying such effects.

(4) Finally, any particular study may fail to capture the resiliency process at the point in a child's or youth's development when it is most crucial; alternatively, a resiliency process may operate differently at different phases of development. The protective factor of a male role model, for example, may function differently for the young child of 5 who is learning about family than it does for the youth of 16 who is contemplating dropping out of school. If a model misspecifies the action of this factor, little variance may be explained.

Level of analysis. Most research on resiliency to date has concentrated on the individual, with studies focusing on personal attributes such as intelligence, gender, self-esteem, self-efficacy, autonomy, sociability, aggressiveness, religiosity, and so on. Unfortunately, this emphasis on the individual may unwittingly blame victims for their deleterious outcomes. Moreover, it may lead us to rely too heavily on interventions aimed at changing the individual, when it may be more efficient and economical to create settings that help youth compensate for or protect themselves against risk.

Some investigators have considered a level of analysis that subsumes the individual. This approach can take the form of assessing social relationships (e.g., family relations, mentorship, peer influences) or contextual factors (e.g., neighborhood, SES). Although these broader contexts are usually treated as risk factors (e.g., lack of mentoring or lack of neighborhood facilities), some researchers have begun to include them as resiliency factors (Brook, Nomura, & Cohen, 1989; Brook, Whiteman, Balka, & Hamburg, 1992).

Research is needed to identify the role that social institutions play in helping youth to become resilient and sustain their capacity to face risk. Schools are such settings. A research focus on schools as promoters and safeguards of resilience shifts attention away from the individual and onto a context within which children can develop problem-solving skills, find social supports, and experience success.

Schools and Resiliency

Schools have a significant influence on child and adolescent development (Entwisle, 1990). From the age of 5, children spend a large part of their day in school, and their experiences in school may affect them in multiple ways. The school environment has the potential either to increase children's risk or protect them from the debilitating consequences of other risks. School size, for example, is associated with school dropout, with smaller schools being more protective (Pittman & Haughwout, 1987; Rumberger, 1987). Low academic motivation (absenteeism, dropout), achievement (grades), and commitment (school bonding) have been linked to adolescent drug use (Bachman, et al., 1980; Barnes & Welte, 1986; Coombs et al., 1985; Hawkins et al., 1992; Johnston & O'Malley, 1986; Kandel, 1980). Rutter et al.'s (1979) longitudinal study of children from the first grade to the tenth grade highlights the many influences of school. They found that students vary markedly in their behavior, attendance, exam success, and delinquency, and that these outcomes are systematically and strongly associated with school characteristics.

Several school-based interventions have been designed to help children develop skills (Weissberg, Caplan, & Sivo, 1989), cope with stress (Felner & Felner, 1989; Pedro-Carroll & Cowen, 1985), and reduce risk behavior (Perry et al., 1990). Unfortunately most school-based prevention programs have employed a deficit model (Weissberg et al., 1989). Such programs typically target children likely to be educationally disadvantaged, disruptive, or delinquent (Maughan, 1988), and stress individual behavior change.

School experiences can obviously contribute to both risk and protective mechanisms, but as Maughan (1988) suggests, the role of schools has received relatively little consideration in the study of resiliency processes. Rutter (1987) suggests that schools can be protective because they can promote self-esteem and self-efficacy by providing opportunities for students to experience success and enabling them to develop important social and problem-solving skills. Researchers have found that school-based supportive ties can serve to buffer against potentially hazardous conditions in the home and other nonschool environments (Dubois, Felner, Brand, Adam, & Evans, 1992). Brook, Nomura, and Cohen (1989) found, for instance, that a harmonious and organized school environment where teachers and

students are committed to learning limited the effect of peer cigarette use on adolescent drug use.

Research on the motivational climate of schools indicates that the varying goals pursued by schools influence students' personal goals, which, in turn, influence their feelings of self-efficacy and self-esteem (Maehr & Nicholls, 1980). Such motivational goals may be characterized as *task* and *performance* goals (Ames, 1992; Ames & Archer, 1988). A task goal stresses learning for learning's sake, and success is measured by improvement. The focus is on the intrinsic value of learning (Nicholls, 1984). In contrast, a performance goal stresses demonstrating superior ability relative to others, or avoiding appearing unable. The goal is decidedly competitive in nature, and success is defined in terms of relative standing on some scale, such as test scores, grade point average, or other comparison between students. Emphasis is on the extrinsic aspects of learning. A performance orientation necessitates that there be some winners and some losers (e.g., straight-A students vs. failing students). Children in the performance-focused situation tend to attribute failures to lack of ability (Ames & Ames, 1984; Elliot & Dweck, 1988).

In contrast, children in task-focused situations are more likely to view failures as a challenge to try harder and to develop more useful strategies; they also report less negative affect in response to failure. Students have reported greater self-efficacy when pursuing task goals than performance goals (Urdan, Turner, Park, & Midgley, 1992). Thus, schools can play a protective role by helping students develop the self-confidence and analytic skills they need to solve the problems that confront them.

Ames (1992) also found that task-oriented schools influence other perceptions of self, like the sense of belonging. A competition-oriented school where students are subtly, or sometimes explicitly, pitted against one another may dampen some students' sense of belonging. This is significant because sense of belonging to the school has been shown to enhance student motivation and improve achievement (Goodenow, 1993). Sense of belonging to a school has also been shown to protect against adolescent substance abuse (Hawkins et al., 1992).

Other aspects of school structure and process can also affect student outcomes. While the perceived competence that comes with academic achievement can play a protective role and encourage a student to stay in school, failing in school may make a student more vulnerable to negative outcomes. The presence of an understanding teacher or the availability of other support systems in the school (e.g., peer tutoring, counseling) may increase a student's chances of developing coping skills. Finally, school activities where students have opportunities to share ideas, provide help to others, and participate in decision making about issues of concern to them may also play a protective role. Such activities could include peer education programs, service learning, or student advisory boards.

Although the field of resiliency research is still in its infancy and many issues remain to be worked out, investigations of how social institutions, like our schools, foster resiliency are needed to ensure the creation of settings where children and youth may develop into healthy adults. Such settings can be a critical resource for children and youth, and an important focus for addressing many social problems.

Policy Implications

Resiliency poses several policy implications for research on child and adolescent development. The policy implications listed below are not intended to be a complete or mutually exclusive list. They are intended to generate ideas that will shift attention from a focus on risk factors and the etiology of problem behaviors to efforts to understand healthy and adaptive responses to stressful circumstances.

- *Develop specific funding initiatives for studying resiliency.*

Most calls for proposals and research initiatives target problem behaviors (e.g., violence, substance use, teen pregnancy) and often neglect language that would encourage research on resiliency. A notable exception is the current National Science Foundation's Human Capital Initiative. The NSF program announcement, while not specifically designed for resiliency research, does include language that would address resiliency. It states that human capital research is defined as "research which advances basic understanding of the causes of the psychological, social, economic, and cultural capacities of productive citizenship."

- *Fund longitudinal studies that emphasize exploration of resiliency among youth with risk factors.*

  Resiliency is a developmental construct and must be studied longitudinally, because it is not a trait that a youth is either born with or automatically keeps once it is achieved. Longitudinal research will allow us to study not only how resiliency develops but how it may also deteriorate over time. This research could parallel etiological research on risk factors but focus on what leads to positive instead of negative outcomes. It would be important for longitudinal studies to include critical developmental periods such as school transition or puberty.

- *Fund research that explicitly examines resiliency in different populations.*

  Resiliency research is in its infancy, and the knowledge gaps are sizable. The number of researchers studying a greater number of topics in various populations needs to be increased. Studies that examine interactions of developmental transitions and gender, for example, will help identify how resiliency may differ for males and females. Similarly, studies within different populations (e.g., rural communities or various physical disabilities) would help to further specify how resilience operates. Ethnic group differences may also be important to study, especially among populations where bicultural issues, mainstreaming into majority culture, and strong ethnic ties are part of the developmental experience. In order for resilience to be a useful construct, it needs to be studied in various populations and contexts.

- *Create intervention programs designed specifically to enhance factors found to be protective and to contribute to resiliency.*

  Prevention programs are often designed to eliminate or reduce risk factors found to be related to a negative outcome. Thus, they focus on amelioration of a potentially dangerous status. An alternative approach would be to develop programs that enhance those factors found to protect or inoculate youth against the effects of risk factors. This is fundamentally different because it focuses on building capacity instead of fixing problems. This alternative approach requires us to learn more about the etiology of positive outcomes in otherwise risky situations. Intervention research will push the field to be more specific about outcomes, relationships among variables, and measurement issues.

- *Resiliency research needs to include multiple levels of analysis.*

  Resilience is not simply an individual level construct nor does it lie solely within the individual. Most of the research on resiliency has focused on individual and family factors. More efforts are needed to understand how social institutions—schools, public health departments, court systems—can contribute to or hinder youth resiliency. The discussion above about

schools provides an example of how social institutions can play a role in the resiliency of our children.

- *Research the roles our schools may play in developing resilient youth.*

  Many school programs only evaluate motivation and academic outcomes (e.g., cognitive skills, achievement), but researchers could begin to explore how schools help enhance protective factors such as social skills, problem-solving skills, or self-esteem. Evaluation of school programs designed to have a task-oriented curriculum and reward systems could, for example, include assessment of factors associated with resiliency.

- *Research that focuses on people in a crisis situation and how they differentially adapt is needed to more fully understand the resilience process.*

  People who experience the same stressors but end up with different outcomes (like John and Paul in our opening story) provide an important population for study. The goal of such a program of research would be to identify the stressful situation and follow youth over time to analyze whether their response was resilient or ineffective. One significant common stressor for many youth is poverty, yet we know relatively little about why some youth escape from it while others remain poor and disenfranchised.

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