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Profiles of Risk: Maternal Health, Socioeconomic Status, and Child Health

Jessica Halliday Hardie and
Department of Sociology, University of Missouri — Kansas City, 5100 Rockhill Rd., 208 Haag Hall, Kansas City, MO 64110 (hardiej@umkc.edu)

Nancy S. Landale
Population Research Institute, Pennsylvania State University, 703 Oswald Tower, University Park, PA 16802-6211.

Abstract

Child health is fundamental to well-being and achievement throughout the life course. Prior research has demonstrated strong associations between familial socioeconomic resources and children's health outcomes, with especially poor health outcomes among disadvantaged youth who experience a concentration of risks, yet little is known about the influence of maternal health as a dimension of risk for children. This research used nationally representative U.S. data from the National Health Interview Surveys in 2007 and 2008 (N = 7,361) to evaluate the joint implications of maternal health and socioeconomic disadvantage for youth. Analyses revealed that maternal health problems were present in a substantial minority of families, clustered meaningfully with other risk factors, and had serious implications for children's health. These findings support the development of health policies and interventions aimed at families.

Keywords

child well-being; family health; inequality; intergenerational; parenting

Understanding the social factors that underlie disparities in children's health is of major concern to scholars of inequality. Poor health in childhood can contribute to a trajectory of relatively low attainment and well-being later in life. Children with serious health problems are more likely to drop out of school, have health problems in adulthood, and earn lower incomes than their healthy counterparts (Case & Paxson, 2006). Identifying the sources of child health disparities is essential to the development of effective policies and programs to reduce inequalities in children's development and achievement over the life course.

Prior research has demonstrated unequivocally that the social and economic resources of children's families are critical to their health. Family members share economic resources, home and community environments, and social networks, all of which have an impact on health. Family income is related linearly to children's overall health (Case, Lubotsky, & Paxson, 2002), and low parental education and growing up in a single-parent family increase the likelihood that children will experience poor health outcomes (Bauman, Silver, & Stein, 2006; Montgomery, Kiely, & Pappas, 1996). These factors operate on children's physical and mental health in an additive fashion (Bauman et al., 2006; Evans, 2003) and influence various health outcomes in a similar manner (Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Currie & Lin, 2007).

Apart from identifying inheritable genetic traits, less attention has been paid to linkages between parental health and children's well-being. We propose that parents' health is an

additional dimension of family inequality that contributes to disparities in children's health, and we tested this proposition using data from the 2007 and 2008 National Health Interview Surveys (NHIS; see http://www.cdc.gov/nchs/nhis.htm). We first show how socioeconomic and health disparities cluster within families. We then employ multivariate models to examine disparities in children's health, showing how socioeconomic and health risk profiles are correlated with children's health outcomes. Our analysis makes several contributions to the literatures on multiple risks, family health, and social inequality. First, our use of latent class analysis (LCA) to show how socioeconomic and health disadvantages cluster within families provides unique insight into the distribution of risk in American families. As expected, we found groups of mothers who face socioeconomic disadvantages only, health disadvantages only, both disadvantages, and neither. We also found a significant proportion of mothers who had limited access to socioeconomic resources and health care but did not report health problems, and a smaller group, composed mostly of disadvantaged single mothers who smoked, had limited access to health care, and a slight elevation in the risk of depression but few other health disadvantages. Second, we examine associations between these clusters of risk and children's health outcomes. For some outcomes, socioeconomic and maternal health disadvantages were associated with negative child health outcomes at about the same rate when each is the sole source of risk. When combined, however, these factors pose much higher levels of risk for child health problems than either alone. Finally, we identify key differences across outcomes in patterns of association with socioeconomic and health disadvantage by using seven diverse child health indicators. By demonstrating that socioeconomic and health disadvantage converge to produce categorical profiles of risk, we advance theories of family life, health, and inequality, thereby deepening our understanding of how inequality is replicated across generations within families.

Multiple Risks

According to the multiple-risk perspective, the concentration of social disadvantage matters for children's well-being (Evans & English, 2002; Liaw & Brooks-Gunn, 1994; Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). Risk factors include poverty, family instability, poor housing conditions, and other circumstances that may contribute to children's exposure to stress and health hazards. To assess risk, researchers typically determine cutoff thresholds of disadvantage (e.g., poverty thresholds) and then use them to construct dichotomous indicators of risk, which are summed to create an index of disadvantage (Rutter, 1983, 1993).

Poverty, low parental education, and fragile family structures are particularly salient sources of risk. Impoverished parents cannot provide the same health-promoting resources, such as high-quality medical care, good nutrition, child care, and exercise opportunities, as middle-class parents can. In addition, the neighborhoods in which poor families reside have fewer medical facilities, quality grocery stores, and safe outdoor spaces than higher income neighborhoods (Drewnowski & Specter, 2004; Weir, Etelson, & Brand, 2006), and they carry a greater risk of environmental hazards (Morello-Frosch, Zuk, Jerrett, Shamasunder, & Kyle, 2011). Poorly educated parents may encounter barriers in communicating with health personnel and understanding health-promotion literature (Schillinger et al., 2002). They also take a less proactive approach to health care than parents with more human capital (e.g., education; Sabates & Feinstein, 2005). Finally, single parents are limited in the time and attention they can devote to caregiving, promoting children's development, and health care (Dawson, 1991).

These factors appear to operate additively for a range of youth outcomes, including obesity, allostatic load, IQ, and behavioral problems (Appleyard, Egeland, van Dulmen, & Sroufe,

2005; Evans, 2003; Sameroff et al., 1987). One study used the NHIS data set to show that three indicators of family disadvantage — poverty, low parental education, and single-parent household — were positively and additively related to whether a parent reported that their child had a chronic condition or activity limitation, and negatively and additively related to better overall health (Bauman et al., 2006). Risk indices regularly include these socioeconomic and demographic sources of inequality (Appleyard et al., 2005; Burchinal, Roberts, Hooper, & Zeisel, 2000; Evans & English, 2002; Liaw & Brooks-Gunn, 1994).

Research taking the multiple-risks perspective has thus far not considered maternal health problems as an additional risk factor for children yet, given the strong and bidirectional relationship between socioeconomic status (SES) and adult health (Braveman et al., 2010), the risk of poor maternal health is clearly elevated in disadvantaged families. In this study, we assessed how maternal health problems cluster with poverty, low parental education, and single or stepfamily structure and how these factors are jointly associated with child health and well-being. We focused on maternal health rather than paternal health because existing research, although sparse, provides greater support for the link between maternal and child health (see Christensen, 2004, and Goodman, 2007).

Maternal and Child Health

Health has been described as a resource for parenting (Belsky, 1984). The onset of parental health problems can decrease family resources, such as income and time (Frech & Kimbro, 2011; Hogan, Shandra, & Msall 2007; Wagmiller, Lennon, & Kuang, 2008), and increase both parents' and children's stress (Armistead, Kein, & Forehand, 1995; Osborn, 2007). Research has also shown that maternal health problems are associated with a decrease in social support (Harknett & Hartnett, 2011), which can further reduce families' interpersonal and economic resources. Maternal ill health can reduce the quality of mother – child interactions and parenting (Goodman, 2007), and children may be less likely to communicate concerns about their own health when a parent is ill. Children's attachment to institutions, such as school, may also become weaker when a parent is ill. Because health problems are disproportionately found among the poor, the joint effect of social and health disadvantage may be particularly detrimental to children's well-being.

Some research supports the hypothesis that maternal health and child health are interrelated. Minkovitz, O'Campo, Chen, and Grason (2002) used a large, nationally representative data set to show that lower maternal self-reported health is associated with lower child health and that maternal and child health care utilization are positively related. With the exception of research on prenatal health and children's outcomes, however, studies of maternal and child health are scarce. Most have used small samples and focused on specific parental health conditions. For example, one study found that children of parents with chronic headache pain were more likely to report symptoms of pain or illness (Mikail & von Baeyer, 1990).Hogan et al. (2007) showed that parents with health problems have less time to devote to their children and have difficulty monitoring their children's behavior. Parental disability can also turn parent – child relationships on their head, making children caregivers of their parents or siblings (Aldridge & Becker, 1999; Davey, Gulish, Askew, Godette, & Childs, 2005). Other studies have found that parental health problems produce stress, anxiety, and behavior problems in children (Armistead et al., 1995; Osborn, 2007; Rodrigue & Houck, 2001). Finally, research shows that maternal depression reduces the time mothers spend with their children in structured activities (Frech & Kimbro, 2011) and is predictive of children's physical and mental health, behavior, receipt of health care, and development (Goodman, 2007; Johnson & Flake, 2007; Minkovitz et al., 2005; Turney, 2011a, 2011b). Although maternal depression influences mothers' reports of children's health and behavior (Jake et al., 2000), sensitivity analyses using fathers' reports (Turney, 2011a) and research relying on

laboratory tests and evaluations (Dawson et al., 2003) have revealed similar findings. Nonetheless, the impact of maternal depression on perceptions of child health remains a concern in studies that rely on mothers' reports of their children's behavior and well-being.

Although there is evidence that maternal health matters for children's health and well-being, prior research has primarily utilized one maternal health indicator at a time, focused on children's behavior and development, and used small convenience samples (except within the literatures on prenatal health and maternal depression). In addition, little is known about how SES and maternal health jointly influence children's health. Because SES and health are interrelated, these factors may operate interactively on children's health.

Socioeconomic Disadvantage, Maternal Health, and Children'S Health

We conceptualize parental SES, health, and health behaviors as being interrelated. Prior research has demonstrated that there is a socioeconomic gradient to health, health behavior, and health care (Braveman et al., 2010; Fiscella, Franks, Gold, & Clancy, 2000; Link & Phelan, 1995). Poor health also deprives families of economic resources through health expenditures, lost wages, and lower levels of achievement (Auerbach & Kellermann, 2011). Health problems could also disrupt relationship stability, leading to changes in family structure (Teachman, 2010). Last, health behaviors increase individuals' susceptibility to health problems, and changes in health may prompt changes in health behaviors.

It is not enough to suggest that socioeconomic disadvantage, maternal health, and maternal health behaviors affect one another. Families experience particular combinations of these factors, which may carry different levels of risk. For example, the well-established Hispanic health paradox exemplifies a better-than-expected health profile in the context of relatively low SES (Escarce, Morales, & Rumbaut, 2006). Hispanic adults often have unexpectedly good health despite their limited access to health insurance and health care. Good health may offer Hispanic mothers greater resources, in terms of time and social support, compared to Black or White mothers with similar socioeconomic resources who are struggling to cope with health problems. On the other hand, high levels of education and income may cushion the impact of parental health problems. Two-parent families are better positioned to trade off responsibilities and maintain health insurance when one parent becomes ill. The first goal of this study was to identify common risk profiles among mothers. We expected to find distinctions between high- and low-SES families and healthy and unhealthy mothers, as well as a segment of families who are socioeconomically disadvantaged with limited access to health care yet who demonstrate good health outcomes.

The second goal of this research was to identify associations between maternal risk profiles and children's health outcomes. Although our aim was not to test potential pathways through which risk profiles influence children's health and health behaviors, the ecological model articulated by Bronfenbrenner (1979) suggests three broad mechanisms: (a) shared environments, (b) resources, and (c) family processes. The term *shared environment* has been used in twin research to refer to all nongenetic, shared experiences and resources that have an influence on youths' outcomes. Here we use it to refer to conditions of the home and neighborhood to which mothers and children are jointly exposed. *Resources* include socioeconomic, social, cultural, and health resources present in the family and wider community. Finally, *family processes* include patterns of interaction between family members, such as parenting styles and relationship quality. It is also possible that children's health problems affect maternal health and family socioeconomic well-being. Our findings may therefore reflect simultaneous influences of all family members' health and economic resources.

Although genetic and biological factors can be strongly related to some health outcomes, they are beyond the scope of this study. Our focus is on indicators of children's well-being that are expected to be at least partly socially or environmentally conditioned. In line with the literature on SES and child health, which demonstrates that understanding *patterns* of association between explanatory factors and multiple dimensions of child health is important (Braveman et al., 2010; Currie & Lin, 2007), we examined a broad range of child health indicators. Our study improves upon prior research on children's health by considering maternal health in combination with SES; including a wide range of maternal health, health behavior, and health care access indicators; examining these associations for a number of child health outcomes; and utilizing a large, nationally representative data set.

Method

The NHIS is an annual, nationally representative cross-sectional household survey designed to monitor the health of the U.S. population. This data source is ideal for our purposes because it includes comprehensive health information for large samples of adults and children coresiding in U.S. households. For this study, we used publicly available data from the 2007 and 2008 surveys. The NHIS employs a complex multistage sample design to select households for inclusion. Once households are selected, there are three levels at which data are collected: (a) household, (b) family, and (c) person. Within each participating household, all families are surveyed. Within each family, basic health information is collected for each person. Finally, additional in-depth health surveys are conducted with one sample adult and an adult proxy for one sample child (where applicable) per family. The household survey response rate was 87.1% in 2007 and 84.9% in 2008. Together, the 2007 and 2008 NHIS samples included 58,056 households. These households contained 59,336 families with 150,000 persons. About 76% of selected sample adults agreed to participate in a longer survey, for a total of 45,174. Finally, data were collected for 18,232 sample children, about 87% of those eligible and selected.

We restricted our sample to focal children living in households in which their biological mother was the sample adult ($N = 7,753$) because we used information that was available only in the sample adult and sample child surveys. Families in which the sample adult was a father, grandparent, or other adult living in the home were dropped from the analytic sample. Last, we eliminated households in which mothers were pregnant at the time of the interview ($N = 319$) or the mother was not White, Hispanic, Black, or Asian ($N = 73$). Our final sample size was 7,361. The use of these selection criteria allowed us to use in-depth health information from the focal interviews and to derive population estimates of maternal health.

Compared to the excluded sample, our sample had proportionally more Black, impoverished, and single-parent sample adults, and fewer Asian and poorly educated sample adults. These differences stem partially from the decision to analyze maternal health. Mothers are more likely to be single parents than fathers, and single mothers had a much higher likelihood of being selected as the sample adult than mothers in intact families, because there are fewer adults eligible for inclusion in these households. We adjusted for this difference in the chance of being selected by multiplying the NHIS sample weight (which adjusts for the probability of household selection and nonresponse biases) by the number of adults in the home. All of our analyses are weighted.

We handled missing data in two steps. We performed LCA using PROC LCA in SAS, which uses a full-information maximum-likelihood approach to handle missing values on the three indicators of family SES and eight indicators of mothers' health status (Lanza, Collins, Lemmon, & Schafer, 2007). This adjusts for data that are missing at random, producing latent class probabilities for all sample members, even when they are missing

information on some indicators. After families were assigned to a latent health status, we used multiple imputation with the Stata ICE command to impute missing information on the independent variables. Multiple imputation is an ideal procedure for dealing with missing data because it maintains overall variability and relationships among variables from the original, unimputed data (Rubin, 1987). We included latent class probabilities, as well as our child health variables, in the imputation model. We included the child health variables for use in deriving imputations, and then original missing values were restored, following von Hippel (2007). Five data sets were imputed to take the uncertainty of imputed values into account. Descriptive statistics and multivariate models from each imputed data set were combined across imputations to generate the parameter estimates and standard errors.

Key Measures

Outcome variables: Children's well-being—We assessed seven indicators of children's well-being. Our goal was to provide a comprehensive set of indicators representing omnibus measures of health (overall health), prevalent childhood health problems (asthma, obesity), the daily impact of health problems (activity limitations, school days missed) and utilization of health care (regular medical care, emergency room visits). Children's overall health status was coded 1 if the adult reporting on the child's health indicated it was *fair* or *poor*, and 0 if the child's health was *good*, *very good*, or *excellent*. Asthma and obesity were coded dichotomously, with 1 indicating the health problem is present. Children who are limited in any way (i.e., in play or movement) were coded 1. School days missed were recorded from the verbatim response of the reporter and top-coded at 60. Children who had not seen a physician within the prior year if over age 3, and in 6 months if younger, were coded as having missed a well-child checkup. The number of trips to the emergency room in the prior year was recorded by the NHIS as a nine-category variable, with responses ranging from *none* (0) to *16 times or more* (8). See the Appendix for coding details.

Our analytic sample varies according to the outcome variable, following our previously described imputation method. In addition, children's body mass index was measured only in the 2008 survey, for children ages 12 to 17, yielding a sample of 1,193. School days missed were assessed only for children of school age (N = 5,268). See Table 1 for descriptive statistics.

Risk factors—We constructed latent classes of risk based on traditional measures of disadvantage (Bauman et al., 2006; Burchinal et al., 2000; Evans, 2003; Liaw & Brooks-Gunn, 1994) and measures of maternal health problems. We conducted iterative testing to confirm that these measures were robust in differentiating family disadvantage. This consisted of creating socioeconomic risk indices similar to those used in previous research on multiple risks and children's health (e.g., Bauman et al. 2006) and comparing our findings to conclusions reached with other data sets. Our additive risk indices are associated with children's health outcomes in a manner similar to this previous research. Measures of risk include low family income (1 = *less than the poverty line*), low maternal education (1 = *less than a high school education*), and fragile family structure (1 = *single, cohabiting, or step-parent[s] family structure*). We chose this method of identifying "fragile" family structures because research has shown that children living in stepfamilies, cohabiting-parent families, and single-parent families demonstrate worse outcomes on a range of developmental markers than children from two married, biological or adoptive parent households (see Brown, 2010).

We examined eight dichotomous indicators of maternal health and utilization of medical care. Mother's self-reported health status was coded 1 if fair or poor compared to good or

better. Depressive symptoms were coded 1 if the mother's score on six summed indicators of depressive symptoms that the NHIS adopted from Radloff's (1977) Center for Epidemiologic Studies Depression Scale was at least 1 *SD* above the mean (1 = 7 or above on a 0- to 24-point scale). Physical limitations were considered present if the mother reported being physically limited or had a health problem requiring special equipment. A serious health condition was deemed present if the respondent reported one of the following health problems currently or in the past: diabetes, cancer, hypertension, or any heart problem. Separate dummy variables indicated whether the child's mother was obese or a current smoker. Finally, we included indicators of whether the child's mother had no place to go to when sick and had no medical insurance.

Control variables—In multivariate models we controlled for the number of children under age 18 in the household, top-coded at 7 (25 cases recoded), mother and child age at the time of the survey, whether the child was female, and whether the mother was born in the United States. We also included a control for whether the mother's current or most recent job could be classified as professional, managerial, or skilled technical. Finally, we controlled for the mother's race/ethnicity — White (reference), Hispanic, Black, and Asian — and whether the child was born with low birth weight (under 2,500 g).

Plan of Analysis

We first used LCA to identify subgroups of individuals with similar profiles of disadvantage (or advantage). LCA is a data-reduction technique akin to factor analysis (Vermunt & Magidson, 2002). Unlike factor analysis, however, LCA takes a person-centered approach to statistical analyses. Rather than identifying the unique influence of one variable, controlling for all others, person-centered approaches recognize that variables cluster together within people, and it is the constellation of traits that may be important. LCA relies on a set of observed indicators — in this case, a set of 11 binary indicators of socioeconomic and maternal health disadvantage — from which to infer latent class membership. Each individual's true latent status is not known with certainty; instead, each individual has a probability of membership in each latent class. An important feature of LCA is that each latent class reflects higher order interactions among all 11 indicators. With 11 binary responses, there are $2^{11} = 2{,}048$ possible patterns of unique responses to the disadvantage indicators. LCA allows for this amount of information to be reduced in a meaningful way so that social disadvantage can be characterized by a set of latent classes reflecting dominant profiles in the population.

To identify the optimal number of latent classes, we conducted LCA specifying an incrementally larger number of classes, examining the fit statistics of each model. Measures of model fit compared the expected pattern of responses generated by the postulated model with the observed pattern. Several statistics, such as G^2, are distributed as chi-squares with the degrees of freedom equal to the difference between the number of response patterns in the data minus the number of model parameters and the number of groups. Complex models always improve model fit using these statistics. Information criteria, such as the Bayesian information criterion, are preferred. Our selection of the appropriate number of latent classes was largely based on fit statistics. We also examined the classes to make sure they "made sense" in relation to prior research and our expected class groupings. For all but one class, the LCA output matched our expectations.

After obtaining our latent classes, we assigned each mother to a class using her probabilities of class membership. Next, we ran multivariate regression models that included indicators for latent class membership and our control variables. The models predicted our seven child health and health care outcomes. We used logistic regression to predict dichotomous

outcome variables, negative binomial regression to predict school days missed, and Poisson regression to predict emergency room visits. The latter two variables were distributed like count variables. School days missed were overdispersed, with the variance higher than the mean. The mean for emergency room visits was approximately equal to the variance.

Results

To determine the appropriate number of latent classes summarizing our maternal health and socioeconomic indicators, we assessed the fit statistics for our LCA (see Table S1, part of the online supporting material on the *Journal of Marriage and Family* website [http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1741-3737]). The first model evaluated the fit given independent relationships between the indicators. Subsequent analyses, specifying a greater number of classes, showed improved fit over the independence model until after the six-class model, when the Bayesian information criterion rose slightly, indicating that the six-class model fit the data best.

The six-class model is also theoretically justifiable, showing distinct groupings of socioeconomic and health disadvantages along most dimensions that we expected (e.g., poor access to health care but good health, poor health in a context of high SES and low SES). Class 1 respondents (“low risk”) were neither socioeconomically nor health disadvantaged. Class 2 members (“unhealthy only”) were not socioeconomically disadvantaged but had a relatively high probability of reporting health problems. Class 3 members (“low SES only”) were socioeconomically disadvantaged but had a low probability of reporting health problems. Class 4 members (“low coverage/care”) were socioeconomically disadvantaged and had poor access to health care, but few health problems. In supplemental analyses, we found that immigrants comprised over half of this group, compared to about 19% in the full sample (see Table S2 of the online supporting material). Class 5 members (“disadvantaged smokers”) were socioeconomically disadvantaged; had a high probability of being smokers; had limited access to health care; and had a moderate probability of reporting depression or physical limitations. A supplemental analysis showed that disadvantaged White women were overrepresented in this group compared to other low-SES groups. Finally, Class 6 members (“high risk”) were socioeconomically disadvantaged and had the highest probability of every poor health outcome except smoking. Although prior research led us to expect groupings similar to Classes 1 through 4 and Class 6, we were surprised by the emergence of the “disadvantaged smokers” class.

The first row in Table 2 displays the weighted percentages of cases in each latent class. For example, 44.47% of the mothers were expected to belong to the low-risk class, and 11.66% were expected to be in the unhealthy-only class. In addition, 16.04% were expected to be in the low-SES-only class, and 12.55% were expected to be in the low-coverage/care class. The smallest two classes are the disadvantaged smokers and high-risk classes, expected to comprise 6.49% and 8.79% of the sample, respectively.

Once we determined that our six-class model fit the data best, we assigned mothers to classes on the basis of their highest probability of membership. Assigning a deterministic class identification based on probabilities can be problematic if class assignment is ambiguous. Therefore, we examined whether class membership was distributed with minimal ambiguity. We accomplished this by assessing the mean probability of class membership for each respondent assigned to a class. Individuals could have been assigned to a latent class with a probability of less than .5, because each case was assigned on the basis of the highest probability of membership. As demonstrated in the second row of Table 2, the average probability of membership for each group ranges between .70 and .84.

Table 2 also displays the probability of item response conditional on class membership. For example, individuals in the low-risk class had a probability of .07 of being poor. A member of the high-risk group had a .86 probability of being poor. These probabilities show that indicators of socioeconomic and health risks group together in the manner described above and are summarized in the class labels: high SES is common for members of Classes 1 and 2, whereas low SES is evident among the remaining classes. Health problems clustered most among the unhealthy-only, disadvantaged smokers, and high-risk groups.

Tables 3 and 4 contain the results of our multivariate models of children's health conditions (Table 3) and activity limitations, school days missed, and utilization of medical care (Table 4). In each model, we included indicators of the mother's latent class membership and demographic and family background factors. Our reference category for latent class membership is the low-risk class. We also ran models using high-risk youth as the reference category, which we have not presented here but refer to in our discussion of results. Differences in each health outcome by latent class are also illustrated in Figures S1 through S7 of the online supporting material, which show predicted outcomes generated from our multivariate analyses, with controls set to their means.

Overall Health

The first model in Table 3 presents the results of a logistic regression predicting whether the sample child's health was rated fair or poor. Children of unhealthy-only mothers and low-SES-only mothers both had over three times the odds of having fair or poor health compared to the children of low-risk mothers. High-risk children were the most likely to have fair or poor health. Table 3 shows that these children had over 16 times as high odds of having fair or poor health as the low-risk group. In analyses that used this class as the reference category, children of every other class had statistically significant lower odds of having fair or poor health.

Asthma—Children in the low-SES-only class had 43% higher odds of having asthma than the low-risk class. Children in the high-risk class had more than twice the odds of having asthma, compared to the low-risk class. Supplemental analyses showed that low-coverage/care children had significantly lower odds of having asthma than children in the unhealthy-only, low-SES-only, and high-risk classes. This may reflect a difference in the diagnosis of asthma rather than the presence of the condition. Children in the high-risk class had significantly higher odds of having asthma than every other class.

Obesity—Our results for obesity followed a different pattern: The children of unhealthy-only mothers had the highest risk of being obese, at about 2.5 times as high odds as children in the low-risk class. Supplemental analyses also showed that the children of unhealthy-only mothers had significantly higher odds of being obese than the children of disadvantaged smokers. Children of high-risk mothers exhibited almost 100% higher odds of being obese than children in the low-risk class.

Activity limitation—Children in the unhealthy-only and low-SES-only classes had approximately 60% and 114% higher odds of having an activity limitation, respectively, than children in the low-risk class. Compared to low-risk children, children in the disadvantaged-smokers class had 1.7 times as high odds of having an activity limitation, and children in the high-risk group had over four times the odds of this outcome. Children in the high-risk class had significantly higher odds of having an activity limitation than those in every other class.

School days missed—We conducted a negative binomial regression of school days missed due to illness. Coefficients were equivalent to the expected change in the log of the outcome variable for a one-unit increase in the explanatory variable. These coefficients can also be expressed as incidence rate ratios, which show the expected change in the rate of the outcome variable for a one-unit increase in the explanatory variable. We found that being in the unhealthy-only, low-SES-only, and disadvantaged smokers classes was associated with an increase in the log of school days missed of approximately 0.3 to 0.4. Children in the low-coverage/care class missed approximately 0.2 logged school days more than children in the low-risk class, on average. Being in the high-risk group was associated with a 0.73 increase in the log of school days missed compared to the low-risk class. Compared to the high-risk class, being in Classes 1 through 5 was associated with a decrease in the log of school days missed by amounts ranging from −0.35 (low coverage/care) to −0.73 (low risk).

Well-child checkup—As one would expect, children in the low-coverage/care class had significantly higher odds of missing a well-child checkup compared to the low-risk group. Children in the disadvantaged smokers class also had over 2.5 times as high odds of missing a well-child check-up compared to those in the low-risk class. In supplemental analyses, we found that low-coverage/care children and the children of disadvantaged smokers had significantly higher odds of missing a well-child check-up than every other class except each other. No other differences were statistically significant.

Emergency room visits—Last, we conducted Poisson regression analyses of the number of emergency room visits reported for the sample child. Coefficients can be interpreted as the change in the log of the expected value of the dependent variable, given a one-unit change in the independent variable. For example, the log of the expected value of emergency room visits is 0.37 higher for low-SES-only children than for low-risk children. Children of disadvantaged smokers and children in the high-risk class also visited the emergency room more often, with the associated log values bout 0.4 and 0.8. Children in the high-risk group visited the emergency room a significantly greater number of times on average than every other group.

Finally, we considered the possibility that depressed mothers may report more adverse health statuses for their children, thus accounting for the association between maternal health and children's well-being. In additional analyses (available on request), we removed maternal depression from our LCA and included it as an additional control variable in our multivariate models. Removing depression from our LCA did not change our results, either in the clustering of economic and health disadvantage or the regression analyses.

Discussion

Previous research has demonstrated that SES and maternal health are associated with children's health. In this research, we asked how these factors cluster together and whether particular constellations of risk factors matter for children's health outcomes. We examined a range of children's health outcomes in order to understand patterns of association between these factors. This is an important topic of study, because children's health conditions have long-term consequences for health, well-being, and attainment in later life (Ferraro & Kelley-Moore, 2003). Understanding the social conditions of children's health will improve our ability to create policies and interventions to address these underlying factors, thereby alleviating health disparities (Link & Phelan, 1995).

Our first aim was to identify the ways in which socioeconomic and health disparities cluster within families. Although prior research has demonstrated that indicators of disadvantage, such as poverty and racial/ethnic minority status, are associated with health (Drewnowski &

Specter, 2004; Morello-Frosch et al., 2011; Roxburgh, 2009), we are unaware of any other study that tested an omnibus categorization of joint socioeconomic and health disadvantage. Using LCA, we found that families could be categorized into six classes, capturing the major cleavages in family SES, maternal health, and access to health care. In most cases, these classes reflected the primary socioeconomic and health groupings we expected: no SES or health disadvantages, SES disadvantage only, health disadvantage only, both, and a low-coverage/care group in good health. We also found a group of families characterized by disadvantaged single mothers who were smokers and reported moderate levels of other poor health outcomes. We also learned more about the distribution of these groups in the U.S. population. Although all of the groups characterized by maternal health disadvantages were relatively small, they jointly comprised over one quarter of U.S. families.

Our second aim was to describe how socioeconomic and maternal health factors are associated with children's health. We found strong support for the hypothesis that multiple socioeconomic and health risk factors are associated with children's health outcomes, and we found suggestive patterns in these associations. Although the children of unhealthy-only mothers were at an elevated risk of health problems, they were unlikely to miss well-child checkups or use the emergency room for medical care. This suggests that these families — largely intact families with economic resources — were better equipped to manage their children's health problems than low-SES families. On the other hand, children in the low-SES-only group exhibited higher odds of poor health outcomes as well as an elevated risk of using the emergency room for care. This outcome is undoubtedly related to health, but it also demonstrates the importance of SES in how parents manage children's health. The low-coverage/care group, which resembled the low-SES-only group in regard to socioeconomic and maternal health composition, however, did not show an increased risk of most poor health outcomes, but they were more likely to miss a well-child checkup. Two explanations are possible. First, this group is more heavily composed of immigrant mothers and Hispanics. Their children may exhibit health advantages previously identified among these groups (Escarce et al., 2006). It may also be the case, however, that limited use of medical care reduces the identification of health problems such as asthma and some activity limitations. More research is needed to understand the health outcomes of this group. Finally, children in the high-risk group exhibited notably high risks of all health conditions and emergency medical care. Children of disadvantaged smokers were at risk for several health-management-related items (missing school days and well-child checkups, as well as using the emergency room) as well as activity limitations. Surprisingly, they were at no more risk of being diagnosed with asthma than the low-risk group. In sum, our findings suggest that SES and maternal health are each associated with children's health outcomes, and the combination of these risk factors has an even greater impact.

Our findings support the expectations of an ecological model of family life, which predicts that individuals are embedded within family systems that exert a collective influence on the outcomes of each family member (Bronfrenbrenner, 1979). We argue that these associations may be explained through the shared environments, resources, and family processes present within the home, although we acknowledge that children's health problems may also affect these various dimensions of family life. The connections between maternal health and child health — and the social processes that account for these linkages — draw attention to the need for health policies that emphasize families as well as individuals. Policies that address intergenerational links in health, such as those that provide education about and access to health-promoting resources for all family members, may do more to improve all children's health than programs that focus on children alone. Thinking about health as a shared family experience can provide a new lens to policymakers when designing and implementing such policies.

In this study, we focused on maternal health as a proximate factor for children's health. Further research is needed to understand how paternal health is associated with children's outcomes. In addition, because our data are cross-sectional, we cannot state unequivocally that these relationships are causal. Parental health and economic resources are deeply entwined. Although this endogeneity supports our approach in assessing both components jointly, it is difficult to fully disentangle these factors. Health behaviors may be orthogonal to income and race/ethnicity, complicating these relationships. Children's health problems can also have an impact on family SES, through direct expenditures or the loss of a parent's income when children need care. Genetics may also complicate some pathways but, given the range of outcomes we studied, we believe these results suggest that factors external to genetics are forging a link between maternal and child health. Future research should continue to examine the social pathways of health and well-being within families. Isolating genetic, social, and interactive factors predicting children's health will ultimately improve our ability to construct policies useful for alleviating health disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix

Variable Coding Details

Variable	Question wording/description	Categories and description
Child's health		
Health is fair or poor	Would you say [child's] health is excellent, very good, good, fair, or poor?	1 = fair or poor 0 = good, very good, or excellent
Has asthma	Combination of "Has health professional ever told you [child] has asthma?" & "Does [child] still have asthma?"	1 = yes, has asthma currently 0 = no, does not have asthma currently
Is obese	Child's weight and height	1 = BMI >95th percentile of others youth's age 0 = not above the 95%ile
Has an activity limitation	Is child limited in any way?	1 = yes 0 = no
School days missed due to illness	During the past 12 months, about how many days did [child] miss school because of illness or injury?	0 to 60
Missed well-child checkup	Has someone in family talked to doctor/ health professional about child's health recently?	1 = within 6 months if less than 3 years old or within a year for older 0 = more than above categories
Number of emergency room visits	During the past 12 months, how many times has child gone to the hospital emergency room about his/her health?	0 = none 1 = one 2 = two – three 3 = four – five 4 = six – seven 5 = eight – nine 6 = ten – twelve 7 = thirteen – fifteen 8 = sixteen or more
Maternal health		
Health fair or poor	Would you say your health is excellent, very good, good, fair, or poor?	1 = fair or poor 0 = good, very good, or excellent
CES – D	Is respondent above cutpoint (7) in response to scale questions: "In the past 30 days, how often have you felt [sad, nervous, restless, hopeless, effort, worthless]?" (For each: 0 = *none of the time*, 4 = *all of the time*)	1 = yes 0 = no
Physically limited	How difficult is it for you to [walk, climb, stand, sit, stoop, reach, grasp, carry, push, shop, social, relax]? OR Any health problems that requires use of special equipment	1 = any limitation or use of special equipment 0 = no limitations
Has health condition	Ever been told by doctor you had diabetes, hypertension or high blood pressure, or any heart problem [coronary heart disease, angina/angina pectoris, heart attack, any kind of heart condition or disease]?	1 = yes 0 = no
Obese	Weight and height	1 = BMI of 30+ 0 = BMI of <30
Currently a smoker	Summary of several smoking-related questions	1 = smokes every day or some days 0 = former smoker or never smokes
Has a usual place to go when sick	Is there a place where you usually go when you are sick?	1 = no 0 = yes or more than one
Has medical insurance	Do you have health insurance? (Includes private insurance, Medicare, Medicaid, SCHIP, state-sponsored plan, other government programs, or military plan)	1 = no 0 = yes

Variable	Question wording/description	Categories and description
Family background		
Poverty	Created from family income and household size	0 = two times the household-adjusted poverty line or more 1 = less than twice the poverty line
Family structure	Summary of several family structure variables	0 = married, bio or adopt parents 1 = single parent, cohabiting parents, or stepfamily
Mother's education	Highest level of school completed	0 = high school graduate/GED or more 1 = less than high school
Number of kids in household	Generated variable, top-coded at 7	Continuous: 1 − 7
Mother's age	Age in years	Continuous: 18 – 75
Child's age	Child's age in years	Continuous: 0 – 17
Child is female	Child's sex	1 = female, 0 = male
Low birth weight	What was child's birthweight? (in grams)	1 = less than 2,500 g, 0 = 2,500 g or more
Race/ethnicity	Mother's race/ethnicity	Four indicators: White (reference), Hispanic, Black, and Asian

Note: BMI = body mass index; CES – D = Left for Epidemiologic Studies Depression Scale; SCHIP = State Children's Health Insurance Program.

Table 1

Weighted Descriptive Statistics for Dependent and Independent Variables (N = 7,361)

Variable	*M*	*SE*	Range
Children's well-being			
Health is fair or poor	.01	.001	0 – 1
Has asthma	.09	.004	0 – 1
Obese	.15	.014	0 – 1
Activity limitation	.08	.004	0 – 1
Missed school days due to illness	3.26	0.082	0 – 60
Missed well-child checkup	.10	.005	0 – 1
Number of emergency room visits	0.30	0.010	0 – 8
Disadvantage indicators			
Poor family	.40	.008	0 – 1
Fragile family	.35	.007	0 – 1
Mother is high school dropout	.15	.005	0 – 1
Mother's health			
Health is fair or poor	.08	.004	0 – 1
Depressive symptoms	.13	.006	0 – 1
Any physical limitations	.21	0.007	0 – 1
Serious health condition	.19	.006	0 – 1
Obese	.27	.007	0 – 1
Current smoker	.19	.006	0 – 1
Does not have usual place to go for care	.12	.005	0 – 1
Does not have health insurance	.18	.006	0 – 1
Demographics and family background			
Number of kids in family	2.42	0.022	1 – 7
Mother's age	36.6	0.118	18 – 75
Child's age	8.54	0.083	0 – 17
Child is female	.50	.008	0 – 1
Mother born in U.S.	.81	.006	0 – 1
Mother works in prof./mgr./skilled tech. occ.	.32	.007	0 – 1
Mother's race/ethnicity			
Hispanic	.19	.006	0 – 1
White	.64	.007	0 – 1
Black	.13	.005	0 – 1
Asian	.04	.003	0 – 1
Low birthweight	.10	.005	0 – 1

Note: prof. = professional; mgr. = managerial; tech. occ. = technical occupation.

Table 2

Weighted Conditional Probabilities of Responses for Six Latent Classes (N = 7,361)

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Variable	**Low risk**	**Unhealthy only**	**Low SES only**	**Low coverage/care**	**Smokers**	**High risk**
Percentage in each latent class	44.47%	11.66%	16.04%	12.55%	6.49%	8.79%
Mean predicted probability of being in class	.82	.70	.73	.84	.71	.81
Disadvantage indicators						
Poor family	.07	.13	.83	.86	.64	.86
Fragile family	.15	.22	.66	.35	.84	.66
Mother is high school dropout	.02	.03	.29	.52	.07	.29
Mother's health						
Health is fair or poor	.00	.15	.05	.07	.04	.54
Depressive symptoms	.03	.16	.12	.06	.19	.66
Any physical limitations	.08	.46	.11	.12	.21	.84
Serious health condition	.10	.52	.12	.17	.13	.50
Obese	.13	.53	.32	.28	.18	.59
Current smoker	.08	.15	.30	.08	.60	.46
Does not have usual place to go for care	.04	.01	.01	.49	.47	.15
Does not have health insurance	.03	.03	.01	.89	.55	.25

Note: SES = socioeconomic status.

Table 3

Weighted Logistic Regression Analyses of Children's Health Conditions on Latent Classes, Family Background, and Demographic Factors

	Overall health			Asthma			Obesity		
Variable	*B*	*SE*	OR	*B*	*SE*	OR	*B*	*SE*	OR
Latent class[a]									
Unhealthy only	1.27*	0.51	3.55	0.34	0.18	1.41	0.93**	0.31	2.53
Low SES only	1.12**	0.42	3.06	0.36*	0.15	1.43	0.75	0.40	2.11
Low coverage/care	0.64	0.55	1.90	−0.24	0.21	0.79	0.29	0.48	1.34
Smokers	0.52	0.67	1.69	0.14	0.24	1.15	−0.21	0.49	0.81
High risk	2.80***	0.38	16.47	0.83***	0.17	2.30	0.66*	0.33	1.93
Number of children in HH	−0.07	0.10	0.93	−0.07	0.05	0.93	−0.17	0.13	0.84
Mother's age	−0.01	0.02	0.99	−0.00	0.01	1.00	−0.02	0.02	0.98
Child's age	0.05	0.03	1.05	0.03**	0.01	1.03	−0.14*	0.07	0.87
Child is female	0.06	0.21	1.06	−0.35***	0.11	0.70	−0.81***	0.23	0.45
Mother born in U.S.	0.33	0.32	1.39	0.72***	0.18	2.06	0.23	0.35	1.25
Mother in prof./mgr./skilled tech. occ.	−0.05	0.32	0.96	0.16	0.12	1.18	−0.21	0.26	0.81
Race/ethnicity[b]									
Hispanic	1.12***	0.29	3.06	0.34*	0.15	1.41	0.72*	0.36	2.05
Black	0.90***	0.25	2.47	0.61***	0.13	1.85	0.53	0.31	1.70
Asian	0.55	0.66	1.73	0.11	0.40	1.12	−1.46*	0.68	0.23
Low birth weight (child)	0.52	0.28	1.68	0.34*	0.16	1.41	−0.04	0.41	0.96
Constant	−5.89***			−3.22***			1.15		
N	7,360			7,347			1,157		

Note: OR = odds ratio; SES = socioeconomic status; HH = household; prof. = professional; mgr. = managerial; tech. occ. = technical occupation.

[a]Reference category = low risk.

[b]Reference category = White.

*$p < .05$.

** $p < .01$.

*** $p < .001$.

Table 4

Weighted Analyses of Children's Health Limitations, School Days Missed, and Health Care Utilization on Latent Classes, Family Background, and Demographic Factors

	Activity limitation[a]			School days missed[b]			Missed well-child checkup[a]			Number of emergency room visits[c]		
Factor	***B***	***SE***	**OR**	***B***	***SE***	**IRR**	***B***	***SE***	**OR**	***B***	***SE***	**IRR**
Latent class[d]												
Unhealthy only	0.48*	.22	1.61	0.32***	.10	1.37	0.32	.23	1.38	0.11	.14	1.11
Low SES only	0.76***	.19	2.14	0.38***	.13	1.47	0.23	.17	1.26	0.37***	.15	1.45
Low coverage/care	0.23	.24	1.26	0.17*	.10	1.18	0.86***	.16	2.36	0.22	.15	1.25
Smokers	0.52*	.27	1.68	0.31**	.16	1.36	0.98***	.24	2.68	0.41*	.26	1.51
High risk	1.46***	.18	4.30	0.73***	.16	2.07	0.16	.26	1.17	0.80***	.22	2.23
Number of children in HH	0.06	.06	1.06	−0.05*	.02	0.95	0.19***	.06	1.21	−0.13**	.04	0.87
Mother's age	0.01	.01	1.01	0.00	.00	1.00	0.00	.01	1.00	−0.03***	.01	0.97
Child's age	0.05**	.02	1.05	0.01	.01	1.01	0.05**	.02	1.05	−0.01	.01	0.99
Child is female	−0.56***	.12	0.57	0.14**	.05	1.16	−0.03	.11	0.97	−0.12	.06	0.89
Mother born in U.S.	0.79***	.22	2.20	0.48***	.11	1.62	−0.08	.19	0.92	0.24*	.14	1.27
Mother in prof./mgr./skilled tech. occ.	−0.09	.14	0.92	−0.00	.06	1.00	−0.54***	.14	0.58	−0.16*	.07	0.85
Race/ethnicity[e]												
Hispanic	−0.44*	.21	0.64	−0.11	.06	0.89	0.21	.19	1.23	0.01	.10	1.01
Black	−0.37*	.16	0.69	−0.35***	.05	0.70	−0.02	.17	0.98	0.07	.09	1.07
Asian	−1.40*	.56	0.27	−0.10	.13	0.91	0.60*	.25	1.83	−0.32	.14	0.72
Low birth weight (child)	0.42*	.18	1.52	0.00	.07	1.00	−0.50*	.20	0.61	0.18	.13	1.20
Constant	−4.29***						−3.38***			−0.13		
N	7,357			5,156			7,340			7,356		

Note: OR = odds ratio; IRR = incident rate ratio; SES = socioeconomic status; HH = household; prof. = professional; mgr. = managerial; tech. occ. = technical occupation.

[a]Outcome predicted using logistic regression.

[b] Outcome predicted using negative binomial regression.

[c] Outcome predicted using Poisson regression.

[d] Reference category = low risk.

[e] Reference category = White.

* $p < .05$.

** $p < .01$.

*** $p < .001$.