

**The Impact of Familial Socioeconomic Resources on Childhood Sickness:  
Evidence from Late 19th Century America**

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**ABSTRACT**

*Objectives.* We estimated the impact of socioeconomic status (SES) on children's sickness in late 19<sup>th</sup> century America --- an era when many common illnesses and diseases were largely unpreventable --- in order to understand whether the capacity to avoid sickness is a precondition for SES gradients in health.

*Methods.* Using logistic regression techniques and data from linked 1870 and 1880 U.S. Census records, we modeled childhood sickness in 1880 as a function of SES in 1870 and 1880. We estimated the impacts of parents' wealth, literacy, and occupation on whether children were sick in 1880 and on whether children suffered from (1) infectious, mosquito-borne diseases, (2) other infectious diseases, (3) traumatic injuries, (4) chronic diseases, and (5) unclassifiable diseases.

*Results.* SES was associated neither with children's overall odds of sickness in 1880 nor with their odds of suffering from any of the specific categories of sickness in that year.

*Conclusions.* Although 19<sup>th</sup> century SES gradients in childhood mortality are well-documented, there appear to have been weaker SES gradients in morbidity. These findings may have implications for modern developing countries.

## The Impact of Familial Socioeconomic Resources on Childhood Sickness: Evidence from Late 19<sup>th</sup> Century America

Did socioeconomic status (SES) gradients in disease exist before there were effective means of avoiding disease? Modern theories about the origins of health gradients contend that SES inequalities translate into health disparities only when socioeconomically advantaged people can deploy their resources to effectively prevent disease. In this article, we ask two questions on this topic. First, how large were SES gradients in U.S. children's health in the late 19<sup>th</sup> century, prior to the development of germ theory and effective public health interventions? Second, did SES gradients in American children's health in that era vary by disease type, such that gradients were more pronounced for diseases that advantaged people could inadvertently avoid (e.g., via residential or occupational segregation)? Our analyses and results are important for empirical, theoretical, and policy reasons.

Empirically, we know little about SES gradients in *morbidity* in the U.S. before the mid-20<sup>th</sup> century. There were gradients in mortality in the U.S. in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, at least in some locales;<sup>1-5</sup> there is also considerable evidence about trends in SES gradients in mortality in the U.S. since the mid-20<sup>th</sup> century.<sup>6-8</sup> However, with only a few exceptions,<sup>9,10</sup> evidence about health disparities in the U.S. comes from samples of individuals observed after the middle of the 20<sup>th</sup> century. Our first research question will thus provide new empirical evidence about 19<sup>th</sup> century U.S. health disparities.

Theoretically, the case of health disparities in the late 19<sup>th</sup> century U.S. facilitates exploration of a key corollary of "fundamental cause" theory:<sup>11-13</sup> Health risks must be preventable or treatable in order for there to be SES gradients in morbidity and mortality, regardless of whether an individual is aware of how to prevent this health risk. In the U.S. in the late 19<sup>th</sup> century, many of the most common diseases --- tuberculosis, malaria, measles, and others --- spread via means that were scarcely understood at the time, even by those with socioeconomic advantages. Although higher SES people

could not do much *intentionally* to avoid diseases, some of their actions may have *unintentionally* produced SES gradients. For example, residential segregation patterns may have resulted in concentrations of infectious disease among disadvantaged people who were forced to live in close quarters in the middle of cities. Better nutritional status may have afforded high SES families with greater host-resistance to many infectious diseases such as tuberculosis. Likewise, occupational exclusion potentially resulted in the concentration of traumatic or repetitive stress injuries among working class people. Our second research question is thus motivated by a desire to explore differences across disease types in the magnitude of SES gradients. We expect to observe weaker SES gradients for diseases that could not have been avoided, even inadvertently, in the late 19<sup>th</sup> century (e.g., those spread by mosquitoes and some chronic diseases) but larger gradients for diseases that could have been inadvertently avoided (e.g., illnesses spread by close person-to-person contact or injuries usually sustained in manual jobs).

From a policy point of view, our findings about the 19<sup>th</sup> century U.S. may be germane to efforts to understand disease prevalence and health disparities in modern developing countries. In many ways, modern developing countries resemble the U.S. of the late 1800s: Rates of disease were high, the profile of diseases featured relatively more infectious illnesses, public health infrastructure was minimal, and the welfare state was relatively weak. Although the comparison is not perfect --- for example, the U.S. of the late 19<sup>th</sup> century was not part of a globalized economy, did not benefit from non-governmental charitable organizations, and did not face the same demographic pressures --- the answers to our questions may nonetheless provide insight into health disparities in modern developing countries.

Were there SES in gradients in American children's health in the late 19<sup>th</sup> century, and did those gradients differ across disease types? Our results contribute new empirical evidence about historical SES gradients in morbidity (as opposed to mortality); provide theoretical insight into the role of disease

preventability in the emergence of SES gradients in disease; and, are useful for understanding public health issues in modern developing countries.

## **METHODS**

The 1880 U.S. Census is the only (surviving) enumeration to include a direct question about each household member's health. To model SES gradients in morbidity, we linked children's census records from 1880 (where their health is observed) to their records in 1870 (where more complete SES measures are available).

### **Data**

We began with data on people living in households included in the random 10% and 1% samples from the 1880 Census.<sup>14</sup> From this 11% sample of the U.S. population in 1880, we randomly selected children between the ages of 11 and 14 in that year; conceptually, these children were old enough to have been alive in 1870 but too young to be at high risk of moving out of their parents' households. Children were classified according to whether they had any sickness or disability in 1880. We randomly selected 1,898 sick children from this group (a total of about 75.9% of all sick children) and 1,902 non-sick children (a total of about 0.4% of all non-sick children).

Using genealogical methods and the website Ancestry.com --- and relying on information about children's and each of their family members' names, ages, places of birth, and place of residence in 1880 --- we attempted to locate these 3,800 children and their families in the 1870 Census. We successfully linked records for 1,190 (or 63% of) children who were sick in 1880 and 1,173 (or 62% of) non-sick children. Linkage rates did not vary significantly by parents' literacy or by children's sickness, race, or sex. Our linking procedures are described more completely elsewhere.<sup>15</sup>

### **Measures**

*Health.* The 1880 Census included the following health question, which was asked in reference to each person in the household: "Is the person [on the day of the enumerator's visit] sick or temporarily

disabled, so as to be unable to attend to ordinary business or duties? If so, what is the sickness or disability?" Although this measure is known to undercount health problems among some groups,<sup>16</sup> it has been used profitably in a variety of research applications.<sup>16, 17</sup> We classified children in 1880 according to whether they had any sickness or disability (0=Not Sick, 1=Sick); as noted above, our linked 1870-1880 sample includes 1,190 sick children and 1,173 non-sick children. We then examined the text strings describing sick children's health problems and coded them into one of five mutually exclusive categories: *infectious, spread by mosquitoes* (e.g., malaria); *infectious, not spread by mosquitoes* (e.g., tuberculosis); *traumatic injuries* (e.g., missing limbs); *chronic diseases* (e.g., cancer); and *all other* (or unclassifiable) sicknesses. As shown in Table 1, among sick children we most frequently observe infectious diseases not spread by mosquitos and chronic diseases. However, 1 in 20 sick children suffered from a mosquito-borne infectious disease and about 1 in 8 suffered from a traumatic injury.

*SES.* The 1870 and 1880 Censuses each indicate household members' ability to read and write. Separately for 1870 and 1880, we classified children according to whether both their mother and their father could read and write (0=No, 1=Yes). As shown in Table 1, in 1870 almost 1 in 3 children had at least one parent who could not read and write. For both 1870 and 1880, text strings describing children's father's occupation was coded to the occupational classification standards of the 1950 U.S. Census. From those codes, we have constructed a measure of whether the father was a farmer (0=No, 1=Yes) and we have continuously scaled occupations according to Duncan's Socioeconomic Index (SEI).<sup>18</sup> Finally, the 1870 Census includes two measures of wealth: one that reflects the value (in dollars) of the household's real estate and one that reflects the value (in dollars) of the remainder of the household's personal estate. In our sample, more than half of all children lived in households with at least some real estate wealth in 1870, and about three quarters of children lived in households with any personal estate wealth.

*Controls.* We include measures of focal children's sex (1=Male, 0=Female) and race (1=Black, 0=White) in 1880; almost no children were identified as anything other than white or black.

### **Statistical Analyses and Modeling**

All statistical analyses were carried out using Stata (version 11, Statacorp, College Station, TX). Missing data on the SES variables were imputed using the multiple imputation routine ICE<sup>19</sup> in Stata. Five imputed datasets were analyzed together using MICOMBINE. We did not impute values when data were missing because records could not be linked.

### **RESULTS**

In Table 1 we present descriptive statistics for all variables for the 2,363 children included in the linked 1870-1880 sample. The left portion of the table pertains to all children; the middle and right portions pertain to sick and non-sick children, respectively. Separately for each variable, the final column reports *p*-values from *t*- or *Z*-tests comparing values for sick and non-sick children. Sick children are more likely to be male and to live in households with less personal estate wealth. However, sick and non-sick children are equivalent with respect to all other SES measures observed in 1870.

Table 2 reports results from a series of logistic regression models. First we regressed a binary indicator of whether children suffered from *any* sickness or disability in 1880 (0=No, 1=Yes) on children's race, sex, and the several measures of SES obtained in 1870. Although children's odds of having any sickness or disability vary as a function of sex and race, we observed no significant association between SES and children's odds of sickness. The next columns in Table 2 report results from logistic regressions of binary indicators of whether children suffered from particular categories of disease (0=No, 1=Yes); in each model, children who suffered from a different disease than the one considered in the model were excluded. With only one exception --- which is to be expected by chance --- we found no significant associations between children's odds of having particular types of disease and their SES in 1870. In general, we observed no SES gradients in health in our linked 1870-1880 sample.

Could this null finding be driven by sample selection bias resulting from our inability to link all children's records between 1870 and 1880? That is, could our linked sample differ from the full population in such a way that obscures health gradients? To explore this possibility, we re-estimated the models shown in Table 2 using only the SES measures available in 1880 --- parents' literacy and father's occupation. Although we could not consider measures of household wealth in these models --- since those measures were only available in 1870 --- the fact that these models utilized data *only* from 1880 meant that we could include all of 3,800 children we originally sampled from the 1880 Census. Our results are identical: We observed no significant associations between children's odds of sickness and their SES.

## **DISCUSSION**

In this article we posed two empirical questions. First, we asked how large SES gradients in children's health were in late 19<sup>th</sup> century America, before there were effective ways to avoid many of the most common diseases. Second, we asked whether those SES gradients varied by disease type, such that gradients were more pronounced for diseases that advantaged people could inadvertently avoid. We observed no relationships between SES and late 19<sup>th</sup> century American children's odds of being sick at all or of being sick with particular types of illnesses or disabilities.

These empirical findings can be interpreted in one of at least three ways. First, it may simply be the case that there were, in fact, no measurable SES gradients in American children's sickness in the late 19<sup>th</sup> century. Accidents and infectious diseases happened to children regardless of their families' socioeconomic resources; mosquitos bit rich and poor alike, almost nobody had reliable access to clean water, and farm and industrial accidents were widespread.

A second interpretation of the results in Tables 1 and 2 is that lower SES families under-reported children's sickness. The 1880 sickness question asks about illnesses or disabilities that made people "unable to attend to ordinary business or duties." Two aspects of the question wording are of interest.



First, the word “unable” may not have meant the same thing to everyone. Whereas lower SES children may have been sick, their financial need may have been such that they had to attend to their duties anyway; higher SES children may have interpreted the same sickness as entirely preventing their attention to business or duties. A fever may have been unpleasant for a lower SES child, but they were still “able” to work; in contrast, a higher SES child with the same fever may not have had the same work imperative. The result being that any real SES-morbidity differences were nullified by a bias in the way the respondent answered the question. Second, the reference to “business or duties” may have been interpreted as referring to people’s jobs or farm responsibilities (and not to school or leisure activities as would be the case in current times). It is not clear how higher SES families would respond to this question if their sick child had no job- or farm-related “business or duties” in the first place.

A third interpretation of our empirical findings is that SES gradients in *mortality* may be obscuring SES gradients in *health* among these children. In Figure 1 we present a heuristic diagram that depicts the processes we hypothesize may have been at work. In the diagram, each shaded bar represents a child’s life. For the sake of illustration, there were five “high SES” and five “low SES” children; all were born before 1880. Suppose, as noted in the figure, that there were SES gradients in the rates at which children became sick: 4 of 5 low SES children got sick but only 3 of 5 high SES children got sick. Nonetheless, in 1880 we observe no SES gradient in sickness: In that year, half of low SES children and half of high SES children were sick. This result --- the lack of an SES gradient in 1880 despite higher incidence rates among low SES children --- was entirely due to higher mortality rates among low SES as compared to high SES sick children. As depicted in the figure, 1 in 3 high SES sick children died before 1880; in contrast, 3 in 4 low SES sick children died prior to 1880.

To what degree did reality in 1880 reflect the situation depicted in this heuristic diagram? Our results provide no evidence on this question, but it seems reasonable to suppose that observed SES gradients in child mortality in this era<sup>5</sup> also held among children who got sick. Thus, it seems plausible

that SES differences in actual incidence rates of sickness were obscured by SES differences in survival rates among sick children, which resulted in no observed SES gradients in health.

Nothing in our evidence allows us to adjudicate between these three interpretations of our empirical findings. However, we would note that the latter two --- each of which implies that there *were* SES gradients in morbidity that we are simply unable to observe --- may also affect our understanding of modern SES gradients in developing countries. That is, if there are SES gradients in childhood morbidity, SES group differences in how health questions are interpreted and/or in rates of child mortality may inhibit our ability to observe them.

### **Limitations**

The data we used are imperfect in many respects. Our measure of health in 1880 is crude by modern standards, and is known to modestly undercount sickness among some groups.<sup>16</sup> Our analyses rely on linked 1870-1880 Census records, and our rates of linkage are far from perfect. Where possible, we have tested the robustness of our findings to assumptions about these sorts of limitations in the data. For example, our main finding about SES gradients in health holds in separate analyses --- the results of which are available upon request --- that focus just on specific racial and gender groups; this alleviates concerns about the impact of group-specific undercounts in rates of sickness.

### **Conclusions**

Although 19<sup>th</sup> century SES gradients in childhood mortality are well-documented, there appear to have been weaker SES gradients in morbidity. These findings may have implications for research on health disparities in modern developing countries.

### **Human Participant Protection**

Institutional review board approval was not needed for this project because only publicly-available secondary data resources were used.

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Table 1. Descriptive Statistics for All Variables (Linked 1870-1880 Records)

	Full Sample (Max. N = 2,363)			Sick in 1880 (Max. N = 1,190)			Not Sick in 1880 (Max. N = 1,173)			p
	Valid N	Avg/%	(sd)	Valid N	Avg/%	(sd)	Valid N	Avg/%	(sd)	
<i>Child's Type of Sickness</i>										
No Sickness	2,363	50%		1,190	0%		1,173	100%		—
Infectious (Mosquitoes)	2,363	3%		1,190	5%		1,173	0%		—
Infectious (Germs)	2,363	17%		1,190	33%		1,173	0%		—
Traumatic Injury	2,363	7%		1,190	13%		1,173	0%		—
Chronic Disease	2,363	10%		1,190	20%		1,173	0%		—
Other Sicknesses	2,363	14%		1,190	28%		1,173	0%		—
<i>Child's Demographic Characteristics</i>										
Child is Male	2,363	51%		1,190	53%		1,173	49%		<b>0.04</b>
Child is Black	2,363	14%		1,190	13%		1,173	15%		0.08
<i>Family Wealth in 1870</i>										
Real Estate Value (\$100s)	2,033	16.2	(32.4)	1,026	16.0	(31.0)	1,012	16.4	(33.7)	0.81
% with \$0	2,033	44%		1,026	45%		1,012	44%		0.82
Personal Estate Value (\$100s)	2,131	7.6	(26.1)	1,074	6.3	(13.4)	1,063	9.0	(34.4)	<b>0.02</b>
% with \$0	2,131	27%		1,074	26%		1,063	27%		0.65
<i>Father's Occupation in 1870</i>										
Father is a Farmer	2,363	55%		1,190	54%		1,173	56%		0.28
Occupational SEI	2,250	18.8	(17.2)	1,133	18.3	(16.4)	1,117	19.3	(18.0)	0.16
<i>Parents' Literacy, 1870</i>										
Both Parents are Literate	2,363	69%		1,190	68%		1,173	69%		0.92
At least one parent not literate	2,363	31%		1,190	32%		1,173	31%		0.83

Note: The right-most column reports the p-value associated with hypothesis tests of the equality of means or proportions between sick and non-sick children. Bolded p-values are significant at the  $\alpha=0.05$  level or below. See text for a description of the data and measures.

Table 2. Logistic Regressions of Children's Sickness Type (0=Not Sick, 1=Has That Sickness) in 1880, by Child's Demographic Characteristics and Family Socioeconomic Background in 1870, FULL SAMPLE

	<b>Any Sickness</b> (n <sub>Sick</sub> =1,190) (n <sub>Not Sick</sub> =1,173)	<b>Infect. Dis. Spread by Mosquitoes</b> (n <sub>Sick</sub> =61) (n <sub>Not Sick</sub> =1,173)	<b>Infect. Dis. Spread by Germs</b> (n <sub>Sick</sub> =397) (n <sub>Not Sick</sub> =1,173)	<b>Traumatic Injury</b> (n <sub>Sick</sub> =157) (n <sub>Not Sick</sub> =1,173)	<b>Non-Traum. Chronic Disease</b> (n <sub>Sick</sub> =233) (n <sub>Not Sick</sub> =1,173)	<b>Other Sicknesses</b> (n <sub>Sick</sub> =342) (n <sub>Not Sick</sub> =1,173)
	b  b/se	b  b/se	b  b/se	b  b/se	b  b/se	b  b/se
<i>Child's Demographic Characteristics</i>						
[Child is White Female]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]
Child is Black	<b>-0.34 (2.50)</b>	-0.99 (1.73)	-0.12 (0.62)	-0.16 (0.58)	<b>-0.85 (3.16)</b>	-0.29 (1.39)
Child is Male	<b>0.17 (2.00)</b>	-0.03 (0.12)	-0.21 (1.76)	<b>0.79 (4.33)</b>	<b>0.29 (1.99)</b>	<b>0.28 (2.24)</b>
<i>Child's Family Socioeconomic Background in 1870</i>						
Parents' Literacy in 1870						
[Both Parents are Literate]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]
At least one parent not literate	-0.09 (0.90)	0.16 (0.48)	-0.05 (0.31)	-0.12 (0.58)	-0.20 (1.18)	-0.08 (0.52)
Real Estate Value in 1870						
[\$0]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]
\$100-\$800	0.03 (0.19)	-0.12 (0.27)	-0.05 (0.24)	0.04 (0.13)	0.37 (1.27)	-0.03 (0.14)
\$800-\$1800	0.24 (1.67)	-0.06 (0.14)	0.22 (1.08)	0.18 (0.61)	<b>0.55 (2.12)</b>	0.22 (1.02)
\$1800-\$3800	0.05 (0.31)	0.15 (0.30)	-0.03 (0.14)	0.14 (0.42)	-0.04 (0.15)	0.24 (0.89)
>\$3800	0.07 (0.42)	-0.46 (0.92)	0.26 (1.04)	0.17 (0.53)	0.09 (0.33)	-0.09 (0.37)
Personal Estate Value in 1870						
[\$0]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]	[Ref. Category]
\$100-\$200	0.01 (0.08)	0.39 (0.73)	-0.03 (0.11)	0.34 (1.01)	-0.11 (0.42)	-0.06 (0.27)
\$200-\$500	-0.09 (0.71)	-0.14 (0.37)	-0.25 (1.30)	0.36 (1.24)	0.06 (0.27)	-0.19 (0.96)
\$500-\$1000	-0.04 (0.27)	0.41 (0.85)	-0.21 (0.90)	0.23 (0.74)	0.05 (0.21)	-0.10 (0.44)
>\$1000	-0.05 (0.31)	0.37 (0.68)	-0.21 (0.80)	-0.24 (0.81)	0.23 (0.82)	-0.07 (0.29)
Father's Occupation in 1870						
Father's Occupational SEI	0.00 (1.68)	-0.01 (1.13)	0.00 (1.00)	-0.01 (1.01)	0.00 (1.05)	0.00 (0.94)
Constant	-0.08 (0.20)	<b>-3.25 (2.32)</b>	-0.66 (1.18)	<b>-3.33 (4.02)</b>	<b>-2.46 (3.46)</b>	-1.18 (1.81)

Note: Missing data on the independent variables are imputed using the multiple imputation routine ICE in Stata. Five multiply imputed data sets are analyzed together using MICOMBINE. Bolded coefficients are significant at the  $\alpha=0.05$  level or below. See text for a description of the data and measures.

Figure 1. Hypothesized Relationships Between Children's SES, Sickness, and Mortality

