

Family Wealth and Mortality: An Analysis of Alternative 19th Century Data Sources.

Douglas L. Anderton,
Social and Demographic Research Institute, University of Massachusetts-Amherst

Jeffrey K. Beemer
Social and Demographic Research Institute, University of Massachusetts-Amherst

Susan I. Hautaniemi Leonard
ICPSR and Population Studies Center, University of Michigan-Ann Arbor

Abstract

With increasing availability of ante-bellum micro-census data which includes real and personal wealth for the population of the United States, there is a resurgence of interest in the impact of socioeconomic status and familial resources on mortality in the early stages of mortality transition. Ferrie's analysis of socioeconomic status and mortality in the U.S. from 1850-1860 is one such study (2002). Other data resources are required to track these relationships through the transition and the "dark ages of American Inequality" (Williamson and Lindert 1980), after which census wealth data are unavailable. Steckel's comparison of tax assessment and wealth records (1994) as well as our own efforts to link tax assessment records to the Connecticut River Valley historical demography project's database, provide an opportunity to extend wealth analyses into the later years of the nineteenth century and to cross-validate census and tax wealth records. In this paper we examine individual and familial discrepancies in reporting of wealth in census and tax records to identify potential biases in studies that use each type of data resource. The impact of these discrepancies for studies of family wealth and mortality are illustrated through comparative modeling using the two resources.

Draft prepared for presentation at the International Conference on Kinship and Demographic Behavior, University of Utah, Salt lake City, Utah, October 31, 2005. Please do not reproduce or cite without authors' permission.

Introduction

Over the past decade, there has been a resurgence of research on historical mortality transitions in conjunction with the standard of living debate (e.g. Anderson 1996; Bengtsson, et al. 2004; Corsini & Viazzo 1997; Fogel & Costa 1997; Meckel 1990, Preston & Haines 1991; Scott & Duncan 1998; Schofield et al. 1991; and Steckel & Floud 1997). These national and international studies have clarified the effect of family wealth and the complex interactions of proximate determinants of infant and childhood mortality during nineteenth-century mortality transitions. One result of this research is a growing recognition that the complexity of health and wealth relationships requires more than the typical one dimensional approach that characterized much of the earlier research on wealth and health. Further fine-grained analyses are needed in which associations uncovered in national or regional-level data can be more sensitively measured and understood in specific disease environments (e.g. Steckel & Floud 1997; Reid 1997; Lee 1997). Some individual-level and small-area studies (e.g. Reid 1997) suggest standard of living may have effects only in the “worst” health environments and others (e.g. Lee 1997) suggest the effects of wealth may be overwhelmed, or less pronounced, in the face of high infectious mortality. The situation is further complicated in longitudinal studies which address the effects of wealth over the course of the epidemiological transition as mortality environments, as well as populations themselves, change .

Our research addresses the complex relationship between family wealth and mortality by looking at the sociodemographic correlates of mortality in New England during the late nineteenth-century mortality decline. Preliminary studies, using limited wealth and occupation information available from early censuses, support the idea of wealth or class effects for infant mortality during the most stressful periods of New England’s emergent industrial urban centers (Hautaniemi et al. 1999; Hautaniemi 2002). As Reid (1997) suggests, these findings may

provide some theoretical reconciliation of opposing views (e.g. Preston & Haines 1991 and Woods & Williams 1995) by furthering our understanding of how social class differentials were influenced by health knowledge, material resources and stressful environments in local contexts. In our previous New England research we have focused specifically on the localized socioeconomic, public health and compositional effects on mortality and mortality decline in Northampton and Holyoke – two emergent urban/industrial mill towns of western Massachusetts. These small towns experienced the full force of population and urban/industrial growth concurrent with epidemic mortality in the mid-nineteenth century. New England as a whole had higher child mortality levels than other regions of the country and experienced a mortality plateau throughout the latter half of the nineteenth century. By the time of sustained mortality decline at the turn of the century these cities had matured into substantial urban/industrial centers – population growth had slowed, public health infrastructures had been initiated, and the population aged significantly as mortality and immigration of younger factory laborers declined. Accordingly, Northampton and Holyoke constitute a case study of stressful emerging urban-industrial environments in which localized determinants of mortality and mortality decline are especially salient. We expect relationships between family wealth and mortality might be more readily discerned in such settings than at a national/regional scale or within widely studied urban centers like New York, Philadelphia and Chicago, that were already well settled and relatively well developed at the onset of the mortality transition.

This article focuses more specifically on the impact of family wealth on individual -level mortality during the early stages of the mortality transition in Northampton and Holyoke, Massachusetts and the complexities in analyzing wealth effects in dynamic emerging urban-industrial settings of the nineteenth century. We use an existing individual-level database constructed by computerized linkage of sampled census records from each town and census

between 1850 and 1910 to corresponding death records from the two years following each census. These linked records were then supplemented through a further linkage of tax valuation records. The linkage of tax records allows us to compare, or validate the analysis of wealth data in early U.S. censuses with wealth and wealth effects estimated from local tax records. In addition, the tax assessments allow us to extend our analysis of wealth effects into the period of time after the U.S. Census ceased collecting wealth data, i.e. the so called “dark ages of American inequality” (Williamson & Lindert 1980, 47). For the present paper we focus our analysis on a subset of this database to investigate family wealth effects on mortality between 1860 and 1880 during peak periods of growth in the emerging towns which extend beyond, yet overlap, the reporting of wealth in the U.S. Census.

The Complexity of Locally Situated Mortality Transitions

The theory of a monotonic mortality transition occurring in western Europe and the U.S. across the late 19th and early 20th centuries has given way to an awareness of a much more complex set of conditions and experiences that vary across time and space (e.g. see Bengtsson, et al. 2004; Corsini & Viazzo 1997; Fetter, Coelho, Rogers & Nelson 1997). For the US, in particular, the evidence suggests that socioeconomic conditions, health, and mortality actually may have declined in the third and early fourth quarters of the nineteenth century (e.g. Costa & Steckel 1997; Swedlund 1990; Hautaniemi et al. 1999). Regional variations, including those in the particularly stressful urban environments of New England’s emergent (or ‘new’) industrial cities, provide natural laboratories, which offer opportunities to gain appreciable understanding of the constellation of variables and accompanying interactions that produced varying outcomes.

In the U.S., sustained mortality decline began in the 1870s. Dramatic changes followed quickly. Expectation of life improved from 47 to 51.5 years from 1880 to 1900 as the infant

mortality rate fell from about 225 in 1880 to 114 in 1910 (Preston & Haines 1991, Table 2). Urban mortality decline played a central role in the epidemiological transition and, in turn, introduced fundamentally changing patterns of mortality and morbidity by age, sex, socioeconomic status, etc. As Haines and Preston note (1997), "Improvement was most rapid in large urban areas where mortality had been the worst ... mortality improved for virtually all groups ... but relative differentials shifted. Unfortunately, this important series of events is only imperfectly documented. Vital registration data did not cover the entire U.S. until the Death Registration Areas (DRA) was complete in 1933" (77). Even where registration data are available, important individual-level detail is often absent, e.g. "occupation of parents is rarely reported in conjunction with child deaths" (Haines & Preston 1997:92). Yet, analyses resorting to aggregate data have a clearly limited potential to disentangle the complex changes in relative cause-specific mortality and shifting sociodemographic mortality influences in the midst of rapid social change.

General mortality levels over this period were particularly high in New England. And, although Preston and Haines (1991) do not distinguish newly emergent or rapidly growing urban/industrial centers from the existing large cities, size of place had a pervasive influence on turn of the century mortality in their analysis. Mortality was elevated by 20% in cities of 5,000-24,999 and by 30% in larger cities. At the same time, mortality was actually lower among the very largest cities (similar patterns characterize Quebec, Montreal and nearby towns - Pelletier et al. 1997). Preston and Haines (1991) largely attribute higher urban mortality to density and direct contamination of common resources such as food and water supplies. Public health assault on these urban mortality threats were just beginning in the 1890s and likely to have been limited to specific localities with such measures.

Urban mortality change in the latter part of the 19th century had profoundly different impacts upon different age groups (e.g. Crimmins & Condran 1983; Hautaniemi 2002; Higgs 1979; Higgs & Booth 1979; Preston & Haines 1991) and different sex-specific age groups (e.g. Elman & Myers 1997; Waldron 1983; Preston 1976; Retherford 1975). Perhaps the greatest strides in understanding mortality change have been in our ability to document patterns in infant and childhood mortality. The resurgence of interest in explanations of infant mortality produced a number of landmark studies in the U.S. (e.g. Condran & Crimmins-Gardner 1978; Meeker 1972; Higgs 1973; Higgs & Booth 1979; Haines 1977; Preston & Haines 1984; Smith 1983; Vinovskis 1972; etc.). In addition, a number of studies undertook to examine specific trends in urban areas (e.g. the Philadelphia Social History Project - Condran & Cheney 1982; Condran et al. 1984). A key issue in many of these studies was the attempt to estimate the effect of associations among household/family, socioeconomic, and public health variables and the rates of infant or childhood mortality. Parallel studies were also being conducted using European data (e.g. see Haines & Preston 1985; Preston & van de Walle 1978; and Szreter & Mooney 1998). Preston and Haines's Fatal Years (1991) provided a comprehensive study of cross-regional variation in U.S. childhood mortality at the turn of the century. Much of this work has used unlinked, aggregate census or registration data and has thus been able to capture general trends while sacrificing the opportunity to look at more specific associations and interactions which are likely to be discerned only with detailed individual data in localized settings. For example, studies of specific localities and/or the use of localized health intervention data (e.g. Boston - Meckel 1985; Philadelphia - Condran et al. 1984; Condran & Cheney 1982) have proved more successful in isolating the role of specific improvements in general public health measures such as improved water and sewage systems, quarantines, etc. Studies of aggregate data have been less clear in support for the import of public health initiatives (e.g. Crimmins & Condran 1983;

Preston & Haines 1991) or find a more general importance of socioeconomic status (e.g. Higgs 1979).

Previous research has clarified several issues regarding changes in childhood mortality and refined competing hypotheses explaining the timing and cause of mortality declines. At issue have been the proportional contributions of medical intervention, public health measures, nutrition, socioeconomic status, ethnicity, and education/knowledge of parents/household members, etc. (e.g. Antonovsky 1967; McKeown & Record 1962; McKeown 1976; Fogel 1986; Preston 1985; Szreter 1988; McKinlay & McKinlay 1977). Compelling arguments have been made that nutrition and socioeconomic status (i.e. class) were not major mortality determinants in the U.S. prior to the early 1900s (e.g. Preston & Haines 1991), but questions remain on these points, especially the cumulative role of early childhood experiences on lifelong frailty (e.g. Fogel 1993; Condran & Cheney 1982). What seems to be clear is that, in the first decades of the 20th century, wages and other socioeconomic variables account for substantial variations in childhood mortality in U.S. cities (e.g. Condran 1994; Swedlund & Ball 1998; Hautaniemi et al. 1999; Woodbury 1926). Again, localized studies are more sensitive to the effects of childhood mortality determinants such as wage differentials which may be obscured by regional variation in aggregate studies. And, in settings of urban/industrial change socioeconomic effects are further complicated by rapid changes in occupational structures, population composition, immigration, etc., which require a detailed individual/family level of analysis to address the relative importance of childhood mortality determinants.

The mortality transition also resulted in important changes in adult health and mortality in the late 19th and early 20th century (e.g. Preston 1996). A number of studies have documented the importance of sharply changing age or sex-age-specific differentials (e.g. Alter & Riley 1989; Elman & Myers 1997; Pope 1992; Preston 1976; Retherford 1975; Riley 1987; Verbrugge

1989; Waldron 1993; Woods 1993). Sex and age-specific changes, including collinear socioeconomic mortality differentials, reflect new regimes of occupational exposure, rising rates of degenerative diseases, and the possibility of emerging ecologies which may increase the risk of contracting certain infectious diseases as other infectious diseases decline (e.g. Elman & Myers 1997). Crimmins and Condran (1983), for example, noted a greater contribution of airborne diseases to adult mortality, and waterborne diseases to infant mortality, in mortality trends while Condran et al. (1984) demonstrate the resulting differential impact of public health improvements on adult and infant mortality. Heterogeneities in the response of working-age individuals can be expected during health transitions, including a shift to mortality at older ages, a rising incidence of degenerative diseases, increased relative male mortality, and even overall increases in the rates of adult mortality (Pope 1992). These changes in adult mortality are amplified by patterns of development and population growth in the emergent urban/industrial towns of New England characteristic of many developing countries. Initial rapid population growth in these towns was fueled by younger factory labor immigrants seeking new opportunities in developing sectors. As immigration became a smaller segment of the growing urban population and population growth stabilized, urban centers experienced an aging population coincident with a decline in infant and childhood mortality. For some ethnic groups migration also changed from predominantly younger factory workers to family migration. This combination of trends accelerated aging of the population and presumably accentuated age-sex-specific changes in mortality over the course of the transition.

The Emergent Urban-Industrial Towns of Northampton and Holyoke

Our focus on specific emergent urban/industrial communities provides a locale in which such effects might be most salient and readily identified. Again, the use of detailed individual-

level data on wealth, household/family structure, cause of death, nativity, etc., is required to address competing mortality influences in a complex longitudinal analysis.

Over the course of the early mortality transition, between 1850 and 1910, the emergent mill towns of Northampton and Holyoke changed dramatically due to industrial growth. Both communities experienced the full impact of industrialization but differently. Northampton's population quadrupled during this period, from 5,278 in 1850 to 19,431 in 1910, as it transitioned from a rural market economy to a robust mix of industry, agriculture, and commerce (Hautaniemi 2002, 43). Northampton's infrastructure developed slowly, with severe housing shortages and lack of public works contributing to poor public health conditions. There were a small number of industrial mills of moderate size in Northampton which in 1855 employed only 10 percent of the labor force in the valley (Hankins 1954). A number of these firms were destroyed by a major flood in 1874 and many of the larger concerns moved to nearby Holyoke (Benson 1954; Jacob 1999; Green 1939). Although Northampton never recovered to emerge as a major industrial center, mixed industry continued as part of a diverse economy, with farming and commercial trades, in this county seat (Hautaniemi 2002).

Over this same period, Holyoke residents experienced similar conditions but on a much larger scale. By comparison, Holyoke's population grew far more rapidly, from 3,249 in 1850 to 59,732 in 1910 (Hautaniemi 2002, 54). Like Northampton, economic opportunity was the driving force underlying this growth. Holyoke's industrial emergence followed a more deliberate and singular path however. Unlike Northampton, Holyoke was a planned community due to the vision and intervention of the Boston Associates. Earlier ventures in Lowell and Lawrence, Massachusetts proved lucrative for the Boston capitalists, and with the natural resources of the Connecticut river, Holyoke held even greater potential as an industrial mill town. The cotton

textile industry became Holyoke's first principal economy as a result, serving as a catalyst for its exploding immigrant population.

Despite differences in their history, there are many parallels in the demographic history of these two towns. Both towns experienced a radical population growth over this period. The ensuing strains of urban growth and resulting high mortality environments were ameliorated only by the later decline of growth and development of infrastructure (Hautaniemi et al. 1999; Beemer et al. 2005). Waves of immigration were transnational in scale and affected the composition of the two towns similarly over time. Moreover, the constant influx of poor immigrant laborers fueled by these transnational population movements sustained remarkable levels of inequality in the two developing urban-industrial areas. In such settings of high mortality and dramatic inequality, one might expect to find the full impact of misery and poverty among the working poor.

Analysis of Wealth Sources, Comparisons and linkage

While population and mortality data is relatively easy to come by for nineteenth-century settings, data on wealth is not. And, the issue of measuring inequality in relation to health and mortality depends upon the types of socioeconomic measures used and their reliability. The most widely used data on socioeconomic status have been income-based measures. One of the limitations of using income data exclusively is its inability to provide a more comprehensive picture of total wealth holdings. Most studies on infant and childhood mortality correlates have attempted to avoid this limitation by relying on aggregate measures of census wealth within families. Census family wealth does provides a more comprehensive measure of socioeconomic status than income, but affords a limited period of coverage (individual wealth was recorded on the Census only between 1850-1870).

As Steckel (1994) has suggested, another source for measuring wealth in local settings can be found in tax valuation records. The advantage of using tax records is not only longitudinal coverage over the epidemiological transition, but also the level of detail they provide for distinguishing various types of wealth holding. Moreover, the reporting of taxable wealth was generally compulsory while the reporting of wealth on the Census was voluntary and subject to somewhat arbitrary enumerator distinctions. Steckel's study (1994) of 19th century census manuscripts and tax assessment lists, for Ohio and Massachusetts, details the advantages and disadvantages of each of these wealth sources. Overall, Steckel's (1994) data for Massachusetts show that there is a significant overall correlation between measures of wealth derived from these tax assessments and reported Census wealth measures.

Our data for Northampton and Holyoke, Massachusetts confirm the general correlation across sources of wealth data for the years of 1860 and 1870 when both data resources are reliably available. However, as Table 1 (below) shows, there are also some clear differences in the simple distribution of family wealth from the two different resources that are important for mortality analysis. This table presents the quartile and mean measures of family wealth. Here, family wealth is simply the sum of individually reported wealth in immediate families (as distinguished from larger census families) imputed from the census schedules (see Hautaniemi 2002).

Table 1.

Distributions of family wealth holding in dollars according to tax assessments and Census records, 1860 & 1870 Northampton & Holyoke, Massachusetts.

Holyoke		0% (no wealth)	25%	50%	75%	Mean
1860	Tax	79.4	0	0	0	585.4
	Census	2.5	50	100	300	1581.3
1870	Tax	75.0	0	0	40	578.0
	Census	58.5	0	0	800	2060.0
Northampton		0% (no wealth)	25%	50%	75%	Mean
1860	Tax	40.0	0	600	3200	4173.3
	Census	24.4	100	800	4200	4356.6
1870	Tax	51.5	0	0	1300	2121.0
	Census	25.8	0	1000	4500	5176.8

One of the most important discrepancies between tax and census assessments is the reporting of small amounts of family wealth. Tax assessments have a potential for underreporting and exempting small amounts of wealth. Census records also have difficulty in consistent reporting of such small amounts of wealth. For example, in Holyoke Massachusetts (1860 - 1870), census records of wealth were recorded for a large number of households or census families at a flat rate of \$50 and multiples of that amount. When examining the census records for this period it is clear that the enumerators entered this rate consistently for large residential groups of individuals in poorer areas of the town. Nevertheless, it is unclear in substantive terms what distinguished those households or individuals with \$50 of recorded personal wealth from those with no recorded wealth. This presents problems in terms of interpreting such wealth-holdings for households who are by any reasonable measure of living standards indistinguishable from households without wealth, i.e., similar dwelling size and geographic location, family structure, occupation, etc.

Since we are primarily interested in either the longer term effects of significant wealth holding or the effects of more substantial resource mobilization which wealth may afford in the

face of acute health needs, one simple solution to the inconsistency of measurement in small amounts of wealth is to rely upon a measure which does not draw fine distinctions at the lower end of wealth distributions. For this purpose, in the analysis which follows we rely upon a dichotomy of those in the upper three quartiles of the wealth distribution as a measure of significant wealth holding and combine those in the lower quartile into a category of insignificant wealth holding. Although this measure is less sensitive to reporting discrepancies than the simple presence or absence of wealth, it is still somewhat affected by the heaping of wealth reporting categories and different numbers of individuals end up in lower quartiles as a result of different heaping. Nonetheless, this measure appears robust enough for the analyses we present. The general caution remains, when using historical wealth resources it is likely that fine distinctions between wealth holding categories are likely to be plagued by measurement errors and inconsistency across different resources. Analytical distinctions of wealth holding should not be highly sensitive to such minor discrepancies which are likely, at the same time, to affect classification or analysis of a very large and poor segment of the population.

Analysis of Age-Adjusted Mortality in Northampton and Holyoke, 1860-1880

The following analyses examine the correlation of family wealth holding and cause-specific mortality for Northampton and Holyoke from 1860 through 1880. Our choice to compare 1860 to 1880 is to afford a significant period of change during a period of rapid population growth. We do not focus on the intervening censal year of 1870 because it was an unusual mortality year for both towns in several respects. First, there was a smallpox epidemic in Holyoke in 1870 that caused higher than normal mortality rates, especially among children. Second, the 1870 data was notably problematic in terms of linkage for mortality and census

schedules. To examine wealth and mortality across these periods we compare the mortality rate of those with significant wealth holdings to the mortality rate for those without.

To control for any confounding influence of changes, or differences, in the age distribution from 1860 to 1880, we directly standardized the two mortality rates of 1860 and 1880 to the mid-period 1870 population age distribution. This can be understood in counterfactual terms, i.e., if the age distributions for each town had been the same as 1870 from 1860 through 1880, respectively, what would the death rate look like relative to their unadjusted rates? Finally, to afford the largest and most robust sample size possible the two town populations are pooled for the computation of these standardized rates.

As the results of Table 2 indicate, in 1860 there is a very similar finding whether one relies upon census wealth or tax assessment wealth. Mortality is higher for those without significant family wealth holdings and lower for those with greater resources. Lower mortality among those with greater resources is, of course, what one might expect to find. This makes the 1880 findings all the more problematic.

Table 2.

Age adjusted death rate totals for families by significant wealth holdings in census & tax assessments, 1860 & 1880 Holyoke & Northampton, Massachusetts.

Northampton & Holyoke	1860 Census	1860 Tax	1880 Tax
Total			
Significant Wealth	8.3 (5781)	8.8 (3211)	19.6 (2964)
No Significant Wealth	10.3 (2323)	9.0 (4893)	12.4 (5509)

By 1880, when only tax assessment data are available, there appears to be a reversal in these wealth findings with lower mortality among those with no significant family wealth.

Fortunately, an explanation for the unusual results in 1880 can be seen in the dynamic and changing nature of these emergent communities over the course of the transition. The age-

standardized analysis in Table 2 ignores dramatic longitudinal changes in other aspects of the population composition of these emergent urban-industrial towns over the course of changing mortality. Most importantly, this analysis aggregates distinct ethnic categories that radically change in proportions and composition over the period of analysis.

Adding to the U.S. native population, in these early years of transition, the two primary immigrant groups were the Irish and French Canadians; both largely Catholic populations. Other various European and East Asian ethnic groups, primarily Eastern Europeans, comprised the remainder of the immigrant population. Figure 1 shows the ethnic breakdown of Northampton and Holyoke’s sampled population from 1860 through 1880. Clearly, the most notable change during this period is the dramatic shift in population composition as Irish immigration declined and French Canadian immigration increased. The immigrant population within the “Other” category remained relatively stable throughout this period.

Figure 1.

Northampton and Holyoke population by ethnicity, 1860-1880

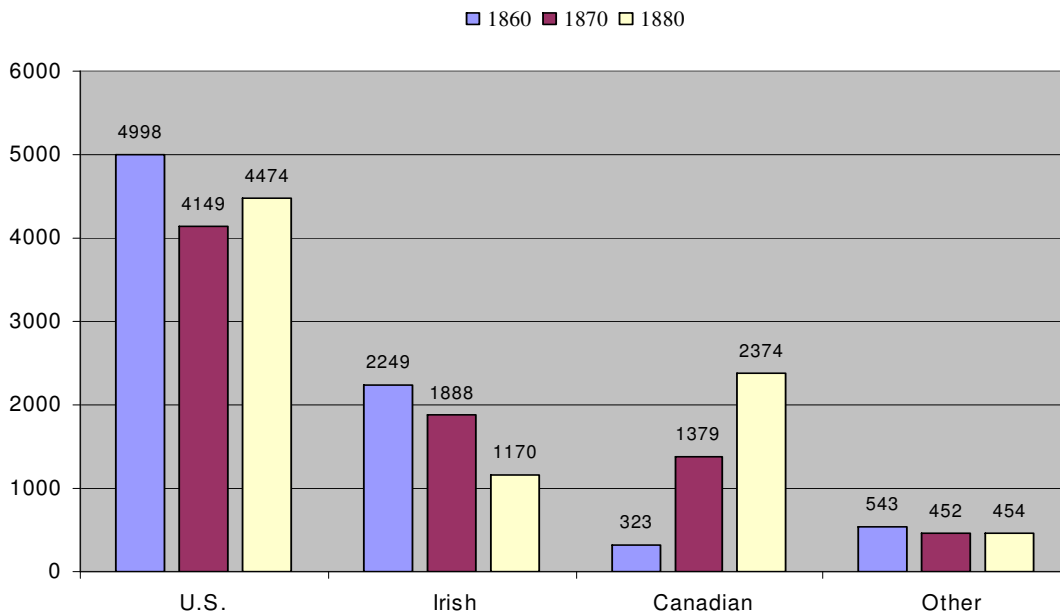


Table 3 compares the age-standardized mortality rates (ASMR) of each of these ethnic groups according to whether immediate families reported significant wealth holdings in either the census and/or tax records. For 1860 this breakdown shows that the lower mortality among those with resources is largely due to the U.S. native population during this period.

Table 3.

Age adjusted death rates by ethnicity for families by significant wealth holdings in census & tax assessments, 1860 & 1880 Holyoke & Northampton, Massachusetts.

Northampton & Holyoke	1860 Census	1860 Tax	1880 Tax
U.S.			
Significant Wealth	9.3 (3893)	8.9 (2468)	19.0 (1983)
No Significant Wealth	14.2 (1105)	11.6 (2530)	13.8 (2492)
Irish			
Significant Wealth	5.9 (1307)	9.0 (545)	14.1 (534)
No Significant Wealth	6.3 (942)	4.5 (1704)	14.0 (636)
Canadian			
Significant Wealth	10.2 (168)	0 (65)	10.9 (264)
No Significant Wealth	7.2 (155)	9.0 (258)	7.1 (2110)
Other			
Significant Wealth	1.8 (413)	0 (133)	14.3 (183)
No Significant Wealth	0 (121)	1.7 (401)	5.5 (271)

The first large scale immigrant population in the towns, especially Holyoke, were the Irish, who began arriving in Ireland Parish (later Holyoke) in the late 1840s following the Irish Famine of 1846. Although financed by Boston capital, it was Irish laborers who were largely responsible for building the infrastructure of Holyoke. And, the circumstances of the Irish in Holyoke were certainly those which one might anticipate would encourage high mortality (Green, 1939). In 1860 the Irish, perhaps surprisingly, had lower overall age-adjusted mortality rates than the U.S. native population regardless of wealth holding. Although this effect might represent some migration selection, such as a healthy worker effect, mortality differences by wealth among the Irish immigrants are highly sensitive to the data resource and

operationalization of wealth during this early period. Results are clearly affected by reporting differences between the Census and tax assessments. Then, by 1880 there appear to be no significant differences in mortality among the Irish with and without tax reported wealth holdings and the Irish continue to have a lower overall mortality than the native U.S. population. Meanwhile, in 1860, French-Canadians were not an appreciable segment of the town populations. This situation changed radically by 1880. When comparing the 1860 and 1880 tax assessments, mortality in these emergent urban-industrial areas increased significantly among both the wealthy and non-wealthy for every ethnic group except the French Canadians, who have a persistently lower mortality, despite well-documented higher infant mortality, concentrated among those without significant wealth. Meanwhile, this group, French Canadian immigrants without wealth, grow from a very small proportion of the population in 1860 to nearly a fourth of the population. The dramatically lower mortality of this group is the major reason for lower mortality among those without wealth in 1880. And, the most likely explanation is the presence or influence of a healthy worker effect creating a selection bias among immigrants.

During this period, French Canadians were actively recruited to work in mill towns all across Massachusetts. French-Canadians, began arriving in large numbers in Holyoke around 1859, shortly after the economic crisis (“Panic”) of 1857. The influx of French-Canadians during this period was an orchestrated endeavor, as was the case with much of Holyoke’s economic designs. As Hautaniemi (2002) notes, the French-Canadians were “directly recruited into Holyoke’s work force” due to the efforts of Nicholas Prue, an agent for the Lyman Mills who went to “Quebec with a specially-built wagon resembling a prairie schooner to recruit workers, for which he was paid four dollars a head” (Ibid., 47). Most recruits were young, single women. It was assumed that most of the workers would be temporary or seasonal laborers (Ibid.) and this was also the intent of many of the newly recruited French-Canadians themselves. Those hired in

this first migration phase via direct recruitment had year-long contracts and whether they actually returned to Canada after their contracts ended or simply remitted their earnings is unclear.

The migration patterns of the French-Canadians followed the economic fluctuations that occurred in Holyoke throughout this period. Holyoke underwent a series of economic crises beginning in the 1850s with periodic Panics occurring through the end of the 19th century. In 1879, following the Panic of 1873, another influx of French-Canadians began arriving in Holyoke (Hautaniemi 2002). This was the largest influx of French-Canadian immigrants into Holyoke up to that point. The primary difference of the second migration phase was that the immigrants consisted primarily of families and not simply individuals looking for temporary or seasonal employment. When we examined family size among French Canadian immigrants during this period, their immediate families were generally the largest of any single ethnic group. The French Canadians had a mean family size of nearly 7, while the Irish, U.S. and other ethnic groups all had a mean family size of 5 or less. The dwelling size and number of families per dwelling also demonstrated a larger cohabitation of families among the French Canadians – with resulting dwelling densities more than double those of the Irish. It is clear that unlike the earlier migration phase, the French Canadians during this migration phase were not simply transitory single laborers.

One of the significant contributing factors to this massive influx was the depressed economic conditions in Quebec in the 1870s. As conditions became untenable in Quebec, French-Canadians emigrated to the United States in large numbers, to New England in particular. They were looking for economic opportunity that most likely represented more of an abandonment of homeland than the earlier recruitment migration in 1859. Features of this large-scale French Canadian immigration are different from the earlier arriving Irish and earlier waves

of French Canadian immigration. These differences may give some explanation for what appears to be a significant healthy worker effect. Unlike the Irish, and despite economic pressures, the French Canadian immigration was not as clearly a forced migration by the exigencies of survival. And, again unlike the Irish, many French Canadians saw the possibility of temporary migration over such short distances. Those who were ill could wait to migrate, and those who became ill could perhaps return. Travel between Quebec and the Connecticut River Valley was relatively easy: the railroad had brought these later arrivals and the railroad could take them home again. Certainly, there may have been a much more substantial circular migration back to their original home by migrants who befell ill fortune or health.

Apparent healthy worker effects, which are clearest among the French Canadians, might also be reflected in the U.S. native population. Although the size of this population declines only slightly between 1860 and 1880 there may have been continuing local migration to and from the mill towns over this period. And, comparing the same wealth resource, tax records, the relationship of wealth to mortality experienced a much smaller but similar change as the French Canadians. That is, those without significant wealth in 1860 had slightly higher mortality and yet, by 1880 they had slightly lower mortality. A similar case may be made for other immigrants. Only the Irish, who represent a relatively stable, earlier arriving, population in the rapidly expanding towns show little, or equivocal, evidence of healthy worker effects.

The expectation, following most studies on socioeconomic status and mortality, is that those with significant wealth holdings will typically experience lower mortality than those with insignificant or no wealth holdings. Historical as well as contemporary research shows that lower socioeconomic status is associated, by and large, with greater health risks. As Ferrie notes (2002), "...it seems reasonable to imagine that higher status individuals may be able to purchase better nutrition (both more calories and a greater variety of calories sources), and better housing

(larger, better ventilated, farther from sanitary hazards, more thoroughly protected against rain and cold)” (17). Our findings support the recent research of others which suggest that such effects may not be easily discerned or especially salient in dynamic settings of urban-industrial development in the nineteenth century. Like Reid's (1997) and Lee's (1997) emphasis on the changing disease environments of such settings, our analysis suggests the changing population composition and immigration patterns associated with development may have significant confounding and even ameliorating effects on the health of the poor in otherwise harsh disease environments. Wealth or socioeconomic status alone are not always sufficient predictors of high mortality in dynamic nineteenth century local area studies. Given the complexity of mortality determinants in such changing disease environments, it is important not to overestimate any single contributing factor. Socioeconomic status provides an important dimension to this mortality transition, one that is becoming better documented as we develop more comprehensive and sensitive wealth measures.

Modeling Wealth Effects on Mortality

In order to assess wealth effects on mortality in a multivariate context and control for the changing ethnic composition of the population, Table 4 (below) presents a Poisson rate regression for death rates in 1860. We give the results for the two towns combined and separately for Holyoke and Northampton. This model essentially adds ethnic groups to a similar model developed for mortality in the two towns by Hautaniemi et al. (1999), which first indicated the possibility of wealth effects on mortality in this population. To achieve robust sample sizes, we include all age groups within the models and include controls for age as model effects. In addition, the model uses tax assessment, rather than census, wealth to extend the analysis to 1880 in Table 5 (below).

Table 4.

Poisson rate regression model of individual-level mortality effects, 1860 Holyoke & Northampton, Massachusetts.

Model Effects	Both Towns	Holyoke	Northampton
Irish (Other)	.651 (.220)	.249*** (.133)	1.65 (.686)
Canadian	.772 (.566)	.856 (.653)	6.50 (.001)
Female (Male)	.888 (.253)	1.07 (.440)	.843 (.338)
Age 15-29 (0-14)	.790 (.309)	.656 (.419)	.966 (.481)
Age 30-44	1.20 (.459)	1.26 (.705)	1.15 (.605)
Age 45-64	2.25** (.833)	3.06** (1.66)	1.91 (.989)
Age 65>	3.00** (1.52)	1.56 (.002)	4.37*** (2.42)
Dwelling density (11 or less per dwelling)	.871 (.270)	.961 (.353)	.864 (.528)
Operatives & laborers (Other, no occupation)	.404** (.165)	.365 (.225)	.532 (.300)
Professional, craftsman & farmers	.550 (.262)	1.15 (.788)	.307* (.211)
Immediate family significant total taxable wealth (no significant total taxable wealth)	.746 (.296)	.667 (.332)	.788 (.257)
Holyoke (Northampton)	1.03 (.296)	NA	NA
LR chi2	27.61***	26.83***	15.14
Degrees of freedom	12	11	11
N of Observations	840	379	461

Note: The excluded categories for each dummy variable are indicated in parentheses for the first labeled category. Standard errors are included in parentheses below each coefficient.

*Significant at $p < .10$; **Significant at $p < .05$; ***Significant at $p < .01$.

Table 5.

Poisson rate regression model of individual-level mortality effects, 1880 Holyoke & Northampton, Massachusetts.

Model Effects	Both Towns	Holyoke	Northampton
Irish (Other)	1.80*** (.350)	2.30*** (.675)	1.59 (.462)
Canadian	.478** (.156)	.534* (.200)	.527 (.537)
Female (Male)	.786 (.157)	.838 (.216)	.692 (.240)
Age 15-29 (0-14)	.622 (.191)	.890 (.342)	.404* (.215)
Age 30-44	.724 (.229)	.918 (.366)	.560 (.299)
Age 45-64	1.63* (.451)	1.58 (.598)	1.70 (.722)
Age 65>	5.02*** (1.51)	2.17 (1.33)	6.35*** (2.66)
Dwelling density (11 or less per dwelling)	.578** (.135)	.632 (.179)	.508 (.240)
Operatives & laborers (Other, no occupation)	.770 (.197)	.528* (.175)	.998 (.427)
Professional, craftsman & farmers	.494 (.213)	.248* (.188)	.690 (.389)
Immediate family significant total taxable wealth (no significant total taxable wealth)	1.34 (.261)	1.45 (.404)	1.15 (.311)
Holyoke (Northampton)	2.22 (.535)	NA	NA
LR chi2	93.45***	58.80***	48.00***
Degrees of freedom	12	11	11
N of Observations	710	361	349

Note: The excluded categories for each dummy variable are indicated in parentheses for the first labeled category. Standard errors are included in parentheses below each coefficient.

*Significant at $p < .10$; **Significant at $p < .05$; ***Significant at $p < .01$.

In both 1860 and 1880 most model effects are similar to those of Hautaniemi et al. (1999). Sex has no significant mortality effect in any of the models and age effects generally reflect increasing mortality with increasing age. The earlier peak of mortality among older working-age adults in 1860 Holyoke and Hautaniemi et al.'s (1999) finding of earlier cardiovascular mortality in the population may suggest this cause was more prominent in Holyoke during this period. Dwelling density of twelve or more residents per dwelling is not significant. Occupational effects are similar to earlier analyses with slightly lower mortality in Operatives and Laborers, which is significant for the total sample in 1860 and for Holyoke in 1880. Professional, craftsmen and farmers have the lowest mortality for Northampton in 1860 and Holyoke in 1880 even when controlling for the direct effects of family wealth. Again, these model effects are similar to those of earlier analyses.

Both models reveal no significant effects for wealth despite the fact that the wealth coefficients generally indicate lower mortality for the wealthy in 1860 and higher mortality in 1880. Coefficients for ethnic groups reveal the pattern discovered in the earlier analysis of rates, which remain even after controlling for wealth. The Irish in Holyoke have lower mortality in 1860 when they are the largest recent immigrant group in the population. By 1880 the Irish have significantly higher mortality in the total sample as well as in Holyoke. Meanwhile, the French Canadians in 1880, by then the largest recent immigrant group, have the lowest mortality.

This pattern of more recently arriving immigrants to the emergent mill towns having the lowest mortality supports the hypothesized healthy worker effect. Other results of our analysis may also lend support to this hypothesis. The lower mortality among operatives and laborers, for example, may reflect such effects. In addition, although wealth effects are not significant, there is a general shift from lower mortality to higher mortality among those with wealth. Since our model does not control for recently arriving native immigrants, which includes any possible

healthy worker effect in the native immigrants to the area, this shift could reflect a lower mortality among less wealthy native immigrants to the rapidly growing towns in 1880.

Wealth and the Recording of Death

It should also be noted that socioeconomic status likely influenced not only mortality but the reporting of mortality. We see no bias in reporting the death event. One indication of this was the complaint of the time that the wealthy were accorded discretion in the reporting of causes of death while the poor were viewed more critically. As an article from Dr. Hall's journal, which appeared in the Northampton Daily Hampshire Gazette July 19th, 1859, laments "to report the "heart" as the cause; this silences all inquiry and investigation, and saves the trouble and inconvenience of a repulsive post mortem ...through a report of "diseases of the heart" ... many an opium eaters is let off into the grave which covers at once his folly and his crime; the brandy drinker too, quietly slides around the corner ... this report of diseases of the heart is the mantle of charity which the politic coroner and the sympathetic physician throw over the graves of genteel people." Conversely, nineteenth century views of disease frequently associated diseases of contagion with the ill manners, bad habits and uncleanness of the lower classes (Yaukey and Anderton, 2001).

Trends in cause-of-death reporting provide an additional window into mortality trends and the potential social biases that accompanied nineteenth-century cause-of-death narratives. The Grammars of Death Project, working in the same two towns of Massachusetts but with a larger sample including all deaths between 1850 and 1912, is exploring the effects that changing cause-of-death reporting has had on our understanding of nineteenth-century mortality trends. Although that project does not include family wealth measures, the data in the present analysis offers the unique opportunity to examine the relationship between family wealth and ethnicity and the ways in which leading causes may have been ascribed through cause-of-death reporting.

Throughout this period changing conceptions of disease and their classifications resulted in corresponding changes in the reporting of literal causes of death and their ensuing nosological classifications (Anderton and Hautaniemi, 2004). Competing descriptions or nomenclature of the same disease were common and depended less on any real or known etiological distinctions than on symptomatic bases for which one term was preferred over another. Phthisis and consumption, for instance, constituted distinct nomenclature for what is now know as tuberculosis. The term consumption was more common in the early part of the nineteenth century and simply referred to the wasting away of the body. As Anderton and Hautaniemi (2004) note, "...consumption was a lay equivalent to the medically prevalent "Phthisis," or simply wasting, coined in early Greece. During the last half of the nineteenth century, such deaths were increasingly identified as phthisis in western Massachusetts" (Ibid., 122).

Table 6 presents the five leading literal causes in 1860 and in 1880 for Northampton and Holyoke. In 1860 consumption is ascribed far more frequently than phthisis overall, and this higher frequency holds as well among those with wealth compared to those without wealth.

Table 6.

Leading causes of death by percentage in 1860 & 1880 Northampton and Holyoke, Massachusetts.

1860	Wealth	No-wealth
PHTHISIS	2.63	1.43
TYPHOID	5.26	4.29
CONSUMPTION	21.05	15.71
PNEUMONIA	2.63	1.43
CROUP	2.63	4.29
1880	Wealth	No-wealth
PHTHISIS	18.29	15.44
TYPHOID	4.88	6.71
CONSUMPTION	0	9.40
PNEUMONIA	4.88	5.37
CROUP	4.88	4.03

By 1880 Phthisis has emerged as a preferred nomenclature in U.S. medical circles and the shift is apparent in western Massachusetts. However, this shift was clearly not uniform across social classes and ethnic groups. Consumption is clearly ascribed more frequently among those without wealth than those with wealth. On the other hand, Phthisis is ascribed more frequently (although less dramatically) among those with wealth than those without wealth. It would appear that phthisis had become the preferred nomenclature for those with wealth, and consumption continued to be reported as a leading cause for those without wealth. One possible explanation looks to the presence of class bias in the diagnosing of disease and cause-of-death reporting. Differential access to physicians who were trained in the latest medical knowledge and techniques most certainly had an impact on the type of diagnoses an individual could expect. Lower class families may have been less likely to be diagnosed by physicians whose primary clientele had come to expect the professional stature that accompanied the best medical training and education that money could buy.

The access to physicians of different training raises the question of ethnicity in connection with cause-of-death reporting. French speaking Canadian families, for example, were probably more likely to be attended by French speaking, and differently trained, physicians than the English speaking native or Irish populations. There are, in fact, differences in leading causes of death by ethnic group. In 1880, the leading cause of death for French Canadians was typhoid, which constituted nearly 28% of all deaths among French Canadians compared to other causes. The next leading cause was Phthisis, which comprised nearly 14% of all causes. The only other ethnic group that came close to such a high incidence of a single leading cause were the Irish. Here, phthisis constituted approximately 24% of all deaths among the Irish, with consumption coming in at a distant second comprising 6% of all Irish deaths in 1880. However, the Irish were more similar to the native U.S. population in clearly having a nomenclature for Tuberculosis as

their leading cause of death. It may be that differential medical practices did underlie this ethnic difference. There were a large contingent of Canadian born physicians practicing in Holyoke, with their own medical society who were almost certainly trained in Quebec. However, it is perhaps even more likely that French Canadians suffered a year of severe typhoid mortality unique to their group and perhaps connected with migration from high typhoid areas in Canada at the time. It is important, however, to be cautious in making any such inferences, given the relatively small Ns associated with cause-of-death reporting among the French Canadians for this period. We mean only to suggest that the analysis of mortality trends by family wealth may also be influenced by other correlates of wealth including ethnicity and the reporting of mortality.

Conclusion

The complex relationship between family wealth and mortality is difficult to disentangle without the presence of individual-level data in conjunction with the type of family wealth detail afforded by census and tax records. Many of the national/regional area studies on the nineteenth-century mortality transition have the advantage of scope. These studies typically consist of aggregate census or registration data that provide for a broader context and perspective for understanding nineteenth-century mortality determinants and thus are able to capture more general trends. Nevertheless, what is gained in scope is lost in detail. The limitations that underlie the broader associations uncovered in national or regional-level data can be more sensitively measured and understood in specific disease environments. Northampton and Holyoke constitute a case study in which localized determinants of mortality and mortality decline are likely to be especially salient at the same time that such relationships are likely to be shaped by radical population growth and changes in composition.

We have shown that for overlapping years the general conclusions which might be drawn from census records of family wealth and those from tax assessment records of family wealth are largely similar. And, we have demonstrated that the family wealth effects on mortality which are derived from tax assessments after the U.S. Census ceased to collect wealth data are both reasonable and insightful. With either resource these analyses have demonstrated the advantages of individual-level data to disentangle the complex relationships between family wealth and mortality during the early stages of the nineteenth-century mortality transition and the complexities in analyzing wealth effects in dynamic emerging urban-industrial settings, like Northampton and Holyoke. Longitudinal coverage of individual level data across the mortality transition is better established with the addition of tax data. And, not exploited in the present analysis, tax assessment records also offer a greater level of detail in distinguishing various types of wealth holding. We do, however, find that caution is necessary when analyzing small amounts of family wealth. We found that important discrepancies between tax and census assessments were present in the reporting of small amounts of wealth and found little reason to have great faith in the consistency or accuracy of either data source for such small amounts.

Using these resources we found further evidence of the complexity and importance of local environments in analyzing the relationship between family wealth and mortality in the nineteenth century. When analyzing the correlation of family wealth holding and cause-specific mortality for Northampton and Holyoke from 1860 through 1880, we found that regardless of whether census wealth or tax assessment wealth is used, mortality is higher overall, as one might expect, for those without significant family wealth holdings in 1860. In 1880, however, we found that overall mortality rates shifted direction and those with significant family wealth holdings experienced higher mortality than those without significant family wealth holdings. What accounts for this surprising shift in mortality appears to be the influx of French Canadian

immigrants in the late 1870s and early 1880s. The immigrant population changed rather dramatically as the French Canadians displaced the Irish as the dominant immigrant group. Unlike the earlier French Canadian migration phase, families constituted a large part of this population. Unlike the earlier Irish immigrants, there was a history of circular or temporary migration among this population, there is less reason to believe migration was as forced by necessity, and a return home was not beyond question in the face of bad fortune or ill health. These differences may explain what appears to be a significant healthy worker effect among the French Canadian immigrants. A similar, less pronounced selection effect might also be reflected in the U.S. native population as well as other groups. What this suggests is that compositional effects and patterns of immigration in conjunction with developing infrastructures may confound or even improve the health conditions of the poor in otherwise harsh disease environments. In complex local environments the simple hypothesis that family wealth and resources will lead to a lower mortality is not an unconditional expectation. This finding is especially important for the rather simplistic view of emerging urban-industrial areas as environments which place satanic burdens upon the poor. Whatever those burdens might have been, they may not have been sufficient to overcome the fact that migration favors the healthy. Through the dramatic growth of New England towns during this period the negative effects of poverty may well have been overshadowed by a steady stream of newly arriving healthy workers. Those who stayed across the decades may have acquired wealth, but they were not selected for health.

Finally, we also suggest that even the very reporting of mortality in the relatively modern nineteenth century may have been influenced by class and ethnic differences. We are not, by any means, the first to suggest such effects. Our data do, however, allow us to give a relatively clear demonstration that such differences did exist in mortality reporting for family wealth and ethnic groups with differential wealth holdings. We do not believe such effects had

any substantial effect on overall mortality trends. However, these findings offer a further caution regarding the complexity of local environments when cause specific mortality trends are to be examined in relationship to family wealth.

References

- Alter, George and James C. Riley. 1989. "Frailty, Sickness, and Death: Models of Morbidity and Mortality in Historical Populations." *Population Studies* 43: 25-45.
- Anderson, M. 1996. "Population change in north-western Europe, 1750-1850." Pp. 191- 279 in *British Population History: from the Black Death to the present day*. edited by Michael Anderson. Cambridge: Cambridge University Press.
- Anderton, Douglas L. and Susan I. Hautaniemi. 2004. "Grammars of Death: An Analysis of Nineteenth-Century Literal Causes of Death from the Age of Miasmas to Germ Theory." *Social Science History* 28: 111-143.
- Antonovsky, A. 1967. "Social Class, Life Expectancy, and Overall Mortality." *Milbank Memorial Fund Quarterly* 45: 31-73.
- Beemer, Jeffrey K., Douglas L. Anderton, and Susan I. Hautaniemi. 2005. "Sewers in the City: A Case Study of Individual-Level Mortality and Public Health Initiatives in Northampton, Massachusetts, at the Turn of the Century." *Journal of the History of Medicine and Allied Sciences* 60: 42-72.
- Bengtsson, Tommy, Cameron Campbell and James Z. Lee. 2004. *Mortality and Living: Standards in Europe and Asia, 1700-1900*. Boston, Mass : MIT Press.
- Benson, L.W. 1954. "Floods and Disasters." Pp. 355-63 in *The Northampton Book: Chapters from 300 Years in the Life of a New England Town 1654-1954*, edited by The Tercentenary History Committee. Northampton, MA: The Tercentenary Committee.
- Condran, G.A. 1994. "What 'Fatal Years' Tells Us that We Did Not Already Know." *Bulletin of the History of Medicine* 68: 95-104.
- Condran, G.A. and E. Crimmins-Gardner. 1978. "Public Health Measures and Mortality in U.S. Cities in the Late Nineteenth Century." *Human Ecology* 6: 27-54.
- Condran, Gretchen A. and Rose A. Cheney. 1982. "Mortality Trends in Philadelphia: Age- and Cause-specific Death Rates 1870-1930." *Demography* 19: 97-123.
- Condran, G.A., H. Williams & R.A. Cheney. 1984. "The Decline in Mortality in Philadelphia from 1870-1930: The Role of Municipal Services." *The Pennsylvania Magazine of History and Biography* 108: 153-177.
- Corsini, C. and P. Viazzo, eds. 1997. *The Decline of Infant and Child Mortality: the European experience, 1750-1990*. UNICEF.
- Costa, D.L. and R.H. Steckel. 1997. "Long-Term Trends in Health, Welfare and Economic Growth in the United States." in *Health and Welfare During Industrialization* edited by R. Steckel and R. Floud. Chicago: University of Chicago Press.

- Crimmins, E.M. and G.A. Condran. 1983. "Mortality Variations in U.S. Cities in 1900." *Social Science History* 7: 31-59.
- Elman, C. and G. Meyers. 1997. "Age and Sex Differentials in Morbidity at the Start of an Epidemiological Transition: Returns from the 1880 U.S. Census." *Social Science and Medicine* 45: 943-956.
- Fetter, B., P.R. Coelho, J. Rogers and M.C. Nelson. 1997. "Forum: The Epidemiologic Transition." *Health Transition Review* 7: 235-255.
- Fogel, R. W. 1986. "Nutrition and the Decline in Mortality Since 1700: Some Preliminary Findings." Pp. 439-555 in *Long-Term Factors in American Economic Growth* edited by S. Engerman and R. Galloway. Chicago: University of Chicago Press.
- Fogel, R. W. 1993. "New Sources and New Techniques for the Study of Secular Trends in Nutritional Status, Health, Mortality and the Process of Aging." *Historical Methods* 26: 5-43.
- Fogel, Robert W. and Dora L. Costa. 1997. "A Theory of Technophysio Evolution, with Some Implications for Forecasting Population, Health Care Costs, and Pension Costs." *Demography* 34: 49-66.
- Green, C.M. 1939. *Holyoke, Massachusetts: A Case History of the Industrial Revolution in America*. New Haven: Yale University Press.
- Haines, M.R. 1977. "Mortality in Nineteenth Century America: Estimates from New York and Pennsylvania Census Data, 1865 and 1900." *Demography* 14:311-331.
- Haines, M. R. 1985 "Inequality and Childhood Mortality: A Comparison of England and Wales, 1911, and the United States, 1900." *Journal of Economic History* 65: 874- 913.
- Haines, M.R. and S.H. Preston. 1997. "The Use of the Census to Estimate Childhood Mortality." *Historical Methods* 30: 78-96.
- Hankins, F.H. 1954. "Economic Transition: 1817-1860." Pp. 77-84 in *The Northampton Book: Chapters from 300 Years in the Life of a New England Town 1654-1954*, edited by The Tercentenary History Committee. Northampton, MA: The Tercentenary Committee.
- Hautaniemi, Susan I. 2002. "Demography and Death in Emergent Industrial Cities of New England." Ph.D. dissertation, Department of Anthropology, University of Massachusetts, Amherst, MA.
- Hautaniemi, Susan I., Alan C. Swedlund, and Douglas L. Anderton. 1999. "Mill Town Mortality Consequences of Industrial Growth in Two Nineteenth-Century New England Towns." *Social Science History* 23: 1-39.

- Higgs, R. 1979. "Cycles and Trends of Mortality in 18 Large American Cities, 1871-1900." *Explorations in Economic History* 16: 381-408.
- Higgs, R. and D. Booth. 1979. "Mortality Differentials Within Large American Cities in 1890." *Human Ecology* 7: 353-370.
- Jacob, Edward C. 1999. *One Morning in May: The Mill River Disaster of 1874*. Haydenville, MA: Edward C. Jacob.
- Lee, C. 1997. "Socioeconomic Background, Disease, and Mortality among Union Army Recruits: Implications for Economic and Demographic History." *Explorations in Economic History* 34:27-55.
- McKeown, T.H. 1976. *The Modern Rise of Population*. New York: Academic Press.
- McKeown, Thomas and R.G. Record. 1962. "Reasons for the Decline of Mortality in England and Wales during the Nineteenth Century." *Population Studies* 16: 94-122.
- McKinlay, J.B. and S.M. McKinlay. 1977. "The Questionable Contribution of Medical Measures to the Decline of Mortality in the United States in the Twentieth Century." *Milbank Memorial Fund Quarterly* 55: 405-428.
- Meckel, R.A. 1985. "Immigration, Mortality, and Population Growth in Boston, 1840-1880." *Journal of Interdisciplinary History* XV: 393-417.
- Meckel, Richard A. 1990. *Save the Babies : American Public Health Reform and the Prevention of Infant Mortality, 1850-1929*. Baltimore: Johns Hopkins University Press.
- Meeker, E. 1972. "The Improving Health of the United States, 1800-1915." *Explorations in Economic History* 9: 353-373.
- Pelletier, F., J. Légaré and R. Bourbeau. 1997. "Mortality in Quebec During the Nineteenth Century: From the State to the Cities." *Population Studies* 51: 93-103.
- Pope, C. 1992. "Adult Mortality in America before 1900: A View from Family Histories." Pp. 267-296 in *Strategic Factors in Nineteenth Century American Economic History* edited by C. Goldin and H. Rockoff. Chicago: University of Chicago Press.
- Preston, S.H. 1976. *Mortality Patterns in National Populations*. New York: Academic Press.
- Preston, Samuel H. 1996. "Population Studies of Mortality." *Population Studies* 50: 525- 536.
- Preston, S.H. and M.R. Haines. 1984. "New Estimates of Child Mortality in the United States in 1900." *Journal of the American Statistical Association* 79: 272-281.
- Preston, Samuel H. and Michael R. Haines. 1991. *Fatal Years: Child Mortality in Late Nineteenth-century America*. Princeton: Princeton University Press.

- Preston, S.H. and E. van de Walle. 1978. "Urban French Mortality in the Nineteenth Century." *Population Studies* 32: 275-297.
- Reid, A. 1997. "Locality or Class? Spatial and Social Differentials in Infant and Child Mortality in England and Wales, 1895-1911." in *The decline of infant and child mortality: the European experience, 1750-1990* edited by C. Corsini and P. Viazzo: UNICEF.
- Retherford, R. 1975. *The Changing Sex Differentials in Mortality*. Westport: Greenwood Press.
- Riley, J. 1987. "Disease Without Death: New Sources for a History of Sickness." *Journal of Interdisciplinary History* 4: 537-563.
- Scott, S. and C. Duncan. 1998. *Human Demography and Disease*. Cambridge: Cambridge University Press.
- Schofield, R., D. Reher and A. Bideau, eds. 1991. *The Decline of Mortality in Europe*. Oxford: Clarendon Press.
- Scott, S. and C. Duncan. 1998. *Human Demography and Disease*. Cambridge: Cambridge University Press.
- Smith, D.S. 1983. "Differential Mortality in the United States before 1900." *Journal of Interdisciplinary History* 13: 735-759.
- Steckel, Richard H. 1994. "Census Manuscript Schedules Matched with Property Tax Lists." *Historical Methods* 27: 71-85.
- Steckel, R. and R. Floud. 1997. *Health and Welfare During Industrialization*. Chicago: University of Chicago Press.
- Swedlund, A.C. 1990. "Infant Mortality in Massachusetts and the United States in the Nineteenth Century," in A.C. Swedlund and G. J. Armelagos, eds. *Disease in Populations in Transition*, pp. 161-182. New York: Bergin and Garvey.
- Swedlund, A. & H. Ball. 1998. "Nature, Nurture, and the Determinants of Infant Mortality: A Case Study from Massachusetts, 1830-1920." A. Goodman and T. Leatherman, eds. *Towards a New Biocultural Synthesis: Political-Economic Perspectives in Biological Anthropology*. Ann Arbor: University of Michigan Press.
- Szreter, S. 1988. "The Importance of Social Intervention in Britain's Mortality Decline, c. 1850-1914. A Reinterpretation of the Role of Public Health." *Social History of Medicine* 1:1-37.
- Szreter, S. & G. Mooney. 1998. "Urbanization, Mortality, and the Standard of Living Debate: New Estimates of the Expectation of Life at Birth in Nineteenth-Century British Cities." *Economic History Review* LI(1): 84-112.

- Verbrugge, L.M. 1989. "Sex Differences in Health and Mortality." *Journal of Health and Social Behavior* 30: 282-304.
- Vinovskis, M.A. 1972. "Mortality Rates and Trends in Massachusetts before 1860." *Journal of Economic History* 32:184-213.
- Waldron, I. 1993. "Recent Trends in Sex Mortality Ratios for Adults in Developed Countries." *Social Science & Medicine* 36: 451-462.
- Williamson, Jeffrey G. and Paul H. Lindert. 1980. *American Inequality: A Macroeconomic History*. New York: Academic Press.
- Woodbury, R.M. 1926. *Infant Mortality and its Causes*. Baltimore: The Williams and Wilkins Company.
- Woods, Robert. 1991. "Public Health and Public Hygiene: The urban Environment in the Late Nineteenth and Early Twentieth Centuries." in *The Decline of Mortality in Europe* edited by R. Schofield, D. Reher, and A. Bideau. Oxford: Clarendon Press.
- Woods, Robert. 1993. "On the Historical Relationship between Infant and Adult Mortality." *Population Studies* 47:195-219.
- Woods, Robert, Naomi Williams 1995. "Must the gap widen before it can be narrowed: long-term trends in social class mortality differentials", *Continuity and Change* 10: 105-137.
- Yaukey, David and Douglas L. Anderton. 2001. *Demography: The Study of Human Population*. Long Grove, Illinois: Waveland Press.