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9 Adult Mortality in America before 1900

A View from Family Histories

Clayne L. Pope

Economists and, to a lesser degree, economic historians have measured progress in the standard of living solely in terms of income per capita. Yet, there is a general belief that measurement of other elements, including the distribution of income, leisure, morbidity, and mortality, are needed for an accurate assessment of living standards.

Decreases in mortality rates have played a major role in the improvement of life in the twentieth century. The decrease in infant mortality from above 100 per thousand at the turn of the century to the current level of about 10 per thousand has contributed significantly to improved life expectation and the psychological comfort of families. The increase in adult life expectation, roughly a 35 percent improvement at ages twenty and sixty, has also materially enhanced the level of living.[1] Certainly, no one would argue that our assessment of progress in the standard of living would remain unchanged if life expectation had not improved.

Our knowledge of trends in mortality for the eighteenth and nineteenth centuries is considerably more fragmentary than our knowledge of the trend in

The data set used here was created by joint efforts of the Center for Population Economics, University of Chicago, and the College of Social Science, Brigham Young University. Donna Breckenridge supervised data collection, and Mark Showalter and Danelle Boothe provided programming. Nathan Sheets and Brigitte Condie Madrian provided research assistance. A very early draft of this work was presented at the Ninth Congress of the International Economic History Association in Bern and at the American Economic Association Meetings in 1986. Suggestions received at workshops at the University of Chicago, Brigham Young University, and University of California, Los Angeles, were very helpful. Richard Butler, Stanley Engerman, Robert Fogel, David Galenson, Claudia Goldin, Michael Haines, Dan Levy, Rulon Pope, Kenneth Sokoloff, and Larry Wimmer generously read drafts of this paper and provided useful suggestions for improvement.

1. U.S. Bureau of the Census, *The Statistical History of the United States from Colonial Times to the Present* (Stamford, 1964) Series B 76–112; and *Statistical Abstract of the United States, 1989,* 109th edn., U.S. Department of Commerce, pp. 73–77.

income per capita. Adequate death registration procedures did not exist for all states until 1933. Until 1910, death registration coverage was concentrated in the more industrialized and urbanized states of the Northeast.[2] Consequently, the oft-cited life tables from 1890 to 1920 based on the death registration area cannot be representative of the nation as a whole unless regional variation in mortality was unimportant by the turn of the century.[3] Life tables constructed for periods before the development of a significant death registration area (before 1900) are limited in geographical coverage and do not, in most cases, provide evidence on mortality for long time periods.

This essay adds to our knowledge of the trend in mortality before 1900, with particular emphasis on the antebellum period. The findings reinforce the importance of extending measurement of the standard of living beyond income per capita. The downturn in life expectation noted by Robert W. Fogel and others for the antebellum period is reconfirmed. The sizeable sex differential in mortality favoring women appears to be a twentieth-century phenomenon. Westward migration appears to have increased mortality rates modestly, especially for women, and regional differences in mortality narrowed in the nineteenth century.

9.1 Mortality Before the Twentieth Century

Scholars studying the trends in mortality have not yet reached a consensus on the period before 1900. Mortality studies of the colonial period have usually focused on counties or communities such as Andover or Salem, Massachusetts, or Charles County, Maryland, and are usually based on small samples of males. Most of the estimates have been confined to the seventeenth

2. The growth of the death registration area may be summarized as follows with the percentage of the population covered by that year:

Year	*%*	*States Added By That Year*
1880	6.2	District of Columbia, Massachusetts, New Jersey
1890	18.6	Connecticut, New Hampshire, New York, Rhode Island, Vermont
1900	26.2	Indiana, Maine, Michigan
1910	51.4	California, Colorado, Maryland, Minnesota, Montana, Ohio, Pennsylvania, Utah, Washington, Wisconsin
1920	80.9	Delaware, Florida, Illinois, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, North Carolina, Oregon, South Carolina, Tennessee, Virginia
1930	95.3	Alabama, Arizona, Arkansas, Georgia, Idaho, Iowa, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, West Virginia, Wyoming
1933	100.0	Texas

Sources: U.S. Bureau of the Census, *Historical Statistics of the United States: Colonial Times to 1970,* bicentennial edn. (Washington, D.C., 1975), part 1, p. 44; *Measures Relating to Vital Records and Vital Statistics* (Washington, D.C., 1943).

3. Preston and Haines find that the death registration, upon which the life tables of 1901 are based, somewhat misrepresents U.S. mortality, especially for blacks. See Samuel H. Preston and Michael R. Haines, "New Estimates of Child Mortality in the United States at the Turn of the Century," *Journal of the American Statistical Association,* 79 (June 1984), pp. 233–54.

and early eighteenth century and suggest that life expectation did not improve in New England over the colonial period.[4] Scholars do find, however, some improvement in life expectation in the Chesapeake where death rates were initially far worse.[5] Colonial evidence is thin because larger reliable samples are difficult to create. There is almost no evidence on mortality in the middle colonies.

The views of the trend in life expectation for the antebellum period are especially diverse because very few life tables (outside of Massachusetts) have been constructed for the antebellum period.[6] One group of scholars sees continuous, but uneven, improvement in life expectancy after the colonial period. Warren Thompson and P. K. Whelpton use life tables constructed by others to extrapolate a modest upward trend in life expectation from 1790 to 1890 with a sharp increase thereafter. Richard Easterlin also suggests an improvement in life expectation throughout the nineteenth century. Both depend heavily on the Wigglesworth life table for 1789 which Maris Vinovskis has

4. Phillip Greven, Jr., "Historical Demography and Colonial America," *William and Mary Quarterly*, 24 (July 1967) pp. 438–54; Daniel Scott Smith, "The Demographic History of Colonial New England," *Journal of Economic History*, 32 (Mar. 1972), pp. 165–83; John Demos, "Notes on Life in Plymouth," *William and Mary Quarterly*, 22 (Apr. 1965), pp. 264–86; Susan Norton, "Population Growth in Colonial America: A Study of Ipswich, Massachusetts," *Population Studies*, 25 (Nov. 1971), pp. 433–52; James K. Somerville, "A Demographic Profile of the Salem Family, 1660–1770," (manuscript, 1969). The New England estimates are summarized in Maris Vinovskis, *Fertility in Massachusetts from the Revolution to the Civil War* (New York, 1981), chap. 2.

5. Daniel S. Levy, "The Economic Demography of the Colonial South" (Ph.D. dissertation, University of Chicago, 1989); Daniel S. Levy, "The Life Expectancies of Colonial Maryland Legislators," *Historical Methods*, 20 (Winter 1987), pp. 17–27; Lorena S. Walsh and Russell Menard, "Death in the Chesapeake: Two Life Tables for Men in Early Colonial Maryland," *Maryland Historical Society*, 69 (Summer 1974), pp. 211–27; Daniel Blake Smith, "Mortality and Family in Colonial Chesapeake," *Journal of Interdisciplinary History*, 8 (Winter 1978), pp. 404–27; Darrett B. Rutman and Anita H. Rutman, *A Place in Time: Explicatus* (New York, 1984); James M. Gallman, "Mortality Among White Males: Colonial North Carolina," *Social Science History*, 4 (Summer 1980), pp. 295–316.

6. Paul H. Jacobson, "An Estimate of the Expectation of Life in the United States in 1850," *The Milbank Memorial Fund Quarterly*, 35 (Apr. 1957), pp. 197–201, is based on averages of the data on Massachusetts and Maryland published by Joseph C. G. Kennedy for the census of 1850 (Kennedy, *The Seventh Census: Report of the Superintendent of the Census for December 1, 1852* [Washington D.C., 1853]). For an evaluation of Jacobson's life table, see Maris Vinovskis, "The Jacobson Life Table of 1850: A Critical Reexamination from a Massachusetts Perspective," *The Journal of Interdisciplinary History*, 8 (Spring 1978), pp. 703–24; Michael R. Haines, "The Use of Model Life Tables to Estimate Mortality for the United States in the Late Nineteenth Century," *Demography*, 16 (May 1979), pp. 289–312, follows William Brass, "On the Scale of Mortality," in *Biological Aspects of Demography*, William Brass, ed., vol. 10 of the *Symposia of the Society for the Study of Human Biology* (London, 1971), to fit a two-parameter logit system to a set of life tables for parts of the United States from 1850 to 1910 and use the resulting system to examine the trend in U.S. mortality from 1850 to 1900; Maris Vinovskis, "Mortality Rates and Trends in Massachusetts before 1860," *Journal of Economic History*, 32 (March 1972), pp. 184–213; Levi Meech, *Systems and Tables of Life Insurance* (New York, 1898). For an appraisal of the Meech life table, see Michael R. Haines and Roger C. Avery, "The American Life Table of 1830–1860: An Evaluation," *Journal of Interdisciplinary History*, 11 (Summer 1980), pp. 73–95; A. J. Jaffee and W. I. Laurie, "An Abridged Life Table for the White Population of the United States in 1830," *Human Biology*, 14 (Sept. 1942).

criticized as being too low. Conrad and Irene Taeuber conclude that there was little upward movement in life expectation for the first half of the nineteenth century, but rather steady improvement thereafter. Edward Meeker examines the trend from 1850 to 1915 and concludes that life expectation improved very slowly before 1880, more thereafter. Paul Jacobson examines the increase in cohort life expectancy for cohorts born between 1840 and 1960. He shows modest increases in life expectation for males born in the 1850s and 1860s compared with the previous decade and larger increases for the later cohorts. The female pattern is similar, but the decadal increases begin earlier. Robert Higgs finds increasing life expectation in both the countryside and urban areas after 1870.[7]

Other scholars find little improvement in life expectation in the nineteenth century or actual declines. Vinovskis finds little evidence of an upward trend in life expectancy in the small agricultural towns of Massachusetts before 1860. Yasukichi Yasuba uses an examination of the census populations adjusted for immigration to argue for a fall in life expectation in the three decades before the Civil War. Fogel and Kent Kunze, both using genealogical samples, find a downturn in life expectancy in the antebellum period. Michael Haines's study combines sophisticated demographic techniques with the death rates in the census mortality schedules to produce life expectations for the last half of the nineteenth century. His estimates, lower than most for the period, show improved life expectation from 1850 to 1870, then a decline from 1870 to 1880 with improvement to 1900.[8] There seems to be a consensus that mortality diminished in the late nineteenth century—certainly after 1880. But no consensus has emerged on the trend in mortality from the late eighteenth century to the Civil War.

The large gaps in measurement of mortality are sometimes filled with a combination of fragmentary evidence and model life tables such as those of

7. Warren S. Thompson and P. K. Whelpton, *Population Trends in the United States* (New York, 1933), p. 230ff.; Richard A. Easterlin, "Population Issues in American Economic History: A Survey and Critique," in *Recent Developments in the Study of Business and Economic History: Essays in Memory of Herman E. Krooss,* Robert E. Gallman, ed., (Greenwich, 1977); Maris Vinovskis, "The 1789 Life Table of Edward Wigglesworth," *Journal of Economic History,* 31 (Sept. 1971), pp. 570–90; Conrad Taeuber and Irene B. Taeuber, *The Changing Population of the United States* (New York, 1958), p. 269ff.; Edward Meeker, "The Improving Health of the United States, 1850–1915," *Explorations in Economic History,* 9 (Summer 1972), p. 358; Paul H. Jacobson, "Cohort Survival for Generations Since 1840," *Milbank Memorial Fund Quarterly* (July 1964), p. 48; Robert Higgs, "Mortality in Rural America, 1870–1920: Estimates and Conjectures," *Explorations in Economic History,* 10 (Winter 1973), pp. 177–95; and "Cycles and Trends of Mortality in 18 Large American Cities, 1871–1900," *Explorations in Economic History,* 16 (Oct. 1979), pp. 381–408.

8. Vinovskis, *Fertility in Massachusetts,* chap. 2; Yasukichi Yasuba, *Birth Rates of the White Population in the United States, 1800–1860* (Baltimore, 1962), pp. 86–96; Robert W. Fogel, "Nutrition and the Decline in Mortality since 1700: Some Preliminary Findings," in *Long-Term Factors in American Economic Growth,* Stanley L. Engerman and Robert E. Gallman, eds., Studies in Income and Wealth, vol. 51 (Chicago, 1986); Kent Kunze, "The Effects of Age Composition and Changes in Vital Rates on Nineteenth Century Population Estimates from New Data" (Ph.D. dissertation, University of Utah, 1979); Haines, "The Use of Model Life Tables."

Ansley Coale and Paul Demeny.[9] The model life table provides estimated relationships between age, sex, and mortality based on life tables calculated from reliable data, which are usually based on twentieth-century experience in more developed countries.[10] Of course, the result of these sophisticated and useful efforts is dependent on the validity of these model tables for the particular time period and geographical area. After all, model tables are simply smoothings or averages of observed life tables.[11] These fundamental relationships for age, sex, and mortality that are the essence of model life tables are unlikely to be invariant through ime and across space.[12]

Since life expectancy is a basic measure of the material performance of a society, it is surprising how little we know about the course of mortality before the systematic development of death registration at the start of the twentieth century. The problem has not been lack of interest in mortality, but rather the lack of data sources that could generate evidence on a broad front concerning the trends in mortality, regional variation in mortality, and the relative experience of men and women. Scholars will necessarily have to depart from the familiar environs of death registrations and census data if they wish to create useful series on life expectation or mortality for the United States before 1900 or 1880 at best. The suggestion here is that data culled from printed family histories can be used to construct long-term series on mortality and life expectation for the native-born white population.

9.2 Family Histories as a Source of Demographic Data

There are at least 60,000 printed histories of families that have resided in the United States. Large collections are in the Library of Congress, Allen

9. For model tables, see Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, 1966); or United Nations, *Age and Sex Patterns of Mortality: Model Life-Tables for Under-Developed Countries,* Population Studies 22 (New York, 1955).

10. For example, Coale and Demeny use 326 life tables for their classic study. Twenty-three of the life tables are before 1870, all from Europe. About a third (113) are before 1918 with 76 percent of those coming from Europe. Sixty-three percent of all the tables used come from Europe and less than 6 percent from North America. Only three North American life tables are used before 1918. They group the life tables into four "regions" with the U.S. life tables of the twentieth century put in the "west" region.

11. Coale and Demeny found that e_{10} (life expectation at age ten) correlates best with the death probabilities at various ages. Those correlations are quite high for the tables used to construct model west. Indeed the average correlation between e_{10} and the five-year death probabilities is 0.955 for females and somewhat lower for males (0.921). However, for the pre–1870 tables of Europe, the correlations are much lower, 0.666 for females and 0.663 for males.

12. The categorization by Coale and Demeny of the life tables into four regions illustrates the variability of the basic patterns. At level five, male life expectation at birth ranges from 90.6 percent of female life expectation to 97.8 percent in the four area models. At higher levels of life expectation there is less variance, but male life expectation varies from 93.3 percent in model east to 94.6 percent in model north. For a discussion of issues regarding gender and life expectation, see Jacques Vallin, "Sex Patterns of Mortality: A Comparative Study of Model Life Tables and Actual Situations with Special Reference to the Case of Algeria and France," in *Sex Differentials in Mortality: Trends, Determinants and Consequences,* Alan D. Lopez and Lado T. Ruzicka, eds., Miscellaneous Series no. 4, Department of Demography (Canberra, 1983), pp. 443–76.

County Public Library in Fort Wayne, Indiana, New York Public Library, Newberry Library, and the LDS Genealogical Society Library in Salt Lake City.[13] In addition, there are collections with a regional emphasis in many libraries throughout the country. Many of these histories are small and of poor quality, while others are significant books that represents thousands of hours of detailed genealogical research.

A typical U.S. or Canadian family history begins with a brief discussion of European forbears of an immigrant couple who migrated to North America. Most of the book is then devoted to a history of this immigrant couple and their descendants. Table 9.1 illustrates the typical structure of a printed family history. Normally the number of individuals per generation increases for a few generations, then declines because the last generations of a book are incomplete in the sense that not all the individuals of those generations had been born when the book was published. Birth years of a particular generation may span as much as a century because of the time disparity between the birth of the first-born of the first-born and so on compared to that of the last-born of the last-born and so forth. Although the number of people in each completed generation increases, the rate of increase is below the expected rate for most families because some individuals in each generation are not followed in the basic genealogical records, which eliminates their descendants from the book. Because of this attrition, the cross-sectional age distribution within a book will be skewed toward older ages. This attrition, however, will not bias the calculation of the age-specific fertility or mortality rates.

Although family histories or genealogies have been used for some time by historians and demographers, they have not been widely accepted as a good source for mortality analysis for the United States during the pre-registration period.[14] There are concerns that the use of genealogies may generate mislead-

13. Marion J. Kaminkow, *Genealogies in the Library of Congress: A Bibliography*, 2 vols. (Baltimore, 1972), lists the collection of family histories in the Library of Congress through 1971. Two supplements have since been published bringing the listing through 1986. These four volumes survey about 33,500 family histories. In addition, Kaminkow, *A Complement to Genealogies in the Library of Congress* (Baltimore, 1981), reports the results of a survey of twenty-four other libraries to obtain listings of their family histories that were not in the Library of Congress. This volume has 20,000 entries. The largest collections are in the New York Public Library (6,100 books not in the Library of Congress) and the Allen County Public Library, Fort Wayne, Indiana (8,600 volumes of its collection of 26,000 were not in the Library of Congress). The LDS Genealogical Library in Salt Lake City has a very large collection of family histories, many of which would also be in the Library of Congress.

14. Genealogical sources have been used quite widely by historical demographers, especially in Europe. See T. H. Hollingsworth, *Historical Demography* (Ithaca, 1969), for a discussion. J. Dennis Willigan and Katherine A. Lynch, *Sources and Methods of Historical Demography* (New York, 1982), also has a discussion of the uses of genealogical data. Adams and Kasakoff have used a sample of New England genealogies to study patterns of migration. See John W. Adams and Alice Bee Kasakoff, "Migration and the Family in Colonial New England: The View from Genealogies," *Journal of Family History* (Spring 1984), pp. 24–42. Wahl has used a sample of family histories linked to mid-nineteenth-century census records to study fertility and its covariates. See Jenny Bourne Wahl, "New Results on the Decline in Household Fertility in the United States from 1750–1900," in *Long-Term Factors in American Economic Growth*, Stanley L. Engerman and Robert E. Gallman, eds., Studies in Income and Wealth, vol. 51 (Chicago, 1986). Fogel

Table 9.1 Structure of a Typical Family History

Gen	#M	MBY	MDY	MBPL	MDPL	#F	FBY	FDY	FBPL	FDPL
1	1	100%	100%	100%	100%	1	0%	100%	0%	0%
2	1	100	0	100	0	1	100	100	100	100
3	3	100	100	100	100	0	n.a.	n.a.	n.a.	n.a.
4	12	67	83	67	75	9	67	22	11	11
5	24	50	46	46	54	18	44	11	6	0
6	38	74	71	58	58	26	62	35	15	15
7	56	88	66	48	52	55	73	18	9	5
8	76	92	42	67	39	72	90	33	54	28
9	160	94	59	57	44	116	90	41	50	27
10	116	96	60	55	35	131	93	46	47	32
11	15	100	7	53	7	15	73	20	60	13

Notes: Gen is the generation with the immigrants to the United States considered as generation 1, their children as generation 2, and so forth. #M is the percentage of males in that generation. MBY is the percentage with a birth year recorded; MDY is the percentage with a death year recorded. MBPL is the percentage of males with birthplace recorded; MDPL with a deathplace recorded. #F, FBY, FDY, FBPL, and FDPL are the analogous variables for females. n.a. = not applicable.

Source: Eddis Johnson and Hugh B. Johnston, *The Johnsons and Johnstons of Corrowaugh in Isle of Wight County, Virginia*, vol. 1 (Martinsville, IN, 1979).

ing inferences because of selection bias although empirical evidence of bias among the large body of family histories mentioned above is meager.[15] Susan Norton compared reconstructed families with the general population of three communities of Massachusetts between 1790 and 1840 and found that the families in the reconstructed genealogies were slightly larger, more agricultural, and persisted through censuses more often. John Knodel and Edward Shorter found the German village genealogies to be accurate representations of the available data.[16] Examination of family histories suggests that their

found a downturn in life expectation calculated for age ten that correlated closely with the decline in stature for cohorts born before the Civil War. See Fogel, "Nutrition and the Decline in Mortality since 1700." Bettie C. Freemen, "Fertility and Longevity in Married Women Dying after the End of the Reproductive Period," *Human Biology* 7 (1935), pp. 392–418, used genealogies to study the effect of child-bearing on mortality of women. A group of sociologists, historians, and geneticists have used the genealogies of Utah to study genetic links for particular diseases as well as fertility of Mormon families. See L. L. Bean, D. L. May, and M. Skolnick, "The Mormon Historical Demography Project," *Historical Methods*, 11 (Winter 1978), pp. 45–53; L. L. Bean, G. P. Mineau, K. A. Lynch, and J. D. Willigan, "The Genealogical Society of Utah as a Data Resource for Historical Demography," *Population Index*, 46 (Spring 1980), pp. 6–19. There have been other applications. Louis Henry, *Ancienne Familles Genevoises: Etude Demographique, XVI^e–XX^e Siecle* (Paris, 1956); Bennett Dyke and Warren T. Morrill, eds., *Genealogical Demography* (New York, 1980).

15. For an example, see Vinovskis, "Mortality Rates and Trends in Massachusetts before 1860," pp. 191–92.

16. Susan L. Norton, "The Vital Question: Are Reconstructed Families Representative of the General Population?" in *Genealogical Demography*, Bennett Dyke and Warren T. Morrill, eds. (New York, 1980) pp. 11–22; John Knodel and Edward Shorter, "The Reliability of Family Reconstitution Data in German Village Genealogies (*Ortssippenbucher*)," *Annales de Demographie Historique* (Paris, 1976), pp. 115–54.

compilers made every attempt to include all descendants of an immigrant couple with as much data on births, marriages, and deaths as could be reasonably gathered.[17]

9.2.1 General Biases in Family Histories

Demographic data drawn from U.S. family histories underrepresents blacks because their genealogies are so difficult to reconstitute. Immigrants are also underrepresented in the sample used here, which is based on very few books and has not been designed to sample the foreign born in proportion to the population.[18] Even if a sampling scheme had been carefully designed to maintain balance between immigrants and natives, family histories could be a biased source of demographic data on immigrants because an immigrant without a descendant would not generate a family history. (Natives without descendants are well represented in family histories.) Because those immigrants who left descendants may have lived longer than those who did not, family histories may be a biased sample for immigrants.[19]

Biases in family histories reflect weaknesses in the underlying sources of data available to the compilers, such as vital registers, burial records, church records, probates, censuses, or family records. For example, infant and childhood deaths, underrecorded in the underlying sources, are necessarily underrecorded in family histories. This appears to be especially true before 1850. For cohorts born between 1760 and 1799 in the sample studied here, only 4.5 percent of males and 9.7 percent of females die before reaching age ten. From 1800 to 1849 the death rates below age ten for males (females) rises to 8.4 percent (10.1 percent). From 1850 to 1889, deaths below age ten were 15.0 percent for males and 17.7 percent for females. The recorded rise in infant deaths largely reflects improved record keeping.

Death dates are about half as common in family histories as are birth dates because parish registers, census schedules, and other sources allow the compiler to give at least a birth year for an individual. Dispersal of families and married women's name changes make death years harder to find. Fertility patterns, birth intervals, and the low recorded infant mortality rates in family histories suggest that individuals who died in infancy were generally included in the family history—most often with a birth year, but no death year, re-

17. The information on the ancestors of the compiler of a book is not unusually complete compared with information on other family lines—a fact of some comfort to those who want to use the book for demographic history. Individuals within the histories who do not marry are recorded in the book with their vital dates included. In other words, genealogists who compile such books are careful about the completeness and accuracy of their work.

18. For a sample design that does bring in the foreign born in the appropriate proportion see Robert W. Fogel, Stanley L. Engerman, James Trussell, Roderick Floud, Clayne L. Pope, and Larry T. Wimmer, "The Economics of Mortality in North America, 1650–1910: A Description of a Research Project," *Historical Methods*, 11 (Spring 1978), p. 102.

19. Many family histories start with immigrant couples who have children born in Europe who migrate with them to the United States. It may be possible to study the mortality experience of immigrants through these children, not all of whom survive to have descendants.

corded. Consequently, family histories are probably not very useful for the study of infant or child mortality, but they are a suitable source for study of mortality of native-born white adults.[20]

9.2.2 A Sample of Family Histories

Each history begins with an individual or couple who migrated from Europe to the colonies or the United States. This sample was drawn with a primary objective of understanding the structure and biases of family histories. Consequently, nearly the complete book was recorded.[21] From each book, the vital dates and places for each individual were recorded along with information about occupation, religion, and military service where available. Quality codes were attached to the dates that were imprecise such as "about 1825." The most troublesome categories of "before or after a particular year" have been eliminated from the analysis. In some cases, place information not included by the compiler was easily inferred and added. An algorithm using birthplaces of children and death place of a spouse was employed to impute missing death places. The relationships among individuals within the book were also recorded. For analysis of mortality, it was important to distinguish between two groups of individuals—those included by virtue of their birth and those included by virtue of their marriage. That is, individuals may be included because they are bloodline descendants of the immigrant or they may be in the book because they married one of these descendants. All individuals are designated as either "bloodline" or "non-bloodline."

9.2.3 Definition of Group at Risk

Mortality studies in family histories must be confined to a carefully defined subset of the individuals listed in the family history to ensure that an individual was actually at risk of death at the age entered into the life table. The two key considerations concern the way an individual enters the family history and missing evidence on the date of death.

Life tables used here assume that bloodline children, those whose parents are in the family history, are at risk of death from birth. Any child whose parents were recorded in the history would be included in the book, whether they died on the day of their birth or survived to old age. From the vantage of the family history, spouses who entered the family history by marrying direct descendants of the immigrants were not at risk of dying before marriage. If the individuals marrying into the family (non-bloodline) were included from birth, calculated life expectations would be biased upward. Therefore, these individuals are only included in the mortality calculations after marriage.

20. An appendix exploring the potential biases in the family histories that affect their use for mortality estimates is available from the author upon request.

21. Individuals at the very end of the book seemed to be of little use. Obviously, we have better sources than family histories to study twentieth-century demography. Consequently, we adopted a rule of not collecting data on the children of any woman who would not have reached age 45 by the publication date of the family history.

Individuals born near the completion of the book present a different problem. They are at risk of dying up until the compiler stopped collecting data. If there were death information for all deceased individuals in a family history, then all individuals without death dates could be presumed to be alive at publication of the book and their years of exposure could be used in the calculation of life expectancy. But, many death dates are missing, and one cannot distinguish between individuals still living at the time of publication and those whose actual death date has not been included. This deficiency seriously biases death rates upward near the end of a book if individuals with both birth and death years born near the date of the compilation of the book are included. Alternatively, this deficiency would significantly bias death rates downward if all persons without death dates were presumed alive at the compilation of the book. The approach used here is to eliminate all individuals born within ninety years of the latest vital date (not necessarily the publication date) listed in the book.[22]

The sample used here starts with 49,419 individuals taken from twenty-three different family histories. The majority of these individuals, however, had to be eliminated from the data used for mortality analysis.[23]

9.3 Trends in Mortality, 1760 to 1880

Mortality can be analyzed by cohort or by time period. Both approaches are useful and offer different perspectives. The current sample of family histories may be used to examine the trend in mortality for cohorts born between 1760 and 1880. Since the focus here is adult mortality beyond age twenty, period mortality may be analyzed from 1780 onward. It should be noted that the cohort experience is over the whole lifespan. That is, the cohort life expectancy of 44.4 years at age twenty for males born between 1800 and 1809 found in Table 9.2 is a measure of mortality beginning as early as 1820 and continuing until the last person in that cohort dies. A period mortality value for e_{20} (e_i refers to life expectation at age i) of 41.5 years reported in Table 9.4 for the decade 1840–49 reflects the experience for everyone older than age twenty who lived in that decade.

22. The absence of death dates for some individuals in the histories also means that increment/decrement life tables cannot be used. For example, one might consider using individuals with known intervals between birth and the birth of a child and then eliminating them from the life table calculations. Use of such individuals would bias the life tables upward because the individuals selected in this way would add years lived to the denominator but could not contribute deaths.

23. This procedure of collecting all individuals within a book greatly enhanced our understanding of complete histories, but has the disadvantage that book-specific effects could be a factor in the results. There may be particular effects of an extended family on location, economic status, or longevity that constitute a book-effect of mortality. Further work with family histories should increase the number of family histories studied to dilute these effects. Fortunately, most of the books have a wide geographical distribution of births and deaths.

Table 9.2 **Life Expectations for Ten-Year Cohorts (in years)**

		Male Life Expectation at Ages:				Female Life Expectation at Ages:		
Cohorts	N(30)	Twenty	Thirty	Fifty	N(30)	Twenty	Thirty	Fifty
1760–69	117	46.0	38.0	22.8	75	45.1	37.5	24.8
1770–79	135	44.3	37.2	21.8	77	47.9	39.4	24.8
1780–89	174	42.9	35.8	21.3	127	44.5	37.4	24.1
1790–99	208	42.9	35.1	20.8	163	40.7	33.4	20.4
1800–1809	267	44.4	37.3	23.1	205	45.3	38.1	23.6
1810–19	307	44.9	37.0	22.3	254	40.5	34.5	23.6
1820–29	353	41.1	34.9	22.1	314	38.2	33.4	21.8
1830–39	329	40.9	35.4	22.1	284	41.8	36.0	23.2
1840–49	418	42.8	36.8	21.7	372	42.3	36.8	23.5
1850–59	457	44.6	36.6	22.4	384	43.1	36.7	22.9
1860–69	404	43.3	35.9	22.6	360	44.7	38.7	24.0
1870–79	256	44.8	38.7	23.6	216	42.7	38.4	25.0
1880–89	131	46.5	39.9	23.1	133	48.9	41.6	25.8

Notes: N(30) is the number of individuals alive at age 30, which is generally larger than the number alive at age 20 because non-bloodline individuals only enter the life table after marriage.

Source: Family History Sample.

9.3.1 Cohort Life Expectation

Table 9.2 gives estimates based on the family history sample of life expectation at ages twenty, thirty, and fifty by ten-year birth cohorts for males and females. Sample sizes are small but reasonably representative of the geographic distribution of the population.[24] Sample sizes are even smaller for women because books contain less death information for them, probably because of name changes for married women.

The most striking feature of Table 9.2 is the similarity between the life expectancy of cohorts born at the end of the eighteenth century and those born a century later. A comparison of 1760–69 with 1880–89 reveals little improvement for males and only modest improvement for females. For males, life expectation at age twenty is 46.0 years for the 1760 cohort and 46.5 years for the 1880 cohort. Life expectation improves somewhat at ages thirty and fifty. Even comparisons of the 1770 cohort, which had lower life expectation for males than the 1760 cohort, with the cohort of 1880 show less than 8 percent improvement at all three ages. The fact that a century marked by a high rate of economic growth did not significantly raise the life expectation of the most economically favored segment of the population (native-born white

24. It should be noted that the experience is at least twenty years after the birth period in the case of e_{20} and beyond that for life expectations at older ages. Thus, most of the experience recorded in Table 9.4 occurs in the nineteenth and early twentieth centuries.

adults) is worthy of notice and is in marked contrast to the experience of the twentieth century.

The similarity in life expectations in the late eighteenth and late nineteenth centuries hides cyclical movements within the 120 years from 1760 to 1880. Table 9.2 suggests that there were significant periods of decline and improvement in adult life expectancy. Life expectation appears to have fallen for successive cohorts born in the 1760 to 1799 period, with a recovery in the first decade or two of the nineteenth century. Life expectancy then continued its downward trend, reaching a trough in the 1820s for women and the 1830s for men. The later trough for men was probably generated by the higher mortality of younger men in the Civil War. In spite of the effect of war on male mortality, the downturn in cohort life expectancy started earlier and was more severe for women.[25] For women born in the 1820s, life expectation at age twenty was only 78 percent of the expectation for women born in the 1880s. For men, life expectation for the highest mortality cohort (1830) was 88 percent of the value for the 1880s.

Cohorts born after the 1840s experienced modest and sporadic improvement in mortality conditions so that life expectancy for cohorts born in the 1880s was higher than for cohorts born in the revolutionary period. The pattern of decline in life expectation was less pronounced, but present, for ages thirty and fifty. Most of the cyclical movement in death rates appears to have been associated with what are normally the ages of low age-specific mortality between twenty and fifty.

The central finding of an antebellum decline in life expectation for native-born white adults, in spite of a growing economy, is sufficiently disturbing to warrant further exploration and testing. Could the cycle in life expectation be an artifact of the data set or a result of the selection procedures for family histories? It is easier to imagine a bias that would affect the level than one that would generate a spurious cycle.

A spurious cycle in life expectation could be generated by a cycle in the ability of the family historian to gather mortality data. Death years of long-lived individuals might be easier to find (they had a longer paper trail) than those of individuals dying at younger ages. Therefore, a lower proportion of death years to birth years for a particular time period in the histories could generate a higher life expectation. If the ratio of death years to birth years varied systematically over time, a spurious cycle could be generated.

But the cycle in life expectation in this data set is not generated by changing proportions of death recorded. The proportion of those born in a given year, who also have a death year in the family history, does not suggest a cyclical pattern in the ratio of death years to birth years. Early decades show more

25. The period estimates for the Civil War years suggest that the war had an impact on the mortality of both younger men and younger women. The effect goes beyond the war deaths. Perhaps the movement of so many men throughout the country, some with short periods of service who then returned home, increased the deaths from infectious disease.

yearly variance, but most decadal birth cohorts have just over 50 percent of the individuals with recorded death years.[26] The cycles in life expectation are not replicated by the cycles in the ratio of death years to birth years.

A spurious cycle in life expectation could also be produced by shifting regional weights, because this sample was not designed as a random sample of the native-born white adult population. The Northeast is overrepresented for cohorts born in the late eighteenth century and underrepresented for cohorts born in the mid-nineteenth century. Otherwise, the sample is reasonably representative of the regional distribution of native-born white adults. Still, the effect of proper weighting of the four main regions of the country on the antebellum decline remains unmeasured. Regional weights are difficult to calculate for two reasons. The weights should be based only on the geographical distribution of native-born whites who reach adulthood. In census tables before 1850, the foreign born were not separated from natives in census tables and tabulations for early censuses use broad age intervals. In addition, the life expectations are for cohorts with mortality experience that span several decades. Consequently, weights based on any single year inaccurately reflect the shifting weights that should be applied as cohorts age and migrate between regions.

Table 9.3 compares cohort life expectations for the unweighted sample with those of a weighted sample. The weights are calculated for the census year closest to the year of death for each birth grouping. For example, the regional weights for those born between 1800 and 1819 are based on the distribution of native-born white adults in the 1870 census, the census closest to their average year of death. The time periods of Table 9.3 reflect the major turning points in the trend in cohort life expectation. The differences between the expectations in the unweighted sample and those of the weighted sample are not large, and the pattern of the antebellum decline is maintained with nearly the same magnitudes of decline and increase. The weighted estimates show slightly higher female life expectation for cohorts born between 1820 and 1849, but a reduced e_{20} for females born between 1850 and 1869. The amplitude of the female cycle in life expectation is reduced in the weighted sample while, for males, the amplitude of the cycle is increased. But in both cases the changes are small.

9.3.2 Period Effects on the Trend in Mortality

Tables 9.2 and 9.3 show changes in cohort life expectation, but do not isolate the exact period of mortality decline or improvement. It is possible that successive cohorts born in the antebellum period simply suffered higher mortality rates at every age throughout their lives. Adverse changes in the nutri-

26. Surprisingly, the cohort born in the 1830s, a cohort with low life expectancy, is an exception since only 46 percent of that cohort have death years. While the 1830s is one of the decades of low life expectancy, the downturn in life expectation starts earlier and is sustained for more than this decade.

Table 9.3 **Comparisons of Life Expectations at Age Twenty (in years)**

	Males		Females	
	Unweighted Sample	Weighted Sample	Unweighted Sample	Weighted Sample
Birth Periods:				
1760–99	43.5	43.7	44.2	44.0
1800–1819	43.4	43.0	42.5	42.8
1820–49	41.3	41.4	40.2	40.6
1850–69	43.4	44.1	42.6	42.1

	1760–99		1800–1819		1820–49		1850–69	
	Sample %	Weight Used to Re-weight	Sample %	Weight Used to Re-weight	Sample %	Weight Used to Re-weight	Sample %	Weight Used to Re-weight
Region:								
Northeast	53%	.55	33%	.44	24%	.37	14%	.31
South Atlantic	17	.23	20	.15	16	.12	21	.12
North Central	19	.14	36	.26	45	.36	45	.41
South Central	10	.08	11	.15	15	.15	20	.16

Note: Weights are based on the adult white natives in each region in the census nearest to the expected year of death for that cohort. The census of 1840 was used for the groups born between 1760 and 1799; 1870 for the 1800–1819 cohort; 1900 for the 1820–49 cohort; and 1920 for the 1850–69 cohort. The regional life expectations are reported in Table 9.6.

Source: Family History Sample.

tional practices during pregnancy or in early childhood as well as shortages of food might have had this kind of an effect.[27] An alternative explanation for the cohort pattern could be an intense increase in mortality rates for a shorter period of time that adversely affected life expectancy of several cohorts in a differential manner. To illustrate: A severe epidemic in 1860 would not affect cohort life expectation, measured at age twenty, of the cohort born in 1800 as much as it would affect the cohort born in 1840, because the person-years lost would be significantly higher for the cohort that was younger at the time of the epidemic.[28] Consequently, a cycle in life expectations could be caused by

27. J. M. Tanner, *A History of the Study of Human Growth* (Cambridge, 1981).

28. This example assumes that the period impact on death rates is independent of age. There is always the possibility of differential effects by age. Older age groups could have an immunity because of previous exposure to infectious disease such as smallpox, or older people could be more susceptible to death from certain diseases such as influenza. The point here is that a period-specific increase in mortality that causes deaths proportionally in all age categories will lower life expectation more for younger cohorts.

a sharp increase in mortality for a brief period or by a cycle in mortality rates experienced by particular cohorts over their whole lives.

The period estimates in Table 9.4 suggest that the antebellum decline in life expectation was largely the result of high mortality rates from 1840 through the Civil War. The period mortality rate for ages twenty to forty-nine rose from 22 percent and 25 percent for men and women, respectively, for the first four decades of the nineteenth century to 28 percent and 35 percent for the period 1840 to 1859.[29] Clearly, such high period mortality rates experienced by adults in their most productive years drove most of the decline in adult life expectation. Period measures of e_{20} fell from 44.6 years in the 1830s to 40.8 years in the 1850s for males. The decline is steeper for women, whose period life expectation fell from 44.6 years in the 1830s to 37.1 years in the 1840s (39.5 in the 1850s). After the Civil War, life expectations rose, though not substantially. Estimates of period life expectation (e_{20}) are only 45.8 years for men and 42.9 years for women at age twenty in 1880. Thus, the decline in life expectation reported in Table 9.4 for individuals born from 1810 to 1849 was mainly the consequence of high mortality for a short period (1840–69) rather than higher mortality rates throughout their lives.

The Civil War years were marked by very high mortality rates for both men and women. For the period 1860–64, e_{20} for men (not shown in Table 9.4) was 34.9 years with the probability of dying between age twenty and twenty-four of 0.14, which is over three times the rate in earlier decades. The same values for women are 41.5 and 0.08. War casualties could account for some of the decline in life expectation for men, but would not have a measurable effect on women. War deaths including battle deaths and deaths from disease are estimated to be about 8 percent of males ages 15 to 50 in 1860–64.[30] If one assumes that the 1860–64 period without the war would have experienced the same period mortality as an average of the decades 1850 to 1859 and 1865 to 1874, cohort life expectations would increase significantly for males born between 1835 and 1844, but would increase only marginally for other cohorts. But such an adjustment to the 1860–64 rates does not seem warranted since war-related deaths appear to be only part of the story. The effect of moving large numbers of men throughout the country and the stress of the war increased the mortality of adults generally. But, the high mortality in the 1840s and 1850s had a larger effect on the antebellum cycle of life expectation than did the large effect of the Civil War.

Period death rates for the postwar period are lower than the rates for 1840–65, but they are not as low as the period rates at the end of the eighteenth

29. The first four decades would represent level 13 for women and level 14 for men in the model west tables of Coale and Demeny. The 1840s and 1850s would represent levels between 11 and 12 for men and 7 and 8 for women. Obviously these harsh conditions did not persist for very long. Kunze, "The Effects of Age Composition and Changes in Vital Rates," finds a similar downturn but it is not quite as severe in his data.

30. Claudia Goldin and Frank D. Lewis, "The Economic Cost of the American Civil War: Estimates and Implications," *Journal of Economic History*, 34 (June 1975), pp. 299–326.

Table 9.4 Period Life Expectations (in years)

		Male Life Expectation At Age:				Female Life Expectation At Age:		
Period	N(20)	Twenty	Thirty	Fifty	N(20)	Twenty	Thirty	Fifty
1750–79	174	44.4	35.8	20.0	—	—	—	—
1780–99	214	47.4	40.1	24.3	115	45.6	37.4	21.7
1800–1809	169	46.4	39.5	24.8	115	47.9	41.1	26.5
1810–19	204	44.6	38.0	24.4	141	44.4	37.4	24.5
1820–29	236	43.3	36.1	21.1	169	44.9	37.7	24.7
1830–39	280	44.6	36.7	22.7	228	44.6	39.1	25.0
1840–49	346	41.5	35.3	20.6	288	37.1	32.1	19.8
1850–59	328	40.8	35.2	22.0	263	39.5	33.4	22.3
1860–69	412	41.2	35.1	22.1	342	42.2	36.7	24.6
1870–79	428	44.3	36.4	22.3	341	42.2	35.7	22.8
1880–89	375	45.8	38.6	22.9	336	42.9	36.8	22.8

Note: N(20) is the number of individuals used to calculate the probability of dying between 20 and 29. A dash indicates that there were too few observations at older ages to calculate life tables.

Source: Family History Sample.

century. Hence, the long-run improvement was gradual. It appears that much of the rise in life expectation for cohorts born after 1850 came from improvements in the 1890s and early twentieth century.

9.3.3 Comparisons of Family History Life Tables with Other Evidence

Table 9.5 compares period life tables constructed from this family history sample with period tables drawn from other sources. The comparisons are with life tables for whites and native-born whites where possible. These comparisons suggest that life tables based on family histories are very similar to those based on other sources. Period estimates from the family histories for the antebellum era are compared with the life tables of Levi Meech for 1830 to 1860, Jacobson for Massachusetts and Maryland in 1850, and Vinovskis for Massachusetts in 1860. For most values, the life expectation based on the family histories is bracketed by the other estimates. The estimated female life expectation at ages twenty and thirty are slightly lower for the family histories compared with the other three estimates. In the comparison with Meech's life table, estimates from the family histories never deviate by more than 5 percent. The Jacobson life table for 1850, an average of experience in Massachusetts and Maryland, gives a slightly lower value of life expectation for males and a higher value for females than the family histories. Vinovskis has suggested that the Jacobson table understates life expectancy for Massachusetts because an outbreak of cholera in 1849–50 increased mortality. Vinovskis's estimates for Massachusetts are uniformly higher than the family history average for 1830–60, which is drawn from all regions of the country.

Table 9.5 Comparison of Life Expectations from Family Histories and Other Sources

Source	Years	Males				Females			
		e_{20}	e_{30}	e_{50}	e_{60}	e_{20}	e_{30}	e_{50}	e_{60}
Meech	1830–60	40.9	34.5	21.2	14.9	41.4	35.4	22.4	15.7
Family Histories	1830–60	42.8	36.0	21.6	15.3	40.8	35.1	22.5	16.2
Jacobson	1850	40.1	33.6	21.2	15.3	41.7	35.8	23.3	16.7
Haines	1850	37.6	31.0	17.8	11.4	38.8	32.2	18.6	11.9
Vinovskis/Massachusetts	1860	44.0	37.4	22.9	16.0	43.0	37.2	24.1	16.9
Family Histories	1878–82	43.6	35.9	22.7	15.8	41.1	35.6	24.4	17.5
Billings/Massachusetts	1878–82	43.5	36.4	22.5	16.0	43.4	37.3	23.9	17.3
Billings/New Jersey	1880	43.3	36.3	22.3	16.1	44.5	37.8	23.7	16.9
Haines	1880	38.7	31.9	18.3	11.7	39.3	32.7	18.9	12.1
Glover	1901	43.2	36.1	21.9	15.0	45.0	37.8	23.2	16.2
Family Histories Relevant Cohort Values		46.5	38.7	22.4	15.3	42.7	38.4	22.9	16.8

Notes: e_i is life expectation at age i. In the comparison with Glover, cohort values have been taken from cohort life tables. For example, $e_{50} = 22.4$ is taken from the life table for males born between 1850 and 1859. If life expectations are increasing through time, cohort values will exceed period values.

Sources: See footnotes of text. For Billings see the 1880 census, vol. 12.

Family histories also appear to be quite representative of the population for the period following the Civil War. The comparison of Billings's life tables for whites in Massachusetts and New Jersey around 1880 with the family histories is also reassuring. The family histories yield lower life expectation for women at younger ages, but fit closely at other ages. The family history expectations for males in the same period used by Billings, 1878 to 1882, deviate from his calculations by less than 5 percent. James Glover's life table for 1901 is based on the original death registration states concentrated in the Northeast. In Table 9.5, cohort estimates drawn from the relevant birth years are compared with Glover's period estimates. For example, the e_{20} value for males of 46.5 years is the value for the 1880 cohort while the e_{50} value of 22.4 years is the value for the 1850s birth cohort. The estimates are quite close, especially for the older ages of fifty and sixty where the cohort value and the period value should not be significantly different.

There are other comparisons that do not corroborate the genealogical findings as clearly. For example, the Haines estimates for the white population for 1850 and 1880 are uniformly and significantly lower than the family history estimates. The differences are partially explained by the lower life expectation of immigrants, who are not represented in the family histories but are included in the Haines data set. All told, however, the comparisons of family history data with other possible sources are reassuring. The differences between the family history estimates and estimates from other sources are often accounted for by the differences in the group being studied (all whites vs. native whites or Massachusetts vs. the United States). The difference between the results

from the family histories and other estimates is never large enough to require acceptance or rejection of one source or the other.

The three samples based on genealogical records consistently find a decline in life expectation in the antebellum period. Fogel used earlier data drawn from a different sample of family histories and found that cohort life expectation measured by e_{10} declined from the late eighteenth century to the mid-nineteenth century. He estimated a twenty-five-year moving average of e_{10} that peaked for cohorts born around 1790 and hit a trough in 1860.[31] Kunze argued that mortality declined in the period from 1835 to 1860.[32] The sample used by Kunze was not drawn from family histories. Rather, it was taken from genealogical records known as family group sheets that have been filed in the LDS Genealogical Library. These records, each of which contains demographic information on a single family, have been compiled by members of the Latter-Day Saints Church who have searched the same basic record sources used by compilers of family histories. The family history sample reported in Tables 9.2–9.4 yields somewhat higher period life expectation in the first fifteen years of the nineteenth century than Kunze's sample, but very close correspondence thereafter even though Kunze smoothed his results using model life tables.

Taken together, then, evidence from these three family history sources supports the same pattern—decline in period life expectation in the antebellum period, followed by sporadic improvement for at least the two decades after the war, then more consistent improvement. The antebellum decline was especially severe in the two decades before the Civil War, but there was added mortality because of the Civil War. This period pattern of mortality is consistent with cohort life expectations peaking sometime around 1800, containing low values in the 1820s and 1830s, and having the greatest improvement for cohorts whose adult mortality experience was entirely within the twentieth century.

9.4 Regional Variations in Mortality

Studies of colonial mortality present a picture of considerable regional variation in adult mortality, with New Englanders enjoying life expectations well above those for individuals living in the Chesapeake and further south.[33]

31. Fogel, "Nutrition and the Decline in Mortality since 1700," p. 465. Because Fogel used a twenty-five-year moving average and Table 9.2 is simply ten-year cohorts without smoothing, the timing of the peaks and troughs will be somewhat different.

32. Kunze, "The Effects of Age Composition and Changes in Vital Rates," chap. 4. He reports period estimates rather than cohort values. The downturn will come later in the period values as compared with the cohorts.

33. Vinovskis, *Fertility in Massachusetts;* Levy, "The Economic Demography of the Colonial South"; Levy, "The Life Expectancies of Colonial Maryland Legislators"; Greven, "Historical Demography and Colonial America"; Smith, "The Demographic History of Colonial New England"; Demos, "Notes on Life in Plymouth"; Norton, "Population Growth in Colonial America";

There is evidence of the beginning of convergence in adult mortality rates during the colonial period. At age twenty, the life expectation for both men and women appears to have been more than 50 percent higher in New England than the Chesapeake in the seventeenth century. For the early eighteenth century, a comparison of the estimates of Phillip Greven, James Somerville, and Susan Norton for New England with Daniel Levy's for Maryland and South Carolina suggests that the New England advantage had fallen to about 25 percent. The New England studies generally show a slight fall in life expectancy between the seventeenth and eighteenth century, whereas Levy finds substantial improvement in life expectancy in Maryland.[34]

Table 9.6, which gives life expectations by region of residence at death, shows less regional variation in adult mortality in the nineteenth century than the colonial period.[35] No regional value differs from the national mean by more than 12 percent. Comparisons by region also reveal a diminishing southern disadvantage in life expectancy. There was sufficient relative improvement in the South Atlantic region to the point that life expectations for individuals born between 1850–69 who died in the region were actually above the national averages. Furthermore, life expectations of the 1850–69 cohort who died in the South Central region compare favorably with those of the North Central region.

The westward migration from the Atlantic regions to the central regions presents a problem in interpreting Table 9.6. The difficulty is illustrated by the high life expectation for individuals born before 1820 who died in the North Central and South Central regions. The majority of these individuals, born in the late eighteenth or early nineteenth century, were migrants.

Migrants should be treated separately for they generally are a self-selected group of stronger, healthier, or more robust individuals compared to the population from which they came. Alternatively they may experience higher mortality rates because of the stress of migration and migrants' exposure to two different disease environments. In addition to biological factors, migrants are likely to live longer on average than non-migrants simply because the cumulative probability of migration increases with age. That is, persons living long enough to migrate will, on average, have a longer life expectation than non-migrants. Indeed, if migration rates were extraordinarily high, the sending

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Somerville, "A Demographic Profile of the Salem Family"; Walsh and Menard, "Death in the Chesapeake"; Smith, "Mortality and Family in Colonial Chesapeake"; and Rutman and Rutman, *A Place in Time*.

34. Compare Levy, "The Economic Demography of the Colonial South" and "The Life Expectancies of Colonial Maryland Legislators" with Greven, "Historical Demography and Colonial America," Smith, "The Demographic History of Colonial New England," Demos, "Notes on Life in Plymouth," Norton, "Population Growth in Colonial America," and Somerville, "A Demographic Profile of the Salem Family."

35. The colonial comparisons are for small populations or communities while the regional comparisons in Table 9.6 are for a more disperse population. Therefore, one might expect more variance in the colonial estimates.

Table 9.6 Regional Variations in Life Expectation by Sex and Region of Death

	Northeast		South Atlantic		North Central		South Central	
	Male	Female	Male	Female	Male	Female	Male	Female
Life Expectation at Age 20 by Birth Years:								
1760–99								
N(20)	276	151	89	47	97	44	52	26
e(20)	43.3	45.8	38.9	40.4	46.8	43.1	46.4	43.7
1800–1819								
N(20)	134	115	83	47	149	71	44	33
e(20)	43.1	43.5	40.9	38.1	46.1	43.7	40.1	42.5
1820–49								
N(20)	212	168	146	117	399	296	130	112
e(20)	41.3	44.4	38.1	39.8	42.4	39.9	41.3	35.4
1850–69								
N(20)	94	79	137	110	303	222	134	108
e(20)	47.2	40.9	44.4	46.6	42.2	40.7	42.2	43.5
Life Expectation at Later Ages by Birth Years:								
1760–99								
e(30)	36.1	39.1	33.2	34.9	38.1	35.9	37.6	36.6
e(40)	28.8	31.5	26.6	29.6	29.6	27.3	29.8	27.2
1800–1819								
e(30)	36.4	38.5	33.0	33.5	37.5	35.4	33.3	33.0
e(40)	29.5	31.6	26.0	30.9	29.4	26.7	26.3	23.0
1820–49								
e(30)	34.9	37.9	32.0	35.4	36.1	34.9	35.4	30.4
e(40)	27.1	31.0	28.0	30.5	29.7	29.5	30.4	27.3
1850–69								
e(30)	38.7	37.4	36.4	39.2	35.8	35.4	33.5	38.0
e(40)	30.5	30.7	31.2	32.6	30.1	30.3	27.3	30.2

Notes: N(20) is the sample size at age 20; *e*(20) is life expectation at age 20 and so on.
Source: Family History Sample.

region would have very low life expectations in contrast to the very high life expectancy in the receiving region. This would be especially true for life expectations at birth and at younger ages. After the age by which most migration had occurred, the differences between migrants and non-migrants would tend to reflect differences in true risks of mortality rather than measurement bias.

There is another bias that could persist even in measurement of regional life expectation at older ages. When migration is predominantly westward, the greater life expectation of individuals born in the eighteenth century and dying in the central regions was, in part, a reflection of the later settlement dates for most of the central regions.[36] Suppose someone born in Massachusetts in 1780

36. States are listed according to the decade in which they first experienced very rapid population growth (the year of statehood is given in parentheses): *1790s*, Tennessee (1796); *1800s*, Ohio (1803); *1810s*, Indiana (1816), Louisiana (1812); *1820s*, Alabama (1819), Illinois (1818), Missouri (1821); *1830s*, Arkansas (1836), Michigan (1837), Mississippi (1817), Texas (1845); *1840s*, Iowa (1846), Wisconsin (1848); *1850s*, Minnesota (1858); and *1860s*, Kansas (1861), Nebraska (1867).

died in Minnesota. Such a person is likely to have migrated at an old age since Minnesota had only 6,000 inhabitants in 1850 but more than 170,000 by 1860. Obviously, migration distorts the regional comparisons of Table 9.6 in several ways.

Regional life tables based on years of exposure in each region would be ideal. Dates of migration would be needed to create such regional life tables, but migration in the family histories is ordinarily inferred from the place information given on births, deaths, and marriages of individuals and their children. This inference of date of migration would impart a bias to life expectation in one of the two regions. Consider an individual born in Virginia in 1800, who migrated to Mississippi in 1810 (but this date is unknown), married in Mississippi in 1822, and died in Mississippi in 1858. One could reasonably allocate the last thirty-six years of life to the South Central region, but the allocation of the first twenty-two years of life between the South Atlantic and South Central regions would be arbitrary without further information. Allocation of all twenty-two years to the South Atlantic would lead to an overestimate of life expectation there and an underestimate of life expectancy in the South Central region. Some sharing of the twenty-two years of exposure would certainly be a reasonable, though arbitrary, procedure. The approach taken here, for simplicity and because of small regional samples, is to separate migrants from non-migrants, where non-migrants are defined as those who live and die in the same region and migrants are those who die in a region other than their birth region.

9.4.1 Regional Life Expectations of Non-migrants

Table 9.7 reports regional mortality relative to the national average. Comparisons on both axes seem useful—North compared with South and the newly settled West with the East. North-South comparisons of non-migrant males show diminishing excess mortality in the South. Comparisons of the South Atlantic with the Northeast and the South Central with the North Central reveal that life expectation for southern males was lower for all periods with the exception of e_{40} in 1820–49 and 1850–69. The largest differences were for the cohorts born in the eighteenth century. For those males born between 1850 and 1869, excess mortality in the South Atlantic region compared with that of the Northeast was negligible, but the differences between the two central regions still persisted.

The North-South comparisons for females do not favor the North as completely. Life expectation in the South Atlantic region was higher than in the Northeast for e_{40} in 1820–49 and at all ages in 1850–69. Life expectation in the South Central region exceeded that of the North Central for e_{20} and e_{30} in 1800–1819 and 1850–69. It would seem that excess mortality for females living in the South had disappeared by mid-century.

The East-West comparisons can be made only for those born in the nineteenth century. For males, the differences were not often large and tended to favor the East in 1800–1819 and 1850–69 and the West during the 1820–49

Table 9.7 **Regional Indices of Life Expectation for Non-migrants (national $e(i) = 100$)**

	Males				Females			
Birth Years	Northeast	North Central	South Atlantic	South Central	Northeast	North Central	South Atlantic	South Central
1760–99								
$e(20)$	100	n.a.	89	n.a.	104	n.a.	91	n.a.
$e(30)$	100	n.a.	90	n.a.	104	n.a.	91	n.a.
$e(40)$	100	n.a.	92	n.a.	105	n.a.	99	n.a.
1800–1819								
$e(20)$	100	102	94	91	102	102	89	106
$e(30)$	102	99	92	91	106	93	92	97
$e(40)$	105	98	92	91	108	93	105	86
1820–49								
$e(20)$	100	101	95	100	109	100	103	86
$e(30)$	100	103	92	99	108	99	103	86
$e(40)$	94	104	97	104	104	100	106	95
1850–69								
$e(20)$	110	99	103	93	92	96	111	103
$e(30)$	108	101	103	88	99	96	106	103
$e(40)$	102	103	105	88	99	100	107	99

n.a. = Less than twenty observations.

Source: Family History Sample.

downturn in life expectancy. For females, life expectations in the East tended to be higher with a few exceptions.

9.4.2 Life Expectations of Migrants

Table 9.8 compares the life expectations of migrants with non-migrants in the sending region (the region of birth for the migrant) and the receiving region (the death region of the migrant). Although sample sizes are small, some patterns are revealed. At age twenty, life expectations were almost always higher for the migrant (16 out of 20 instances). This result is simply a reflection of the biases discussed above. By age forty, migrants were about as likely (9 out of 20 instances) to have a lower life expectation than non-migrants. Since the biases appear to favor longer observed life expectation for migrants, any value below 100 in the table suggests that migrants were facing adverse mortality conditions.

For persons born during the years 1760 to 1799, migrants lived longer than non-migrants who stayed along the Atlantic seaboard. The later settlement of the North Central and South Central regions combined with the bias for older deaths of migrants outweighs any harsh frontier conditions, with the exception of e_{40} for women who migrated from the South Atlantic to the South Central region. For all three birth periods, male migrants tended to live longer than non-migrants from the sending regions, but the advantage declined at

Table 9.8 **The Relative Life Expectations of Migrants by Sending and Receiving Regions**

	Sending Regions				Receiving Regions			
	Northeast		South Atlantic		North Central		South Central	
Birth Years	Males (1)	Females (2)	Males (3)	Females (4)	Males (5)	Females (6)	Males (7)	Females (8)
1760–99								
$e(20)$	110	122	125	112	n.a.	n.a.	n.a.	n.a.
$e(30)$	104	123	117	113	n.a.	n.a.	n.a.	n.a.
$e(40)$	100	121	110	96	n.a.	n.a.	n.a.	n.a.
1800–1819								
$e(20)$	104	99	103	108	105	100	107	91
$e(30)$	104	109	98	98	108	113	100	93
$e(40)$	101	97	95	74	108	103	96	90
1820–49								
$e(20)$	108	108	119	77	106	103	113	89
$e(30)$	108	117	118	77	99	104	110	92
$e(40)$	105	108	111	73	96	97	104	81

Notes: Column (1) is the ratio ($\times$ 100) of life expectation for migrants from the Northeast to the North Central region to that of non-migrants of the Northeast. Columns (2), (3), and (4) are computed similarly. Column (5) is the simple mean of migrants from either Northeast or South to the North Central Region divided by the life expectation of non-migrants of the North Central region. The result is multiplied by 100. Column (6) is computed similarly. Column (7) is the ratio ($\times$ 100) of the life expectation of migrants to the South Central region to non-migrants of the South Central region. Column (8) is computed similarly. n.a. = Less than twenty observations.
Source: Family History Sample.

older ages. The advantage for e_{20} was about 10 percent, for e_{30} about 8 percent, and for e_{40} about 4 percent. Female migrants from the Northeast to the North Central region also tended to live longer than non-migrants. However, women who migrated from the South Atlantic region to the South Central region in the antebellum period had a much lower life expectation than their non-migrant counterparts. Migration evidently had a different effect on men and women.

The comparison between migrants and non-migrants of the receiving region is also of interest because migrants encountered a new disease environment.[37] Male migrants lived longer than their non-migrant neighbors, although the advantage was not large and largely disappeared by age forty. Such was not the case for female migrants who tended to have lower life expectations than the non-migrant women in the settlement region. The comparisons of migrants with non-migrants in both the sending and receiving regions suggest that migration extracted a small mortality cost for women and an even smaller

37. The bias in measurement exists for the receiving region just as it does for the sending region. If the mean age of migration were 30, then e_{20} for the migrants would be biased upward.

cost for men. The mortality cost of migration was evidently higher in the South than the North.

9.5 Sex Differentials in Mortality

Tables 9.2 and 9.4 indicate that sex differentials in mortality were not large before the twentieth century. Trends and levels were similar for males and females at age twenty, with women's life expectancy lower than men's for cohorts born between 1810 and 1830 and slightly higher after 1870. Women had a higher life expectation at age fifty, although the gap was small until after the Civil War. Thus, the lower life expectation in early adulthood for women was the result of the higher probability women faced of dying during their child-bearing years. The lack of a significant positive differential or the existence, at times, of a lower life expectation for women differs from the twentieth-century experience in developed economies where women live longer than men, although women in some poorer countries experience higher mortality.[38] Almost all studies document a positive relationship between the magnitude of the excess mortality of men and the level of life expectation.[39] That is, the gap between the life expectation of women and that of men widens as the overall level of life expectancy improves.

Colonial and other antebellum studies that include life expectations for women are consistent with the view that excess mortality of males was not apparent until after the Civil War. The studies of Greven, Demos, and Rutman

38. Samuel Preston, *Mortality Patterns in National Populations* (New York, 1976), finds that the increasing sex differential from cardiovascular diseases accounts for over 80 percent of the increase in the differential in the twentieth century. See also Ingrid Waldron, "What Do We know about Causes of Sex Differences in Mortality?: A Review of the Literature," *Population Bulletin of the United Nations*, No. 18 (1986). Many of the causes she cites should have been important in earlier times. Higher consumption of tobacco and alcohol by men probably extends back into the earlier centuries. However, the mortality impact of this consumption may be greater in the twentieth century. She suggests that ischaemic heart disease has a strong male bias, in part because female sex hormones reduce the risk of heart disease for women. Excess female mortality is associated with maternal mortality, obviously, and tuberculosis. Excess male mortality from accidents was probably not as important in the nineteenth century as in the twentieth century. Alan D. Lopez, "The Sex Mortality Differential in Developed Countries," in *Sex Differentials in Mortality: Trends, Determinants and Consequences*, Alan D. Lopez and Lado T. Ruzicka, eds., Miscellaneous Series no. 4, Department of Demography (Canberra, 1983), pp. 53–120, points to the widening differential indicating that most of the differential is due to trends after age forty-five. He finds that "this situation has arisen due to a widening disparity in death rates from the cardiovascular diseases, cancers, and motor vehicle accidents and the virtual elimination of maternal deaths for women.

39. Larry Heligman, "Patterns of Sex Differentials in Mortality in Less Developed Countries," and Jacques Vallin, "Sex Patterns of Mortality," in *Sex Differentials in Mortality: Trends, Determinants and Consequences*, Alan D. Lopez and Lado T. Ruzicka, eds., Miscellaneous Series no. 4, Department of Demography (Canberra, 1983); M. A. El-Badry,, "Higher Female than Male Mortality in Some Countries of South Asia: A Digest," *American Statistical Association Journal* (Dec. 1969), pp. 1234–44; Amartya Sen and Sunil Sengupta, "Malnutrition of Rural Children and the Sex Bias," *Economic and Political Weekly*, 18 (May 1983), pp. 855–64.

and Rutman found excess female mortality in the seventeenth century. But, in the eighteenth and early nineteenth centuries, there was no consistent sex differential in mortality. In Massachusetts, Greven and Somerville find a slight differential favoring females while Norton finds excess female mortality in Ipswich. Vinovskis finds excess mortality for females in 1840–42 and 1859–61 in Massachusetts, excess mortality for males in other years. Meech estimates a lower life expectation for females aged twenty or thirty compared with males and virtually the same expectation for both sexes at age fifty. Jacobson, on the other hand, estimates a slightly higher expectation at age twenty for females.[40] Taken together, the evidence from family histories and other studies is consistent with similar life expectation for males and females at early adulthood until the latter part of the nineteenth century.

The absence of a sex differential in mortality is supported by the sex ratios [(males/females) × 100] found in census summaries. Table 9.9 reports these ratios for the white population and the native-born white population. Because at birth there are slightly more males than females, it is only superior life expectancy of females that shifts the sex ratio below 100. The sex ratio for native-born whites of all ages remained above 100 from 1850 to 1940. This finding supports the view that life expectations for men and women were nearly equal. The sex ratio for individuals ages 20 to 49 first falls below 100 in 1930.[41] Before 1840, the sex ratio for all whites is near that of native-born whites due to the small immigration flow. From 1800 to 1840, the sex ratio for whites was above 100 except for groups older than seventy. Assuming census data provide reasonably accurate estimates of the sex ratios, there could not have been significant excess male mortality in the nineteenth century.[42] Both the direct evidence from the family history sample and other samples and the indirect evidence from the census sex ratios indicate that the systematic mortality sex differential in favor of females is primarily a twentieth-century phenomenon.

The regional breakdowns display an interesting pattern of sex differentials in mortality. In the more settled eastern regions, female life expectation tended to be higher than male life expectation. This is true for the South Atlantic region in all periods and all life expectations except e_{20} for the 1800–1819 cohort. For the Northeast, female life expectation is higher until the last

40. Greven, "Historical Demography and Colonial America"; Demos, "Notes on the Life of Plymouth"; and Rutman and Rutman, *A Place in Time;* Norton, "Population Growth in Colonial America"; Somerville, "A Demographic Profile of the Salem Family"; Vinovskis, "Mortality Trends in Massachusetts"; Meech, *Systems and Tables of Life Insurance;* Jacobson, "Expectation of Life in the United States in 1850."

41. The sharp drop in the sex ratio in 1870 is presumably due to the differential effect of the Civil War on mortality of males and females.

42. Ansley Coale and Melvin Zelnick, *New Estimates of Fertility and Population in the United States: A Study of Annual White Births from 1855 to 1960 and of Completeness of Enumeration in the Censuses from 1880 to 1960* (Princeton, 1963), suggest that there is a differential undercount in the census that would bias the sex ratio slightly upward. See pp. 179–82.

Table 9.9 **Long-term Change in the Sex Ratio**

Census Year	All Ages	All Whites							Native Whites			
		25–44	20–49	≥45	50–64	50–69	≥65	≥70	All Ages	20–49	50–64	≥65
1790	103.8											
1800	105.0	104.8		105.8								
1810	103.9	105.1		107.8								
1820	103.3	104.0		107.0								
1830	103.1		104.7			102.7		96.7				
1840	104.5		107.5			102.2		96.9				
1850		105.2				110.0		106.6	96.5			
1860	105.3	109.3				109.8		95.5	103.7			
1870	102.8		101.8		115.3		101.1		100.6	96.7	109.2	98.5
1880	104.0		105.1		111.6		101.5		102.1	101.5	106.1	98.7
1890	105.2		108.2		107.6		104.3		102.7	103.4	103.8	100.1
1900	104.7		107.5		108.2		101.8		102.6	103.6	104.6	98.7
1910	106.5		109.8		113.7		100.6		102.6	102.2	110.4	98.3
1920	104.3		105.3		112.2		100.6		101.7	100.4	108.0	99.0
1930	102.9		102.4		107.7		100.2		101.1	99.4	104.5	97.5
1940	101.2		99.7		105.3		95.0		100.2	99.1	99.9	92.0
1950	99.0		97.3		99.9		89.1		98.8	97.7	97.1	85.6

Source: U.S. Bureau of the Census, *Historical Statistics of the United States from Colonial Times to 1970* (Washington, D.C., 1975).

period (1850–69) when male life expectation is significantly higher.[43] For those living to the west, however, life expectation for men was quite often higher than for women, especially for the cohorts born between 1800 and 1849. Perhaps migration or living in less densely settled regions had a stronger adverse effect on women than men. It is also possible that male, but not female, migrants were self-selected by their vigor and health.

The cohorts born between about 1770 and 1850 contained the men and women who settled most of the central regions and brought the areas into economic and social maturity. It is within these cohorts that the mortality differential favored men most often. For cohorts born after the Civil War, the mortality differential shifted in favor of women and increased substantially in the twentieth century.

9.6 Summary of Mortality Trends

The results of the small sample from family histories presented here raise interesting questions and provide a point of departure for future studies of mortality before 1900. Caveats have been included in nearly every paragraph because of small sample sizes and the newness of family histories as a data source for the study of mortality. Nevertheless, the consistencies within the family history samples as well as comparisons with other sources are encouraging.

The results may be summarized as follows:

1. Adult life expectation for male and female cohorts declined in the antebellum period and rose sporadically after the Civil War to leave the nineteenth century as a whole with little overall improvement in mortality. The decline in antebellum life expectation reported here confirms the earlier findings of Fogel and Kunze, also based on genealogical sources.
2. The antebellum downturn in cohort life expectation was generated largely by period effects concentrated in the two decades before the war and the broad-ranging impact of the war period. But, the rebound in life expectation after this period was slow and sporadic.
3. The convergence of regional life expectations started during the colonial period and continued into the nineteenth century. Cohorts born in the South at mid-nineteenth century did not have significantly lower life expectations than those born in the North. In fact, female life expectation by 1860 was highest in the South Atlantic region.
4. Migrants generally lived longer than non-migrants, but most of the differential appears to be attributable to measurement bias rather than biological

43. I have no explanation for this anomaly except to note the e_{20} is exceptionally high for males and may be a statistical artifact. The values for e_{30} are closer and the expectations at age forty are equal.

factors. Migration, when measurement bias is controlled, may have increased mortality.

5. Female life expectancy was, at times, lower than that of males at early ages, but was consistently higher after age fifty. Excess female mortality appears to be associated with, but not limited to, the migration and settlement of areas to the west.

9.7 Historical Implications

There is, perhaps, a presumption that the economic growth which increased aggregate economic activity and appears to have increased the average standard of living substantially must also have increased life expectancy over the long run. Data are too fragmentary for the period from 1770 to 1839 to construct firm estimates of GNP and GNP per capita, but the available evidence suggests the economy was growing in both per capita and aggregate terms. More conclusive data from 1839 to 1860 indicate that GNP was growing at a vigorous rate of 4.8 percent and that GNP per capita advanced at an annual rate of 1.7 percent, at a time when the economy was also absorbing larger immigration flows.[44] Agricultural production grew rapidly as new land was brought into cultivation. It is not a large step to assume that food supplies were growing and improving nutrition and nutritional status which, in turn, reduced mortality and morbidity. The evidence presented here suggests that an optimistic assessment of the effects of antebellum economic growth on mortality is not accurate. The puzzle raised by Fogel of rapid growth in output per capita at the same time that height and life expectancy were declining is reinforced by the results presented here.[45] This puzzle still awaits successful resolution.

Yasuba suggested that industrialization and urbanization during the period in question generated the decline in life expectancy.[46] He also cited similar cycles in England, France, Sweden, and Norway. Urbanization would most certainly retard an upward trend in life expectancy. The urban-rural differential noted in colonial Massachusetts persisted well into the twentieth century. At the turn of the century, Glover estimated e_{20} to be 46.0 years for white males and 46.1 for white females in rural areas compared with 39.1 and 43.5 for their counterparts in cities.[47] Urbanization moved people from lower to higher mortality regimes, exacting a price for the increased economic opportunity of the city. Stephen Kunitz, who emphasized the effects of urbanization

44. Stanley L. Engerman and Robert E. Gallman, "U.S. Economic Growth, 1783–1860," in *Research in Economic History*, Paul Uselding, ed., vol. 8, (Greenwich, 1983), pp. 1–46.

45. Fogel, "Nutrition and the Decline in Mortality since 1700," and *Without Consent or Contract: The Rise and Fall of American Slavery* (New York, 1989), pp. 354–62.

46. Yasuba, *Birth Rates of the White Population*, pp. 86–96.

47. James W. Glover, *United States Life Tables: 1890, 1901, 1910, and 1901–1910* (Washington, D.C., 1921), pp. 104–17. These estimates include foreign born, but the differences for nativity are smaller than the urban-rural differences.

in the antebellum period, also pointed to the continuing importance of diseases such as malaria and dysentery that do not confer lifelong immunity.[48] The large increase in immigration from Ireland and Germany during the 1840s and 1850s, as well as the steady migration westward could have increased the exposure of the population to these endemic diseases. Furthermore, harsher conditions and lower population densities in the central regions, settled during the antebellum period, could well have increased infant and maternal mortality.

Fogel, in a series of papers, has also emphasized the importance of nutritional status as an explanation for changes in morbidity and mortality, while Komlos has emphasized reductions in per capita food supplies as the source of decline in heights in the antebellum period.[49] The pattern of cohort life expectation appears to coincide roughly with the recently discovered cycle in stature for the period. Fogel places the start of the downturn in heights with males born around 1830.[50] Komlos places the decline in the heights of West Point cadets slightly earlier. Life expectations for males in Table 9.4 show a downturn starting in the 1820s and continuing for cohorts born in the next two decades, although the sample is too small to pinpoint precise years of the decline.[51]

Explanations of the decline in life expectation for antebellum cohorts should take account of the sharp increase in period mortality between 1840 and 1865. Explanations that rely on a lifelong cohort effect would not be consistent with this sharp period effect. For example, urbanization accelerates after the Civil War when life expectation is also increasing. On the surface,

48. Stephen J. Kunitz, "Mortality Change in American, 1620–1920," *Human Biology*, 56 (Sept. 1984), pp. 559–82.

49. Robert W. Fogel, "Second Thoughts on the European Escape from Hunger: Famines, Price Elasticities, Entitlements, Chronic Malnutrition and Mortality Rates," NBER-DAE Working Paper no. 1 (May 1989); Fogel, "The Conquest of High Mortality and Hunger in Europe and American: Timing and Mechanisms," NBER-DAE Working Paper no. 16 (Sept. 1990); John Komlos, "The Height and Weight of West Point Cadets: Dietary Change in Antebellum America," *Journal of Economic History*, 47 (Dec. 1987), pp. 897–927.

50. Fogel, "Nutrition and the Decline of Mortality since 1700." See also Robert A. Margo and Richard H. Steckel, "Heights of Native-Born Whites during the Antebellum Period," *Journal of Economic History*, 43 (Mar. 1983), pp. 167–74.

51. The time pattern between the height decline and the decline in life expectation could vary. If the height decline is simply a result of a drop in food consumption as a child with no change in the disease environment, then one might expect the downturn in life expectation to occur simultaneously with the downturn in heights, with mortality increases at every age due to the lower nutritional status caused by lower food consumption. However, a decline in heights might be the product of an interaction between marginal diet and an increased level of disease during childhood and adolescence. See Nevin Scrimshaw, Carl E. Taylor, and John E. Gordon, *Interactions of Nutrition and Infection* (Geneva, 1968). If such were the case, the decline in life expectation might precede the decline in heights because of the effect of the increased level of disease on adults whose height had not been affected by disease. The fact that heights seem to reach their lowest point for individuals born in the 1850s or even 1860s, while adult life expectations reached their lowest ebb in the 1820s or 1830s, supports the view that the height decline was, in part, due to an increase in infectious disease rates. Komlos, "The Height and Weight of West Point Cadets," argues against an increase in infectious disease as an explanation for the observed height decline.

the large period effect on mortality between 1840 and 1865 appears to be consistent with a change in the disease environment, starting as early as the 1820s but reaching a peak in the 1840s and 1850s, that affected both height and life expectation.

There is no definitive evidence, at present, on the causes of antebellum decline in stature or life expectancy. The explanation will probably be found in effects and interactions of nutritional status, urbanization, immigration, and westward expansion. A viable explanation must also account for the ineffectiveness of general economic growth to produce increasing life expectation. The specific contributions of different elements to the decline in life expectation will require extensive analysis with large data sets. Family histories, especially when combined with census data for households and counties, should be a significant resource in the search for causes.

Whatever the causes, it appears that the middle of the nineteenth century had its darker side. The period from 1840 to 1860, praised by economic historians as a period of high economic growth, was not the best of times for native-born whites. They faced the startling prospect of significantly higher mortality rates than their parents. These decades were then followed by a war that took the lives of many soldiers and continued the pattern of high mortality rates for civilians. Perhaps economic historians and historical demographers should look more closely at these middle years, as they represent an important and costly episode in American social history.