Life and death during the Great Depression

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Recent events highlight the importance of examining the impact of economic downturns on population health. The Great Depression of the 1930s was the most important economic downturn in the U.S. in the twentieth century. We used historical life expectancy and mortality data to examine associations of economic growth with population health for the period 1920–1940. We conducted descriptive analyses of trends and examined associations between annual changes in health indicators and annual changes in economic activity using correlations and regression models. Population health did not decline and indeed generally improved during the 4 years of the Great Depression, 1930–1933, with mortality decreasing for almost all ages, and life expectancy increasing by several years in males, females, whites, and nonwhites. For most age groups, mortality tended to peak during years of strong economic expansion (such as 1923, 1926, 1929, and 1936–1937). In contrast, the recessions of 1921, 1930–1933, and 1938 coincided with declines in mortality and gains in life expectancy. The only exception was suicide mortality which increased during the Great Depression, but accounted for less than 2% of deaths. Correlation and regression analyses confirmed a significant negative effect of economic expansions on health gains. The evolution of population health during the years 1920–1940 confirms the counterintuitive hypothesis that, as in other historical periods and market economies, population health tends to evolve better during recessions than in expansions.

longevity | mortality | United States

News of the world economic crisis has been widespread since the fall of 2008, and comparisons of current financial and economic problems to those occurring during the Great Depression of the 1930s are common. There is abundant speculation on the consequences of the current economic crisis for a variety of outcomes, including health, but empirical examinations of the effects of economic recessions on population health remain rare. To gain insight into the possible consequences of the current economic crisis for health, we examined the evolution of health indicators in the United States during the Great Depression.

In economics, the terms "recession" and "depression" refer to a decline in economic activity, with "depression" implying a much more severe (longer and deeper) decline, involving high levels of unemployment. The term "Great Depression" is commonly used to refer to the period of widespread contraction of economic activity that started in mid-1929 and lasted until 1933 (1, 2). These years were followed by a period of expansion in the mid-1930s, but unemployment remained high throughout the decade, and economic activity declined sharply once again in 1938, leading some authors to argue that the Great Depression actually extended through the beginning of World War II (2). Therefore, in evaluating the population health impact of the Great Depression, although we reserve "Great Depression" specifically for the years 1930–1933, we examine the period 1920–1940. This 20-year period provides an appropriate time frame to compare the Great Depression to the immediately precedent 1920s, a period of strong economic growth, and to the economic expansion that followed in the mid-1930s.

The U.S. Economy During the 1920s and 1930s. The 1920s began with a major recession in which economic growth (measured by the rate of increase of the gross domestic product; GDP) was negative, and unemployment reached 11.3% in 1921 (Fig. 1). This was followed by a period of runaway economic growth, with GDP expanding at an annual rate of 12.5% in 1923. Economic growth oscillated around more modest levels during the rest of the decade, but it rose to 5.9% in 1926 and to 6.6% in 1929, and the unemployment rate remained below 5% from 1925 to the end of the 1920s.

Although signs of declining economic activity had been apparent since the summer of 1929, the onset of the Great Depression was marked by the stock market crash of October 1929 (1, 2) The collapse of Wall Street was followed by a steep decline in economic activity. Between 1929 and 1930, GDP "growth" was −9.0% (Fig. 1). The contraction of GDP continued for 3 more years, with GDP shrinking 6.5% in 1931, 14.0% in 1932, and 1.4% in 1933. Economic activity accelerated beginning in mid-1933 (1, 3), reaching very large rates of growth—around and over 10%—during the years 1934–1936. This was followed by a new downturn in 1938, with GDP declining 3.6% during that year. The unemployment rate increased sharply during the early 1930s (Fig. 1), reaching its historical maximum of 22.9% in the U.S. in 1932. It subsequently declined between 1933 and 1937, only to increase once again to 12.5% in 1938. Overall unemployment rates remained very high—always above 14% and 2 years above 20%—during the whole period 1931–1935 and oscillated between 9% and 12% the rest of the decade.

Life Expectancy at Birth and Age-Specific Mortality During the 1920s and 1930s. Life expectancy generally increased throughout the period of study (Fig. 1). However, it oscillated substantially throughout the 1920s and 1930s with important drops in 1923, 1926, 1928–1929, and 1936 coinciding with strong economic expansions. During the Great Depression, it rose from 57.1 in 1929 to 63.3 years in 1933. The rates of infant mortality and age-specific mortality for all age groups under 20 years (Fig. 2A) generally declined during the 1920s and 1930s. Superimposed on this general declining trend, peaks in both infant mortality and mortality for children aged 1–4, 5–9, 10–14, and 15–19 were observed in the years 1923, 1926, 1928–1929, and 1934–1936. These peaks all coincide with periods of strong economic growth (Fig. 1).

Mortality rates of men and women aged 25–44 years (Fig. 2B) declined sharply during the recession of 1920–1921, but were either stagnant or increasing during the rest of the 1920s, reaching peaks either in 1928 or 1929, a year of strong economic growth, in all age strata. In all these demographic groups, mortality declined during the early 1930s, coinciding with the Great Depression, and then rose during the strong economic growth of the mid-1930s.
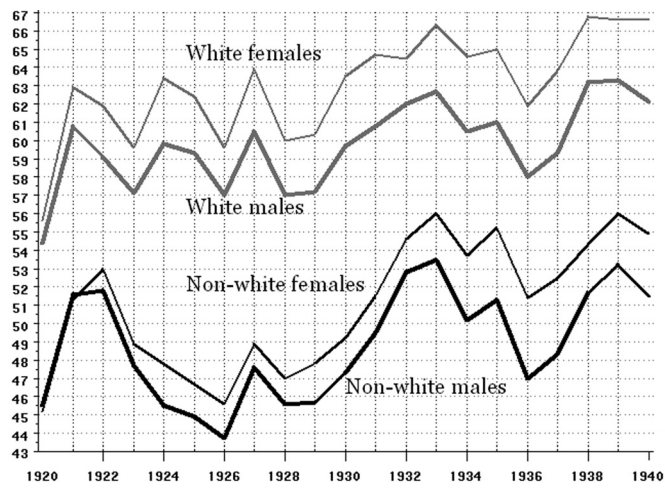
Fig. 1. Life expectancy at birth (years, right scale), unemployment rate (percentage unemployed among the civilian labor force, left scale), and economic growth (annual percentage growth of real GDP, left scale), United States, 1920–1940.

Mortality rates of older people aged 45–64 (Fig. 2C) and 65–84 (Fig. 2D) also appear to have evolved more favorably in the 1930s than in the 1920s. For instance, in males aged 60–64, mortality increased in 1921–1923 (during a period of strong economic growth) and then remained approximately stable during the rest of the decade and the early 1930s (during the Great Depression), only to increase again in 1936 (when strong

growth resumed). Similar patterns of stable or increasing rates during the 1920s, decreasing rates during the early 1930s, and an increase in the mid-1930s with a peak in 1936 are present for nearly all age groups between 25 and 84 years.

Life Expectancy at Birth by Sex and Race. Life expectancy for white and nonwhite males and females (Fig. 3) shows the same general patterns observed for overall life expectancy (Fig. 1). Stable or decreasing life expectancy during the 1920s was followed by increases in life expectancy for white and nonwhite men and women during the Great Depression, a decline in 1936, coinciding with a period of strong economic growth, and increasing life expectancy for the latter part of the 1930s. The patterns are particularly noticeable in nonwhites; nonwhite males lost 8.1 years of life expectancy between 1921 and 1926, and females lost 7.4 years of life expectancy in the same period. In contrast, during the Great Depression nonwhites gained 8 years of longevity, with life expectancy increasing in nonwhite males from 45.7 years in 1929 to 53.8 years in 1933 and from 47.8 to 56.0 in females during the same period.

Specific Diseases and Other Causes of Death. Of six causes of death that compose about two-thirds of total mortality in the 1930s (Fig. 4), only suicides increased during the Great Depression. Suicide mortality peaked with unemployment, in the most recessionary years, 1921, 1932, and 1938. After increasing during the 1920s, mortality due to cardiovascular/renal diseases stabilized in 1930–1932. Tuberculosis mortality had decreased sharply during the 1920s and continued its decline through the 1930s. However, over and above these trends, both cardiovascular and tuberculosis mortality reveal peaks in 1926, 1928, and

Fig. 2. Infant mortality rate (IMR, per 10,000 life births) and mortality rates (per 100,000) for age- and sex-specific groups (''1–4'' is mortality for children at ages 1–4, ''40–44m'' is mortality for males aged 40–44, ''25–29f'' is mortality for females aged 25–29, etc.).

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Fig. 3. Life expectancy at birth (years), for males and females, and whites and nonwhites.

Fig. 4. Crude mortality rate (per 100,000 population) for selected major causes of death.

especially 1936, coinciding with economic expansions. Mortality due to flu/pneumonia was lower during the 1930s than during the late 1920s.

Cars became increasingly common during the 1920s, and traffic-related mortality increased markedly until 1931, but dropped sharply in 1932, the worst year of the depression. It rose again during the economic expansion of the mid-1930s and plummeted in the recession of 1938.

Correlations and Regression Models. Table 1 shows correlations between annual improvements in health—as assessed by gains in life expectancy or reductions in age-specific mortality rates—and annual changes in economic conditions. Improvements in health are negatively correlated with GDP growth and positively correlated with increases in the unemployment rate (Table 1). Patterns were consistent across race, sex, and age groups (negative correlations between GDP growth and health improvement are statistically significant at the usual 0.05 level for 10 of the 16 demographic categories examined, and positive correlations between unemployment change and health improvement are statistically significant in 13 of the 16 demographic categories).

Overall life expectancy increased 8.8 years over the period 1920–1940, i.e., on average the annual gain was 0.4 years. Table 2 shows the mean difference in the annual gain in life expectancy associated with a GDP increase of 1 percentage point in the same year and in the 3 prior years. The negative coefficients for lag zero (all of which are statistically significant) indicate that years of larger GDP growth are also years of smaller gains in life expectancy. None of the coefficients for lagged GDP change are large or statistically significant. The model for the whole population including only GDP growth at lag zero indicates that a percentage point increase in GDP growth is associated with a reduction in the annual gain in life expectancy of 0.20 years (95% confidence interval: −0.06 to −0.34).

The model fitted for the whole population including only lag zero is $\Delta e_t = 0.88 - 0.20 \, g_t$. This model predicts an annual increase of 0.88 years in life expectancy (Δe_t) in years of zero economic growth ($g_t = 0$). The expected change in life expectancy during an expansion year with GDP growth of 5% (it was 5.1% in 1937), would be −0.12 years, that is life expectancy would drop by 0.12 years. In contrast, during a recession year with GDP "growth" of −5% (it was −6.5% in 1931) life expectancy would increase by 1.88 years.

Discussion

Analysis of various indicators of population health shows that population health did not decline and indeed improved during
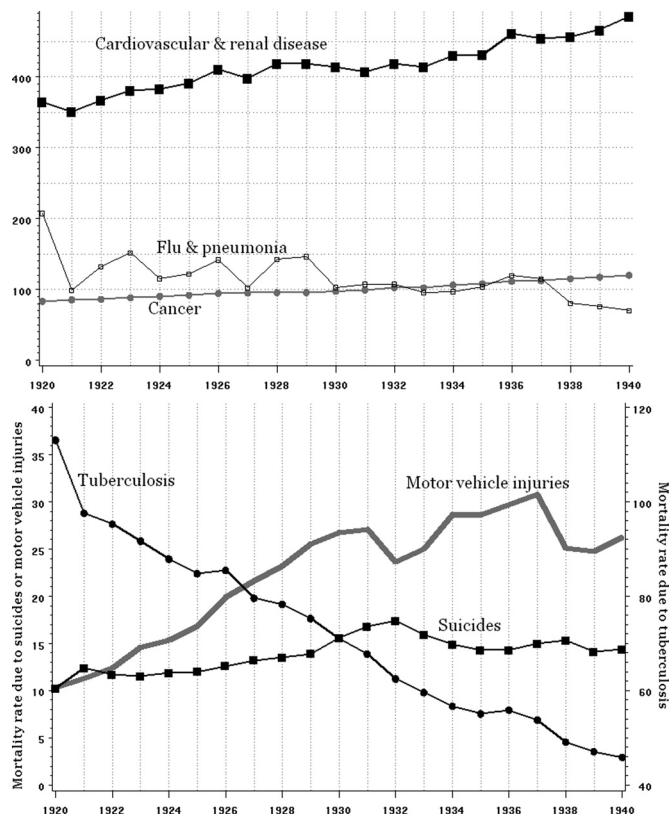
the Great Depression of 1930–1933. During this period, mortality decreased for almost all ages, and gains of several years in life expectancy were observed for males, females, whites and nonwhites—with the latter group being the group that most benefited. For most age groups, mortality tended to peak—over and above its long-term trend—during years of strong economic expansion (such as 1923, 1926, 1929, and 1936–1937). In contrast, the deep recessions of 1921, 1930–1933, and 1938 coincided with generalized declines in mortality rates and peaks in life expectancy. The only exception to this general pattern was suicide mortality, which increased during the Great Depression, but suicides account for less than 2% of all deaths. Overall, our results show that years of strong economic growth are associated with either worsening health or with a slowing of secular improvements in health.

Few if any studies have specifically focused on the evolution of population health during the Great Depression in the United States. Researchers contemporary to the Great Depression observed that mortality had increased during the 1920s (4) and decreased in the early 1930s (5). They also noted with puzzlement that infant and tuberculosis mortality declined between 1929 to 1933, when the economy was in shambles, although there was also evidence of increased malnutrition among low-income groups (6, 7) and increases in infant mortality in some areas with very high unemployment (8). Our work documents that population health did not decline on average during the Great Depression in the U.S.

It has been argued that recessions have lagged effects on health, so that economic downturns would be associated with increased mortality or other negative health outcomes (hospital admissions or morbidity) years later (9, 10). This hypothesis has generated considerable debate (11–13). Given the restricted time frame of the present investigation, we could not explore

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Table 1. Correlations of the annual improvement in health, measured either by the annual increase in life expectancy at birth or by the annual percentage decrease in age-specific mortality—with economic conditions—measured by the annual GDP growth or the change in the unemployment rate in the United States, 1920–1940 ($n = 21$)

		Correlations with	
		GDP growth	Annual change in the unemployment rate
Annual gain in life expectancy at birth	Total	−0.54*	0.64**
	Males	−0.59**	0.69***
	Females	−0.48*	0.58**
	Whites	−0.51*	0.61**
	Non whites	−0.66**	0.72***
	Males	−0.67***	0.73***
	Females	−0.63**	0.68***
Annual percentage decline in age- specific mortality at ages	Infant mortality (< 1)	−0.40†	0.58**
	1−4	−0.29	0.43†
	20−24	−0.54*	0.67**
	30−34	−0.40†	0.57*
	40−44	−0.53*	0.64**
	50−54	−0.56**	0.66**
	60−64	−0.39†	0.49*
	70−74	−0.28	0.35
	80−84	−0.31	0.35

*, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$; †, $P < 0.1$

lagged effects beyond 3 years, and thus cannot rule out longer lagged effects. However, investigations of longer lags have been unable to document long-lag effects of recessions on mortality in the U.S. or other countries (14–16). A recent study of the potential effects of stress in utero during the Great Depression found no associations with disability or chronic disease later in life (17).

If the lagged effects hypothesis were true, one would expect major increases in mortality following a lag after the Great Depression. A peak in mortality occurred in 1936, 4 years after the worst year of the Great Depression coinciding with a period of very strong economic growth. The mortality increase was observed the same year for almost all age groups—even for children under age 4—and for causes of death involving very different pathophysiologic processes—including some causes of death such as injuries, where no plausible lag in causation is to be expected. This makes the lagged effects hypothesis an unlikely explanation of the 1936 peak in mortality.

The fact that population health tends to evolve better in recessions than in expansions was first noted decades ago (18–20), but was largely ignored until recently, when several studies reported this relationship using data from the latter half of the twentieth century (14–16, 21–26). A number of mechanisms may explain the effects of business cycles on health (11, 15, 19–21, 23, 24, 27–30). Many of these mechanisms would produce short-term effects by precipitating death among persons with underlying (sometimes asymptomatic) chronic disease, and increasing rates of unintentional injuries.

Existing data supports several of these mechanisms. Economic expansions have been linked to increases in smoking and alcohol consumption (3, 28, 29), reductions in sleep (31), and increases in work stress related to overtime and faster and more strenuous labor (3), all of which are associated with adverse health outcomes and mortality among healthy persons and among persons with underlying chronic disease (32–35). The increase in mortality due to traffic (36) or industrial injuries (34, 37) during

Table 2. Annual change in life expectancy associated with an increase of one percentage point in annual GDP growth in regression models without lagged effects or with lag effects up to three years

Dependent variable	Lag 0	Lag 1	Lag 2	Lag 3	d	R^2
Annual change in life expectancy for the whole population	−0.20*				2.79	0.29
	−0.24**	0.09			2.32	0.37
	−0.21**	0.10	0.01		3.06	0.42
	−0.22*	0.09	0.03	−0.04	2.94	0.26
Annual change in life expectancy, white population	−0.19*				2.78	0.35
	−0.24**	−0.11			2.29	0.42
	−0.21**	−0.12	0.01		3.00	0.42
	−0.22*	−0.11	0.03	−0.05	2.88	0.49
Annual change in life expectancy, nonwhite population	−0.24**				2.36	0.40
	−0.24**	−0.02			2.02	0.43
	−0.21**	−0.02	0.03		2.70	0.46
	−0.21*	−0.01	0.01	0.04	2.70	0.49

*, $P < 0.05$; **, $P < 0.01$. d is the Durbin-Watson statistic. Because $d \approx 2 \cdot (1 − r)$, where r is the sample autocorrelation of the residuals, $d > 2$ implies negative autocorrelation of the residuals resulting in possible overestimation of standard errors and the underestimation of statistical significance.

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expansions is clearly related to accelerated economic activity. Economic expansions are also associated with increases in atmospheric pollution, which has well-documented short-term effects on cardiovascular and respiratory mortality (24, 38–40).

Other mechanisms involving increases in social isolation, lack of home care, and decreases in social support during economic expansions as a result of greater employment, increased work demands, and work-related migration could also play a role (11, 41–43).

Extrapolations from our results and those of others (16, 21, 23–26, 44–46) suggest that periods of accelerated economic growth could lead to a slowing or even a reversal of long-term trends of improvements in health. For example, our results indicate that for conditions such as infant mortality, which experienced a secular decline over the period of study, this decline slowed or reversed during expansions but accelerated during recessions. At first glance, our findings appear to contradict the observations that in many countries the long-term rise in GDP per capita has coincided with long-term declines in mortality (47). The extent to which this relationship is causal however is questionable (48, 49).

The long-term changes in GDP may be simply correlated with a set of health-enhancing social changes (such as increased access to improved nutrition, smaller family size, etc.), which are quite distinct from the short-term consequences of economic expansions we investigate here. Many countries in the world experienced major improvements in health with little or no economic growth. For example, in India and China, there is a negative correlation between decadal rates of economic growth and reductions in child mortality (50), and almost all of China's post-World War II reduction in infant mortality occurred before the accelerated economic growth during the 1980s–1990s, during which there was relatively little progress in child health. Nevertheless, a detailed investigation of the long-term relationship between secular trends in the economy and in health would require data and analyses very different from the ones we report here.

Although social science is not physics, regularities in the past allow us at least some confidence in forecasting the future. Historical experience tells us that no particular increase of mortality is to be expected as a consequence of a recession beyond an increase in suicides which, although clearly important, is of small magnitude compared to the reduced number of fatalities from other causes.

While economic expansions bring with them increases in employment, greater optimism, and higher incomes (although not always and not for all sectors of the population), recessions are periods of pessimism, shrinking revenues, and social malaise. The Great Depression of the 1930s was a major crisis of social life, in which many people suffered reductions in income and deprivation, and consequent social unrest was widespread. Nevertheless, this was not associated with major declines in population health, which suggests that other mechanisms more than compensate the possible detrimental health impact of high unemployment and economic disruption. A better understanding of the beneficial effects of recessions on health may perhaps contribute to the development of economic policies that enhance health and minimize or buffer adverse impacts of economic expansions.

Data and Methods. Economic and health data were obtained from historical statistics (51). Population health was indexed by life expectancy at birth and mortality rates. We examined age-specific rates and rates due to six causes of death contributing 64.4% of total mortality in 1930: Cardiovascular and renal diseases (36.7%), cancer (8.6%), influenza and pneumonia (9.1%), tuberculosis (6.3%), motor vehicle traffic injuries (2.4%), and suicide (1.4%). In addition to descriptive analyses, statistical models were used to examine associations between the dynamic conditions of the economy and the evolution of health indicators. We calculated correlations between the change in health, measured by the annual change in life expectancy or in a mortality rate, and the change in economic conditions, measured by GDP growth or the annual change in unemployment. GDP growth at year t was defined as the change in the logarithm of real GDP (i.e., GDP measured in inflation-adjusted dollars) between year t and year $t - 1$.

We also fit distributed lag models (52), in which the annual gain in life expectancy (or the percentage decrease in a mortality rate) between year t and year $t - 1$ (Δh_t) is regressed on GDP growth the same year (g_t) and prior years (g_{t-i}), that is,

$$\Delta h_t = \alpha + \sum_{i=0}^{k} \beta_i \cdot g_{t-i} + \epsilon_t$$

where α is a constant, β_i is the effect of economic conditions as indexed by GDP growth at the year $t - i$, and ε_t is the error term. The annual change in life expectancy, the annual percentage change in age-specific mortality, and the rate of growth of GDP are all mean-stationary and variance-stationary series, therefore it is possible to use them in regression models without risk of spurious results due to trends (52). In other words, these analyses estimate associations over and above any correlations generated by parallel long-term trends.

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