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 preceding 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 14.4% 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.

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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
population health did not decline and indeed improved during

Analysis of various indicators of population health shows that

Discussion

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 cor-
related with increases in the unemployment rate (Table 1).
Patterns were consistent across race, sex, and age groups (neg-
ative 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 pop-
ulation 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 \( \Delta e_t = 0.88 - 0.20g_t \). This model predicts an annual increase
of 0.88 years in life expectancy (\( \Delta e_t \)) 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, mor-
tality 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 con-
trast, the deep recessions of 1921, 1930–1933, and 1938 coin-
cided 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 puzzle-
ment 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 popu-
lation 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

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.
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 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)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Annual change in life expectancy at birth</th>
<th>Annual change in life expectancy, white population</th>
<th>Annual change in life expectancy, nonwhite population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations with GDP growth</td>
<td>Correlations with Annual change in the unemployment rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$-0.54^*$</td>
<td>0.64**</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>$-0.59^{**}$</td>
<td>0.69***</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>$-0.48^*$</td>
<td>0.58**</td>
<td></td>
</tr>
<tr>
<td>Whites</td>
<td>$-0.51^*$</td>
<td>0.67**</td>
<td></td>
</tr>
<tr>
<td>Non whites</td>
<td>$-0.65^{**}$</td>
<td>0.72***</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>$-0.67^{***}$</td>
<td>0.73***</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>$-0.63^{**}$</td>
<td>0.68***</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual percentage decline in age-specific mortality at ages</th>
<th>Infant mortality (&lt; 1)</th>
<th>1–4</th>
<th>20–24</th>
<th>30–34</th>
<th>40–44</th>
<th>50–54</th>
<th>60–64</th>
<th>70–74</th>
<th>80–84</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>$-0.40^+$</td>
<td>0.58**</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Males</td>
<td>$-0.29$</td>
<td>0.43†</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Females</td>
<td>$-0.54^*$</td>
<td>0.67**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whites</td>
<td>$-0.40^+$</td>
<td>0.57*</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non whites</td>
<td>$-0.53^*$</td>
<td>0.64**</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>$-0.56^{**}$</td>
<td>0.66**</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>$-0.39^+$</td>
<td>0.49*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>20–24</td>
<td>$-0.28$</td>
<td>0.35</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>30–34</td>
<td>$-0.31$</td>
<td>0.35</td>
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</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Lag 0</th>
<th>Lag 1</th>
<th>Lag 2</th>
<th>Lag 3</th>
<th>$d$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual change in life expectancy for the whole population</td>
<td>$-0.20^*$</td>
<td>0.09</td>
<td>0.10</td>
<td>0.09</td>
<td>-0.04</td>
<td>2.94</td>
</tr>
<tr>
<td>Annual change in life expectancy, white population</td>
<td>$-0.19^*$</td>
<td>-0.11</td>
<td>-0.12</td>
<td>-0.11</td>
<td>0.03</td>
<td>-0.05</td>
</tr>
<tr>
<td>Annual change in life expectancy, nonwhite population</td>
<td>$-0.24^{**}$</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.04</td>
<td>2.70</td>
</tr>
</tbody>
</table>

* $P < 0.05$; ** $P < 0.01$. $d$ is the Durbin-Watson statistic. Because $d = 2 - (1 - r)$, 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.
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 $r$ and year $r - 1$.

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 $t - 1 (\Delta h_t)$ is regressed on GDP growth the same year ($g_t$) and prior years ($g_{t-k}$), that is,

$$\Delta h_t = \alpha + \sum_{k=1}^{l} \beta_k g_{t-k} + \epsilon_t$$

where $\alpha$ is a constant, $\beta_k$ is the effect of economic conditions as indexed by GDP growth at the year $t - k$, and $\epsilon_t$ 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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