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Original Contribution

Individual Joblessness, Contextual Unemployment, and Mortality Risk

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Longitudinal studies at the level of individuals find that employees who lose their jobs are at increased risk of death. However, analyses of aggregate data find that as unemployment rates increase during recessions, population mortality actually declines. We addressed this paradox by using data from the US Department of Labor and annual survey data (1979–1997) from a nationally representative longitudinal study of individuals—the Panel Study of Income Dynamics. Using proportional hazards (Cox) regression, we analyzed how the hazard of death depended on 1) individual joblessness and 2) state unemployment rates, as indicators of contextual economic conditions. We found that 1) compared with the employed, for the unemployed the hazard of death was increased by an amount equivalent to 10 extra years of age, and 2) each percentage-point increase in the state unemployment rate reduced the mortality hazard in all individuals by an amount equivalent to a reduction of 1 year of age. Our results provide evidence that 1) joblessness strongly and significantly raises the risk of death among those suffering it, and 2) periods of higher unemployment rates, that is, recessions, are associated with a moderate but significant reduction in the risk of death among the entire population.

business cycles; Cox model; macroeconomic conditions; mortality; proportional hazards model; recessions; unemployment

Abbreviation: PSID, Panel Study of Income Dynamics.

Job loss has been repeatedly found to be associated with psychological distress and higher risks of disease and death (1–4). Increased mortality among the unemployed may be mediated by reduced income, disrupted social ties, feelings of hopelessness or worthlessness, and difficulties in meeting financial obligations, leading to depression, substance abuse, or other harmful conditions and behaviors (1–3, 5–11). Harmful effects of individual unemployment might take years to develop, but in mass layoffs it has been observed that to a large extent these effects occur during the first year following the loss of the job (3).

Paradoxically, when the association between unemployment rates and mortality is modeled at the aggregate level using longitudinal analyses, which adjust for spatial and temporal influences, the opposite association appears: higher unemployment rates correlate with lower mortality (12–15). This means that over and above long-term trends in mortality, recessions coincide with lower mortality, while economic expansions coincide with higher mortality, so that mortality fluctuates with the business cycle, procyclically. This procyclical fluctuation has been found for total and cause-specific death rates, including cardiovascular and infectious disease mortality, as well as for traffic deaths and industrial injuries (16). The major exception is suicide mortality, which rises during recessions and falls during expansions, oscillating countercyclically (12–14, 17).

Contextual unemployment may be an indicator of changes in the economy that modify the present risk of death for all individuals. During economic expansions, firms hire new workers, traffic volume rises, commuting times increase, working hours rise, and workers are given more overtime in response to the increased demand—which may increase stress at work (18, 19). Increased industrial activity and transportation raise levels of atmospheric pollution (20), and consumption and time-use patterns change (21–24). Overworked persons may provide less care to others—which can be harmful for both caregivers and those who miss out on care (25)—and may sleep less (23), which can also be health-damaging. More frequent commuting and migration during expansions enhance germ transmission and raise the risk of transportation injuries. These and other changes have been hypothesized as mediators of the rise in mortality rates observed during economic upturns (12, 13, 26–36).

In this study, we attempted to understand the paradox of higher mortality risk associated both with individual unemployment and with lower contextual unemployment rates by using—for the first time, to our knowledge—an analysis that allowed us to estimate both the individual and aggregate-level associations simultaneously.

METHODS

We analyzed a data set constructed by merging individual-level data from the Panel Study of Income Dynamics (PSID) with state-level data on macroeconomic contextual conditions from the US Department of Labor for the residential locations of PSID respondents.

The PSID, which has been used in numerous studies of health outcomes (4, 37–39), is the longest-running longitudinal household survey of US citizens. It started with persons living in 5,000 families in 1968. Information on the original respondents and their descendants was obtained via annual interviews through 1997 and via biannual interviews thereafter. African Americans were oversampled. The initial sample was clustered and stratified. Weights for each person-year were developed by PSID staff to keep the sample representative of the US adult population by accounting for differential selection and differential attrition over time. We used these weights in our regressions. Deaths were identified by record linkage with the National Death Index.

To be able to use lagged variables and to avoid problems related to having surveys administered only every other year, we used the 1979–1997 sample of household heads and spouses, for which data for all years are available and all deaths of PSID participants are identified. This sample comprised 156,357 observations. However, many of these observations had missing information for some of the variables—age, sex, race, marital status, educational level, household income, employment status—considered in our analyses. The sample we used included only the observations for which complete information was available (see Web Table 1, available at http://aje.oxfordjournals.org/). The sample had 142,927 observations corresponding to 12,558 individuals and 1,694 deaths. There were 11.4 observations per individual (standard deviation, 6.3). Mean age at first interview was 36.2 years (standard deviation, 16.6). The proportion of participants with less than a high school education (36.5% in 1979) consistently decreased over follow-up. Each year approximately 1% of the persons in the sample died, which is a crude death rate in the usual range for an adult population.

PSID respondents were asked whether they were "working now," "only temporarily laid off, sick leave or maternity leave," "looking for work, unemployed," "retired," "temporarily or permanently disabled," "keeping house," "student," or "other, 'workfare,' in prison or jail." We considered as unemployed those persons who stated that they were "looking for work, unemployed."

We conducted Cox proportional hazards regressions (40, 41) in which the hazard of death at time t in year y (y is the integer part of t) for individual i in state s (h_{ist}) was modeled as follows:

$$\ln h_{ist} = \alpha_t + \beta_0 U_{ys} + \beta_1 E_{iys} + \beta_2 x_{2iys} + \cdots + \beta_k x_{kiys} + \delta_s + \gamma_y,$$

where α_t is a function of continuous time t; U_{ys} is the unemployment rate in year y for state s; E_{iys} is the employment status of individual i in year y in state s; β_0–β_k are the effect estimates of contextual unemployment (β_0), individual employment status (β_1), and other covariates x_{2iys}–x_{kiys} that may have an effect on health (marital status, educational level, income); and δ_s and γ_y are fixed effects for state s and year y, respectively. The covariates can be individual time-invariant factors (in which case x_{kys} is equal for all y), such as sex or race, or time-variant factors such as income or employment status. Omitting subindices for state and year, for any covariate x the ratio of hazard rates for 2 observations p and q is

$$\frac{h_p}{h_q} = \exp[\beta(x_p - x_q)].$$

The hazard ratio is h_p/h_q when $x_p - x_q = 1$, that is, when the variable increases by 1 unit so that $h_p/h_q = \exp(\beta)$.

These Cox models yield estimates of how the mortality hazard—generally interpreted as an instantaneous probability of death—changes in association with both the individual experience of joblessness and the contextual unemployment rate, with adjustment for the other covariates. State and year fixed effects adjust for omitted variables that are either state-invariant or time-invariant. We used a sandwich estimator to compute robust standard errors for repeated observations. Thus, we measured unemployment at 2 levels (individual and aggregate) and estimated its statistical effects on the mortality hazard accounting for the fact that measurements of units within a cluster are more similar than measurements of units in different clusters. In this sense (42, 43), our approach can be considered a multilevel analysis.

All regression models included marital status, educational level, and income as time-varying covariates. For the present investigation, each individual was designated simply as married or nonmarried, with nonmarried used as the reference category. Educational level was included as a categorical variable with 3 categories: no high school education (the reference category), some high school education, and high school diploma or higher education. Real household income was measured in 1990 dollars and attributed to each of the individuals in the household.

In contrast to mechanisms mediating the health effects of macroeconomic conditions, many of which are likely to be quite contemporaneous (e.g., fewer traffic accidents and lower levels of atmospheric pollution in recessions, as well as decreased levels of overtime, increased sleep, or reduced

Table 1. Hazard Ratios Obtained in Cox Regressions in Which the Hazard of Death was Modeled as a Function of Year and State Fixed Effects, the State Unemployment Rate, and the Individual's Age, Sex, Race, Marital Status, Educational Level, Family Income, and Respondent Employment Status, Panel Study of Income Dynamics, 1979–1997[a]

Explanatory Variable	Unemployment Effect at the Individual Level Only: Model M1		Unemployment Effect at the Contextual (State) Level Only: Model M2		Unemployment Effects at Both the Individual Level and the Contextual (State) Level: Model M3	
	HR	95% CI	HR	95% CI	HR	95% CI
Age, years	1.07	1.07, 1.08	1.08	1.08, 1.09	1.07	1.07, 1.08
Female sex	0.48	0.41, 0.56	0.46	0.41, 0.53	0.48	0.41, 0.56
Racial/ethnic minority[b]	1.26	1.04, 1.53	1.26	1.03, 1.53	1.25	1.03, 1.52
Married[c]	0.64	0.55, 0.74	0.66	0.57, 0.77	0.64	0.55, 0.74
Education[c]						
High school diploma or more	0.85	0.71, 1.02	0.84	0.70, 1.01	0.85	0.71, 1.02
Some high school	1.07	0.92, 1.23	1.06	0.92, 1.23	1.06	0.92, 1.23
Income[d]	0.87	0.66, 1.16	0.78	0.55, 1.11	0.87	0.65, 1.16
Employment status						
Unemployed	1.73	1.01, 2.96			1.77	1.05, 2.98
Student	0.69	0.24, 1.96			0.69	0.24, 1.96
Retired	1.77	1.44, 2.18			1.77	1.44, 2.17
Keeping house	1.40	1.09, 1.80			1.39	1.09, 1.79
State unemployment rate[e]			0.91	0.86, 0.96	0.91	0.86, 0.96

Abbreviations: CI, confidence interval; HR, hazard ratio; PSID, Panel Study of Income Dynamics.

[a] Wald 95% CIs were based on robust standard errors for repeated observations in each individual, computed with a sandwich estimator. Times of interview and death were computed with a monthly approximation, ties were handled by the Efron method, and all models converged appropriately. Deaths were assumed to have occurred in the state in which the individual was living during the last interview, but results changed very little after dropping that assumption by making the state of the last interview equal to the state where death occurred (when this was known and both differed). The models included 142,699 observations and 1,635 deaths.

[b] Any answer other than "white" to the PSID question on race/ethnicity.

[c] The reference category for marital status (a dichotomous variable) was "not married," and for education (which had 3 categories) it was "no high school education."

[d] Total annual household income in hundred thousand dollars (at 1990 prices).

[e] Measured as a percentage of the economically active population, so the hazard ratio corresponds to the increase in the hazard associated with a 1-percentage-point increase in the unemployment rate.

smoking), effects of individual job loss may take time to affect mortality, though they may also arise just weeks or months following job loss (3). In an annual time frame, a contemporaneous association between individual unemployment and death may imply causation in both directions, because the onset of disease and death might be caused by joblessness or unemployment might be caused by ill health that then in turn causes death. However, the direction of causality from bad health to unemployment is less likely in models in which unemployed status is observed with a lag of 1 or 2 years. Therefore, we fitted models to estimate 1) the association of unemployment rates and individual employment status with the hazard of death during the same year (Table 1); 2) the lagged association of the individual's employment status in the past year with the hazard of death in the current year (Table 2); and 3) the lagged macroeconomic effects (proxied by the unemployment rate lagged 1 year) on the hazard of death (Table 3). To help control for the possibility of reverse causality from bad health to joblessness, we also fitted 4) lagged expanded models (Table 3) including different combinations of covariates lagged 1 year, as well as an index of limitations to work, which can be considered a rough index of physical health. Finally, we fitted 5) general expanded models including in the regression the major explanatory variables at lags 0, 1, and 2 years (Table 4).

We fitted some models (Table 1) considering the 5 major categories of employment status (i.e., employed, unemployed, student, retired, and keeping house). However, since we were particularly interested in the effects of individual joblessness or contextual unemployment, in most of our models (Tables 2–4) the sample just included observations of persons who were at risk of both exposures because they were either employed or unemployed.

RESULTS

When modeling the hazard of death as a function of age, sex, race, marital status, education, income, and different

Table 2. Hazard Ratios Obtained in Cox Regressions in Which the Hazard of Death was Modeled as a Function of Year and State Fixed Effects, the State Unemployment Rate, and the Individual's Age, Sex, Race, Marital Status, Educational Level, Family Income, and Employment Status, Panel Study of Income Dynamics, 1979–1997[a]

Explanatory Variable[b]	Unemployment Effect at the Individual Level Only: Model M1L		Unemployment Effect at the Contextual (State) Level Only: Model M2L		Unemployment Effects at Both the Individual Level and the Contextual (State) Level: Model M3L		Model M4L		Model M5L	
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Age, years	1.07	1.05, 1.08	1.06	1.05, 1.08	1.06	1.05, 1.08	1.06	1.05, 1.08	1.06	1.05, 1.08
Female sex	0.37	0.26, 0.52	0.37	0.26, 0.52	0.37	0.26, 0.52	0.37	0.27, 0.52	0.37	0.27, 0.52
Racial/ethnic minority	1.70	1.17, 2.47	1.66	1.14, 2.41	1.63	1.12, 2.36	1.63	1.12, 2.36	1.65	1.14, 2.41
Married	0.47	0.33, 0.66	0.47	0.33, 0.66	0.48	0.34, 0.68	0.48	0.34, 0.68	0.48	0.34, 0.68
Education										
Some high school	0.80	0.54, 1.20	0.80	0.54, 1.19	0.84	0.56, 1.24	0.83	0.56, 1.24	0.83	0.56, 1.23
High school diploma or more	1.09	0.74, 1.61	1.05	0.71, 1.54	1.09	0.74, 1.59	1.08	0.74, 1.59	1.08	0.74, 1.57
Income, lag 1 year	0.94	0.66, 1.33	0.91	0.62, 1.33	0.93	0.65, 1.32	0.93	0.65, 1.32	0.92	0.64, 1.32
Unemployed status										
Lag 0 years									0.82	0.47, 1.44
Lag 1 year	2.16	1.32, 3.54			2.20	1.34, 3.62	2.19	1.33, 3.61	2.28	1.37, 3.80
State unemployment rate										
Lag 0 years			0.81	0.70, 0.94	0.80	0.69, 0.93	0.78	0.63, 0.97	0.78	0.62, 0.97
Lag 1 year							1.04	0.83, 1.29	1.04	0.83, 1.31

Abbreviations: CI, confidence interval; HR, hazard ratio.
[a] The effects of both individual employment and contextual (state) unemployment rates were considered at lags of 0 and 1 years, and the sample was restricted to observations for either employed or unemployed respondents. Since the models included lagged values, the first observation in each individual was discarded. The models included 84,480 observations and 346 deaths.
[b] All specifications of variables were as shown in Table 1.

Table 3. Hazard Ratios Obtained in the Same Models as Those Shown in Table 2, Expanded by Including an Index of Work Limitations Lagged 1 Year, Panel Study of Income Dynamics, 1979–1997[a]

Explanatory Variable[b]	Unemployment Effect at the Individual Level Only: Model M1LE		Unemployment Effect at the Contextual (State) Level Only: Model M2LE		Unemployment Effects at Both the Individual Level and the Contextual (State) Level: Model M3LE		Model M4LE	
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Age, years	1.06	1.05, 1.08	1.06	1.05, 1.07	1.06	1.05, 1.08	1.06	1.05, 1.08
Female sex	0.38	0.27, 0.54	0.38	0.27, 0.54	0.38	0.27, 0.54	0.38	0.27, 0.54
Racial/ethnic minority	1.72	1.19, 2.50	1.69	1.17, 2.45	1.66	1.15, 2.40	1.66	1.14, 2.39
Married	0.48	0.34, 0.67	0.47	0.33, 0.67	0.49	0.34, 0.68	0.49	0.34, 0.69
Education								
Some high school	1.13	0.76, 1.67	1.08	0.73, 1.60	1.12	0.76, 1.65	1.12	0.76, 1.64
High school diploma or more	0.84	0.56, 1.26	0.84	0.56, 1.25	0.87	0.58, 1.30	0.87	0.58, 1.30
Income, lag 1 year	0.95	0.68, 1.33	0.92	0.64, 1.33	0.94	0.67, 1.31	0.94	0.67, 1.32
Unemployed status, lag 1 year	2.16	1.32, 3.54			2.09	1.27, 3.46	2.09	1.26, 3.45
State unemployment rate								
Lag 0 years			0.80	0.69, 0.93	0.80	0.69, 0.93	0.78	0.63, 0.98
Lag 1 year							1.03	0.82, 1.29
Work limitations,[c] lag 1 year	1.26	1.03, 1.55	1.29	1.05, 1.57	1.26	1.03, 1.55	1.26	1.03, 1.54

Abbreviations: CI, confidence interval; HR, hazard ratio.
[a] The models included 82,143 observations and 343 deaths.
[b] All specifications of variables were as shown in Table 1.
[c] Categorical variable with 4 levels referring to the absence (0) or presence of some condition limiting "a lot" (3), "somewhat" (2), or "just a little" (1) the amount of work the respondent could do. The hazard ratio represents the increase in mortality risk associated with a 1-unit increase in this variable.

Table 4. Hazard Ratios Obtained From Cox Regressions in Which the Mortality Hazard Was a Function of Indicators of Individual or Contextual Economic Conditions (as in Former Tables) and Other Covariates at Lags 0, 1, and 2 Years, Panel Study of Income Dynamics, 1979–1997[a]

Explanatory Variable	Model L2-A		Model L2-B	
	HR	95% CI	HR	95% CI
Age, years	1.07	1.05, 1.08	1.07	1.05, 1.08
Female sex	0.42	0.29, 0.60	0.42	0.29, 0.60
Racial/ethnic minority	1.57	1.06, 2.32	1.57	1.06, 2.31
Married	0.46	0.31, 0.66	0.46	0.32, 0.66
Education				
Some high school	1.30	0.87, 1.96	1.31	0.87, 1.96
High school diploma or more	0.96	0.63, 1.48	0.97	0.64, 1.49
Income				
Lag 0 years	1.09	0.76, 1.57		
Lag 1 year	0.90	0.56, 1.43		
Lag 2 years	1.06	0.80, 1.41		
Unemployed status				
Lag 0 years	0.84	0.47, 1.49	0.83	0.48, 1.46
Lag 1 year	2.69	1.51, 4.78	2.67	1.50, 4.76
Lag 2 years	0.75	0.36, 1.57	0.75	0.36, 1.58
Limitations to work				
Lag 0 years	1.53	1.17, 2.01	1.53	1.17, 2.00
Lag 1 year	1.03	0.78, 1.34	1.03	0.78, 1.34
Lag 2 years	1.02	0.75, 1.39	1.02	0.75, 1.39
State unemployment rate				
Lag 0 years	0.84	0.64, 1.09	0.83	0.71, 0.98
Lag 1 year	0.99	0.71, 1.37		
Lag 2 years	1.01	0.79, 1.30		
Measure of model fit				
Akaike Information Criterion	130,940		130,939	
Schwartz Bayesian Criterion	131,249		131,229	

Abbreviations: CI, confidence interval; HR, hazard ratio.
[a] The models included 72,471 observations and 306 deaths.
[b] All specifications of variables were as shown in Table 1.

combinations of the *individual's* employment status and the contextual (state) unemployment rate, and considering different specifications and subsamples, the hazard of death is, as expected, higher for older respondents, males, nonwhites, and persons who are unmarried or have a lower level of income or education (Tables 1–4).

The hazard ratio for age in different models (Tables 1–4) varies in a narrow range from 1.06 to 1.08, indicating that each year of age adds approximately 7% to the hazard of death. Females have a significantly lower hazard of death. An increased hazard of death for nonwhites (for instance, by 26%; hazard ratio = 1.26 in model M1, Table 1) is observed across models (Tables 2–4), but the increase in the hazard, though always significant, ranges widely from 25% (Table 1, model M3) to 72% (Table 3, model M1LE).

Compared with nonmarried persons, married persons have a significantly reduced hazard of death—for instance, by 36% (i.e., 1 − 0.64 = 0.36) in model M1 (Table 1). Higher levels of education (high school diploma or more) or income also appear to be associated with decreased mortality risk in most models, but the 95% confidence interval for the hazard ratio corresponding to these variables includes 1, so the association is not significant at the usual level of confidence.

Employment status appears across models as an important and significant determinant of the hazard of death. Compared with employed persons, the hazard of death is significantly higher for the unemployed. In model M1 (Table 1), the hazard is raised by 73% (hazard ratio = 1.73, 95% confidence interval: 1.01, 2.96). Retired persons and persons keeping house also have hazards of death that are significantly increased (by 77% and 40%, respectively; Table 1, model M1).

Across models, the hazard ratio for contextual unemployment is significantly below 1, indicating a reduction of the mortality hazard when the unemployment rate is higher. In model M2 (Table 1), each percentage-point increase in the unemployment rate *reduces* the hazard of death by 9% (i.e., 0.91 − 1 = −0.09). Since the 95% confidence interval for the hazard ratio ranges from 0.86 to 0.96, the 95% confidence interval for the hazard reduction associated with a 1-percentage-point increase in the unemployment rate is 4%–14%.

When model M2 is expanded by including the participant's employment status (Table 1, model M3), the hazard ratio for contextual unemployment does not change at all. The hazard ratio for individual joblessness is now 1.77, whereas it was 1.73 when contextual unemployment was not included in the model.

In the unrestricted sample (Table 1, models M1–M3), the unemployment rate entered into the model contemporaneously and individual joblessness raise the hazard of death by approximately 75%. In the sample restricted to observations of employed or unemployed persons, individual joblessness *lagged 1 year* raises the hazard of death by a factor of 2.2 (Table 2, models M1L, M3L, and M4L). The state unemployment rate, which reduced the hazard of death by about 9% in the unrestricted sample (Table 1), now reduces it by 19% (i.e., 0.81 − 1 = −0.19; Table 2, model M2L). This effect is mostly contemporaneous, since the state unemployment rate is not significant when lagged 1 year (Table 2, models M4L and M5L).

Hazard ratios greater than 2 for unemployed status lagged 1 year (Table 2, models M1L and M3L–M5L) suggest a causal effect of individual unemployed status increasing the risk of death. The hazard ratio for individual unemployment at lag 1 is also significantly elevated in the *lagged expanded* models (Table 3, models M1LE, M3LE, and M4LE), in which an index of work limitations is included, also with a lag of 1 year. This provides further evidence in favor of individual joblessness raising mortality risk, since the index of work limitations can be thought of as a measure of self-assessed health. Hazard ratio estimates for the index of work limitations are between 1.26 and 1.29 and highly significant, so that a 1-point increase in the index raises the hazard of death *the following year* by almost 30%. The inclusion of this index in the model reduces the hazard ratio for individual unemployment, but only minimally (from 2.20 in model M3L (Table 2) to 2.09 in model M3LE (Table 3)), and the hazard ratios well over 2 indicate that unemployed status in the past year is still associated with a doubling of the hazard of death, even after adjustment for prior health.

In model L2-A (Table 4), income, limitations to work, and individual or contextual unemployment are entered into the model at lags 0–2. The model can be improved, however, by eliminating some nonsignificant covariates. Thus, a better fit (lower values for the Akaike Information Criterion and Schwartz Bayesian Criterion) is found for model L2-B, which excludes income and includes the unemployment rate at lag 0 only. The fit did not improve, however, by eliminating lagged values of unemployed status or the index of limitations to work.

In model L2-B, there are significant hazard ratios of 2.67 and 0.83 for unemployed status at lag 1 and for contextual unemployment at lag 0, respectively. Thus, in this sample of employed or unemployed persons, individual joblessness is associated with an almost tripling of the hazard of death the following year. At the same time, a percentage-point increase in the state unemployment rate is associated with a reduction in the hazard of death by 17% (i.e., $0.83 - 1 = -0.17$) at lag 0, without lagged effects.

DISCUSSION

Our results indicate that in comparison with employed persons, the unemployed have a significantly increased hazard of death. Since the increase in this hazard is at least 73% (Table 1, model M1) and 1 extra year of age raises the hazard of death by approximately 7%, the health-damaging effect associated with being jobless is similar to the effect of about 10 extra years of age. However, each percentage-point increase in *contextual unemployment* reduces the hazard of death by approximately 9% (Table 1, model M3). The magnitude of this effect is slightly greater than that of reducing age by 1 year.

The effects of unemployment measured at the group and individual levels are both statistically significant, but with opposite signs: While contextual unemployment reduces the mortality hazard, individual joblessness increases it. When coding individual unemployment as 0 in employed persons and 1 in the unemployed, for the sample of observations corresponding to employed or unemployed persons (n = 100,380) the correlation between individual unemployment and the state unemployment rate is positive and highly significant ($P < 0.0001$), but its value is as small as 0.07. For individual years, this correlation varies between 0.02 and 0.09, and the highest value, 0.091, is for 1984, when the national unemployment rate was at its highest level during the study period. Because of the low level of correlation between these two variables, their effect estimates remain almost identical when the other variable is included in the model.

A key issue is the extent to which these observed associations reflect causal processes. In the case of contextual unemployment, reverse causality would imply that changes in the hazard of death cause changes in the state unemployment rate, which does not seem credible. Therefore it must be concluded that either contextual unemployment is indeed changing the hazard of death or, at the same time that the unemployment rate changes in the state, other processes are occurring that change the hazard of death. Obviously, the latter seems the most logical explanation. Potential mechanisms (pollution, work environment, enhanced circulation of pathogens, etc.) have been noted above.

In the association between individual joblessness and death, causality issues are more complex. In analyses considering contemporary employment status (Table 1), the higher hazard among the unemployed can be explained by unemployment status raising the risk of ill health and death or by persons with poor health and increased mortality risk being at higher risk of becoming unemployed. Both processes are probably at work (5, 9). The results of models in which employment status is lagged 1 year (Table 2) allow less room for bidirectional causation. Finally, the evidence of causality in the direction from individual joblessness to death is strengthened by 1) the results of models in which the effect of unemployment lagged 1 year is adjusted for an index that to some extent measures the level of previous health (Table 3) and 2) the results of models in which lagged effects of joblessness at lags 0, 1, and 2 years are considered (Table 4), with adjustment for other variables, including an index of physical health. In these models, the hazard of death depends on the status of being unemployed measured up to 2 years earlier, and with an adjustment for an index of limitations to work that should adjust somewhat for previous health status 2 years earlier. These adjustments and lags do not totally exclude the possibility that unmeasured ill health increases both the risk of being unemployed and the risk of mortality; however, in applied statistics, lagged effects like these are usually considered strong evidence supporting causation of the outcome by the lagged variable (41).

While in the general population the contextual effect of the economy—indexed by the unemployment rate—is revealed by hazard ratios around 0.9 (Table 1), in samples restricted to persons participating in the labor force hazard ratios are even lower, around 0.8 (Tables 2–4). This indicates that the contextual effect of the economic environment is greater among persons participating in the labor force. Our study is therefore inconsistent with the recently suggested hypothesis that procyclical mortality is a phenomenon restricted to the elderly population (33, 34). It is consistent, though, with results of other studies in which general mortality was found to be fluctuating procyclically at all ages but more intensely among young or middle-aged adults (12, 14, 15).

We used a nationally representative panel of US individuals to evaluate two facts that have been seen as inconsistent: a harmful effect of individual joblessness and a decrease in population mortality during recessions, when unemployment rates rise. We have shown that the two effects co-occur and are consistent with studies that examine them separately. The increase in the hazard of death associated with being unemployed is very strong, but it is restricted to unemployed persons, who generally are a small fraction of the population even in a severe recession. Compared with the increase in the hazard of death among the unemployed, the decrease of the mortality risk associated with a weakening economy is small, but the benefit spreads across the entire adult population. The compound result of both effects is that total mortality rises during economic expansions and drops during recessions, as has been repeatedly found in recent research where investigators have not been able to study both processes concurrently (15, 29, 44–51).

In many previous investigations, education and income have been found to be significant predictors of mortality (52–55). In our results, higher levels of education or income appear to be associated with lower mortality, but the association is—somewhat surprisingly—not statistically significant. It must be considered, though, that our models simply predict the hazard of death over a short run of 1 or 2 years rather than over a longer time interval.

Further research is needed to establish the still-uncertain mechanisms responsible for the phenomena highlighted in this investigation, particularly those linking macroeconomic fluctuations with major causes of death, such as cardiovascular disorders. A better knowledge of these mechanisms might suggest how such major scourges of our society could be ameliorated via some combination of public policy and health practice.

In summary, our findings show that job loss is associated with a large increase in the hazard of death, though this increased risk affects only a minority of the population and is outweighed by smaller (though sizable) health-promoting effects of an economic slowdown that affects the entire population. This combination of effects needs greater attention in health research, policy, and practice.

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