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Economic uncertainty and cardiovascular disease mortality

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Abstract

Previous studies have found a link between economic conditions, such as recessions and unemployment, and cardiovascular disease as well as other health outcomes. More recent research argues that economic uncertainty—independently of unemployment—can affect health outcomes. Using data from England and Wales, we study the association between fluctuations in economic uncertainty and cardiovascular disease mortality in the short term for the period 2001–2019. Controlling for several economic indicators (including unemployment), we find that economic uncertainty alone is strongly associated with deaths attributed to diseases of the circulatory system, ischemic heart disease and cerebrovascular disease. Our findings highlight the short-term link between economic conditions and cardiovascular health and reveal yet another health outcome that is associated with uncertainty.

KEYWORDS
cardiovascular disease, economic uncertainty, mortality

JEL CLASSIFICATION
I10, I15, E32

1 | INTRODUCTION

Previous research has examined the impact of macroeconomic conditions on health. Some studies (Neumayer, 2004; Ruhm, 2000) suggest that recessions can lead to worse population health outcomes (McInerney & Mellor, 2012; Svensson, 2007), while others find that mortality (including cardiovascular disease mortality) is procyclical. Results on physical health depend on the particular context and recession - but most studies agree that bad economic times lead to worse mental health (Bradford & Lastrapes, 2014; Riumallo-Herl et al., 2014) and more suicides (Antonakakis & Collins, 2015; Lopez Bernal et al., 2013; Ruhm, 2000). One of the main health outcomes studied in the literature on macroeconomic conditions is cardiovascular disease mortality. Here, findings also appear to be contradictory. Some show that cardiovascular deaths are procyclical (Neumayer, 2004; Ruhm, 2000; Tapia Granados & Ionides, 2017), while others argue that cardiovascular outcomes might be adversely affected by recessions or economic collapse (Birgisdóttir et al., 2020; Katz et al., 2016; Torbica et al., 2015).

In addition to studying the effects of negative economic events that have already occurred (such as job loss), there is a growing body of literature that examines the impact of uncertainty on health. That is, people's uncertainty regarding future economic developments may adversely affect population health outcomes, as distinct from the health effects of actual job loss or income decline during a recession. For example, studies have provided evidence on the impact of job insecurity (as opposed to job loss) on health outcomes (Burgard et al., 2009; Caroli & Godard, 2016; Virtanen et al., 2013); the impact of uncertainty shocks on mental health and subjective wellbeing (Kavetsos et al., 2021; Metcalfe et al., 2011; Vandoros et al., 2019b) and the association between economic uncertainty fluctuations in the short term and suicides and car crashes (Vandoros et al., 2018, 2019a; Vandoros & Kawachi, 2021).

1.1 | Mechanisms and objectives

Why would we expect economic uncertainty to affect cardiovascular disease mortality? The mechanism is believed to be via direct and indirect effects of psychological stress (Browning et al., 2006; Modrek & Cullen, 2013). In particular, we can think of two distinct pathways: a direct effect of stress on triggering acute cardiovascular disease events, as well as an indirect effect of stress on maladaptive coping behaviors, which may hasten the onset of cardiovascular diseases. By analyzing the link between economic uncertainty and cardiovascular disease deaths, we capture the former. The biological processes behind the direct triggering effect has been extensively studied and mainly include acute autonomic dysregulation, neuroendocrine activation and hemostatic and inflammatory responses among others (Bhattacharyya & Steptoe, 2007). Contrary to the impact of smoking, poor diet or lack of physical exercise, which damage the cardiovascular system on a scale of months to years, these mechanisms are relatively short-term and transitory.

There is an important distinction with regards to uncertainty as a determinant of health compared to the impact of unemployment or recessions on health for two main reasons. First, uncertainty does not always translate into changes in one's finances. While some people may work harder in anticipation of future financial turbulence, or may spend less and save more as a precautionary motive in response to uncertainty, others' behavior may remain unchanged until there are any actual changes in their finances. In the absence of increased unemployment, the opportunity cost of time (which relates to actual job loss), and health as an input into production (relating to hazardous working conditions), which are two of the main mechanisms on how recessions affect health that were put forward by Ruhm (2000) (Ruhm, 2000) might apply to fewer people. In any case, the mechanisms might differ to some extent compared to actual job loss, but both can change living conditions and behaviors.

Second, while economic uncertainty sometimes increases during recessions, the two often demonstrate different patterns. A typical example is the United Kingdom in recent years, where the economic uncertainty index reached very high levels after the Brexit referendum (Baker et al., 2021), while unemployment remained very low and the economy was growing (ONS, 2021). A similar situation was observed following the 2016 US Presidential elections (Baker et al., 2021; CBO, 2021). The impact of uncertainty on health may also unfold over a much shorter time scale (e.g., days) compared to those associated with economic fluctuations (typically over months or years) (Vandoros et al., 2018, 2019a).

Against this background, the objective of this paper is to examine the relationship between economic uncertainty and cardiovascular disease mortality, using data from England and Wales. This study contributes to the literature in a number of ways. First, it examines the impact of uncertainty on cardiovascular disease mortality, rather than the impact of actual adverse events (job loss, income loss) that have already emerged. To our knowledge, this is the first study on this topic. Second, it studies the short-term association between economic uncertainty and cardiovascular outcomes. Third, it provides evidence on yet another impact of uncertainty, in addition to others that have previously been put forward in the literature, such as suicides, car crashes and subjective well-being. It is worth mentioning that our study controls for unemployment, to rule out the possibility of any effect being driven by real economic outcomes instead of uncertainty.

Using variation in weekly data over the period 2001–2019, we found a strong positive correlation between economic uncertainty and mortality relating to strokes and heart attacks in England and Wales. Our results are robust to a number of different approaches and specifications, robustness checks, sensitivity analyses and placebo tests.

The remainder of the paper is organized as follows: Section 2 provides a background on the link between economic conditions and health; Section 3 presents data and methods; Section 4 presents the empirical results; and Section 5 concludes.

2 | BACKGROUND

The literature has extensively studied the link between economic conditions and health. In his pioneering paper, Ruhm (2000) argues that unemployment and recessions are associated with lower mortality. The mechanism put forward by the author related to the opportunity cost of time, which relates to exercising, cooking and time invested in medical screening; hazardous working environments; and other factors such as car crashes, as well as reduced prevalence of drinking and smoking due to affordability (Ruhm, 2000). Several studies have confirmed these findings, showing that mortality is procyclical (Gerdtham & Ruhm, 2006; Haaland & Telle, 2015; Neumayer, 2004; Tapia Granados & Diez Roux, 2009). One of the causes of death presented in these studies that increases during upturns is cardiovascular mortality.

A contrasting body of evidence argues that mortality is countercyclical (Gerdtham & Johannesson, 2005; McInerney & Mellor, 2012). Apart from increased mortality, some studies also report a deterioration of physical health or self-reported health (Jofre-Bonet et al., 2018; Svensson, 2007; Vandoros et al., 2013). Another body of evidence suggests that the impact of recessions might not be that relevant for health any longer (Ruhm, 2015)—which is in line with earlier articles (Böckerman & Ilmakunnas, 2009). This suggests that the relationship between the economy and health may differ by period and setting.

There are a number of studies that have focused on the association between economic recessions and cardiovascular health (Asgeirsdottir et al., 2014; Neumayer, 2004; Ruhm, 2000, 2015; Tapia Granados, 2005). This is not surprising. Cardiovascular disease is the world's leading cause of disability and death, being responsible for 17.9 million deaths in 2019 and representing 32% of global mortality (WHO, 2021). According to recent estimates, their prevalence almost doubled from 271 to 523 million people from 1990 to 2019, while trends in disability and years of life lost are also rapidly increasing (Roth et al., 2020).

Using cross-country data and unemployment rate as a proxy for economic conditions, several studies have shown that cardiovascular mortality and deaths from ischemic heart disease decrease during recessions (Neumayer, 2004; Ruhm, 2000; Tapia Granados & Ionides, 2017). A study based on data from European countries recently demonstrated an inverted-U association between GDP per capita and cardiovascular deaths (Spiteri & von Brockdorff, 2019), whereas a time-series analysis of high-income countries concluded that cardiovascular deaths are not responsive to economic conditions (Dadgar & Norström, 2020). Apart from mortality, existing empirical work has also examined how economic fluctuations impact incidence of cardiovascular disease and resulting hospitalisations. Large-scale economic declines have been found to increase the probability of cardiovascular events (Birgisdóttir et al., 2020; Torbica et al., 2015) and hospital admissions due to acute myocardial infarction (Katz et al., 2016). In addition, the impact of recessions on cardiovascular events has been found to be heterogeneous, as workers who experienced job loss demonstrated higher cardiovascular disease risk, as opposed to those who did not lose their job (Noelke & Avendano, 2015).

Going beyond economic recessions and unemployment, a strand of the literature has focused on the potential impact of stock market performance on cardiovascular health, revealing contradictory evidence. Using data from Asia and the US, several studies show that stock market volatility are associated with increased deaths from coronary heart disease (Ma et al., 2011), higher cardiovascular mortality (Lin et al., 2013) and greater incidence of acute myocardial infarction and stroke (Chen et al., 2012; Fiuzat et al., 2010). Contrary to the findings of these studies, another body of evidence did not find a link between stock market decline and admissions due to stroke and myocardial infarction (Yap et al., 2016) or cardiac deaths (Schwartz et al., 2012).

Last, apart from the actual economic situation and events that have already emerged, overall uncertainty and expectations about future economic activity may also influence cardiovascular health through various channels, such as job insecurity and increased psychosocial stress. The literature has shown that job insecurity, a form of economic uncertainty, can have a negative impact on health (Burgard et al., 2009; Caroli & Godard, 2016; Ferrie et al., 2005; Siegel et al., 2003). Such effects are not limited only to the individual whose job is at risk, but also to other household members (Bünnings et al., 2017).

Recent evidence also shows that economic uncertainty has detrimental impact on several outcomes, such as suicide rates (Antonakakis & Gupta, 2017; Vandoros et al., 2019a; Vandoros & Kawachi, 2021), antidepressant prescription rates (Vandoros et al., 2019b), and newborn health (Kyriopoulos et al., 2019). Road traffic accidents also appear to demonstrate short term spikes due to increased economic uncertainty (Vandoros et al., 2018) or stock market fluctuations (Giulietti et al., 2020), which might be a result of distraction, sleep deprivation or frustration. However, the potential link between economic uncertainty and cardiovascular health has not been empirically examined, despite the burden of disease associated with diseases of the circulatory system.

3 | METHODS

3.1 | Data

We used weekly mortality data for England and Wales spanning over the period 2001–2019 from the ONS, focusing on deaths from diseases of the circulatory system. To obtain data for cause-specific mortality, we relied on the International Classification of Diseases, developed by the World Health Organization (WHO, 2019). This tool systematically consolidates underlying causes of deaths and maps mortality statistics allowing for international and intranational comparability over time. In this study, we examined deaths from diseases of the circulatory system (ICD-10 code: I00–I99) and also studied cause-specific mortality from ischemic heart disease (ICD-10 code: I20–I25) and cerebrovascular disease (ICD-10 code: I60–I69).

To capture economic uncertainty, we used a weekly measure of Economic Policy Uncertainty for the UK, which was calculated based on daily data for Economic Policy Uncertainty Index (EPUI). The EPU index is compiled from textual analysis of digital archives (Baker et al., 2016), covering about 650 national and local newspapers across the UK. It reflects the coverage frequency of articles that include at least one keyword from each of the following term sets: (a) economic or economy, (b) uncertain or uncertainty, (c) spending, deficit, regulation, budget, tax, policy, Bank of England. We took the weekly average of this daily index in order to match deaths that were only available weekly. Table S1 in the Online Supplementary Material shows how the weekly average compares to the daily index. Their average is practically identical (daily: 275.4059; weekly: 275.577; but the daily index is more volatile (standard deviation - daily: 182.5388; weekly: 144.0267). We also obtained data for monthly unemployment rates and population aged more than 16 from the ONS Official Labor Market Statistics. Data on monthly GDP index and Consumer Price Index (CPIH) for the UK were also derived from the ONS. Figure S1 in the Online Supplementary Material shows weekly trends in the uncertainty index and deaths due to cerebrovascular disease, disease of the circulatory system, and ischemic heart disease.

3.2 | Empirical strategy

We test the extent to which economic uncertainty is associated with cardiovascular deaths. In doing so, we estimate the following regression model:

$$\log(\mathrm{D_t}) = \beta_0 + \beta_1 \mathrm{EPUI_t} + \mathrm{X_t'}\gamma + \mathrm{m_t} + \mathrm{y_t} + \varepsilon_\mathrm{t} \quad (1)$$

where $\log(\mathrm{D_t})$ is our main outcome, capturing the natural logarithm of weekly deaths. $\mathrm{EPUI_t}$ is the weekly average of the EPUI. To standardize this measure, we have divided it by the standard deviation. We are mainly interested in coefficient β which measures the association between economic uncertainty and cardiovascular deaths.

$\mathrm{X_t}$ is a vector of regressors that includes unemployment rate, consumer price index, GDP growth and population size. We also control for month fixed effects (FE) $\mathrm{m_t}$ and year FE $\mathrm{y_t}$.

Robust standard errors are reported throughout. After performing an Augmented Dickey-Fuller test, we rejected the null hypothesis of unit roots for both economic uncertainty and our outcomes of interest.

Next, we estimate a model to test potential non-linearity in the association between economic uncertainty and cardiovascular deaths. In doing so, we broke EPUI into terciles and controlled for it through dummy variables for each tercile. After omitting the middle tercile (reference category), we estimated the following equation:

$$\log(\mathrm{D_t}) = \alpha_0 + \alpha_1 \mathrm{Bottom_t} + \alpha_2 \mathrm{Top_t} + \mathrm{X_t'}\delta + \kappa_\mathrm{t} + \lambda_\mathrm{t} + \mathrm{u_t} \quad (2)$$

where Bottom and Top are dummies indicating the bottom and top tercile of the distribution respectively, and α_1 and α_2 are the coeffients of interest. To construct the binary exposures (i.e., Bottom and Top) included in Equation (2), we split the distribution of economic uncertainty into three equal groups (i.e., terciles), each of which includes 330 observations.

After estimating the baseline equation, we perform several robustness checks and sensitivity analyses. First, we run Equation (1) without adjusting for the standard deviation and using the natural logarithm of EPUI. Second, we estimate models after removing extreme values. Third, we test the robustness of our findings by including linear and quadratic time trends in our specification. Fourth, we run the baseline specification after including a lagged dependent variable as a regressor (Giulietti et al., 2020). Fifth, we check the extent to which our main findings are robust to different model specifications, such as Poisson and Negative Binomial regression. Sixth, we perform an analysis using a dependent variable that captures the difference between the observed number of deaths and the rolling 1-month and 1-year average of deaths respectively.

4 | RESULTS

4.1 | Baseline estimates

Table 1 presents the summary statistics of the main variables of interest. During the period examined, the weekly average number of cardiovascular deaths is almost 3,083, with a standard deviation of 648. The weekly average number of deaths from cerebrovascular and ischemic heart disease is 815 and 1424 respectively.

Table 2 presents our baseline regression findings. Based on the Augmented Dickey-Fuller test, we reject the hypothesis that our time series have unit roots (Table S2 in the Online Supplementary Material). We begin by showing the estimates of a regression model, in which we have only controlled for economic uncertainty and month and year FE. Columns 1–3 present the

TABLE 1 Summary statistics.

Variable	Observations	Mean	Standard deviation	Min	Max
Deaths from circulatory system diseases	990	3082.6	647.4	1662.0	5472.0
Deaths from cerebrovascular disease	990	815.2	213.6	404.0	1607.0
Deaths from ischemic heart disease	990	1423.5	361.1	666.0	2784.0
EPUI (Total)	990	275.6	144.0	59.5	1841.0
EPUI (1st tercile)	330	143.2	32.5	59.5	195.3
EPUI (2nd tercile)	330	252.3	33.5	195.7	314.6
EPUI (3rd tercile)	330	431.2	133.3	314.6	1841.0
Unemployment rate	990	5.7	1.4	3.8	8.5
Consumer price index	990	90.5	10.8	73.5	108.5
GDP index	990	86.0	7.5	73.0	100.4
Population over 16 years of age (million)	990	44.4	1.9	41.1	47.5

TABLE 2 Economic uncertainty and deaths (baseline results).

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	**Circulatory system diseases**	**Cerebrovascular disease**	**Ischemic heart disease**	**Circulatory system diseases**	**Cerebrovascular disease**	**Ischemic heart disease**
EPUI	0.0111***	0.00897***	0.0117***	0.0111***	0.00907***	0.0113***
	(0.0034)	(0.0033)	(0.0041)	(0.0034)	(0.0033)	(0.0041)
Controls	No	No	No	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	990	990	990	990	990	990
R-sq	0.874	0.922	0.892	0.875	0.923	0.893
adj. *R*-sq	0.870	0.919	0.888	0.871	0.920	0.889

Note: Controls include unemployment rate, CPIH, GDP and population size. EPUI denotes the index divided by the standard deviation. Robust standard errors in parentheses.

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

findings for the total number of cardiovascular deaths, as well as for deaths from cerebrovascular and ischemic heart disease. In Columns 4–6, we have included additional regressors (unemployment rate, CPIH, GDP and population size), as discussed in Methods section. Economic uncertainty is independently associated with cardiovascular mortality after controlling for several economic indicators, including unemployment, GDP growth and inflation. A one standard deviation increase in EPUI increases the number of cardiovascular deaths by 1.1%. The coefficient of interest is positive and statistically significant in all columns, with its magnitude being similar even after including additional controls. The size of the coefficient is similar regardless the outcome, demonstrating that economic uncertainty has a similar impact on deaths from cerebrovascular and ischemic heart disease.

We next estimate Equation (2) to examine potential non-linearity in the association between economic uncertainty and cardiovascular deaths. In the models presented in Table 3, we control for economic uncertainty through dummies for each tercile of the distribution, allowing for the top and bottom group to exhibit a differential impact on deaths. We find that only uncertainty in the top tercile matters for cardiovascular deaths. These findings demonstrate that high levels of economic uncertainty are particularly detrimental for cardiovascular health, contrary to those in the bottom tercile. The link is therefore asymmetric and stronger in periods of high uncertainty relative to those of moderate uncertainty. Our findings remain robust after the inclusion of several regressors.

4.2 | Leads and lags

Going beyond the contemporaneous links, we explore a potential relationship between lagged or future economic uncertainty and cardiovascular mortality. The former would show the duration of the association; while the latter serves as a placebo test.

TABLE 3 Economic uncertainty and deaths (non-linearity).

Dependent variable	(1) Circulatory system diseases	(2) Cerebrovascular disease	(3) Ischemic heart disease	(4) Circulatory system diseases	(5) Cerebrovascular disease	(6) Ischemic heart disease
Bottom tercile	−0.00599	−0.00911	−0.00798	−0.00655	−0.0099	−0.00791
	(0.00696)	(0.00695)	(0.00786)	(0.00700)	(0.00699)	(0.00791)
Top tercile	0.0260***	0.0230***	0.0266***	0.0255***	0.0226***	0.0259***
	(0.00829)	(0.00766)	(0.00919)	(0.00838)	(0.00772)	(0.00929)
Controls	No	No	No	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	990	990	990	990	990	990
R-sq	0.875	0.922	0.892	0.876	0.923	0.893
adj. *R*-sq	0.871	0.920	0.889	0.871	0.921	0.889

Note: Controls include unemployment rate, CPIH, GDP and population size. Robust standard errors in parentheses.
$^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE 4 Leads and lags of economic uncertainty (circulatory system diseases).

	(1) *t*-3	(2) *t*-2	(3) t-1	(4) *t*+1	(5) *t*+2	(6) *t*+3
EPUI	0.00413	0.00283	0.00979***	−0.00186	0.00373	0.00498
	(0.00349)	(0.00328)	(0.00375)	(0.00363)	(0.00356)	(0.00348)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	987	988	989	990	990	990
R-sq	0.872	0.873	0.874	0.877	0.877	0.878
adj. *R*-sq	0.867	0.868	0.870	0.872	0.873	0.873

Note: Controls include unemployment rate, CPIH, GDP and population size. EPUI denotes the index divided by the standard deviation. Robust standard errors in parentheses.
$^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

We first examine whether economic uncertainty up to 3 weeks earlier is associated with mortality (Table 4, Columns 1–3) and find some evidence in support of this hypothesis for the first week. Quantitatively, the estimate of the coefficient of the lagged economic uncertainty (Model 3 in Table 4) is lower than that of the contemporaneous impact. This is suggesting of a triggering effect of economic uncertainty on cardiovascular disease mortality. Apparently, our baseline model shows that the main impact on cardiovascular mortality appears in the same week, this additional analysis reveals a residual impact that occurs the week after. There is no association between uncertainty and mortality two or 3 weeks later, which might be a sign of adaptation. (or that the window of triggering effects has passed). On the contrary -and as expected-we do not report evidence of a relationship between future economic uncertainty and current cardiovascular deaths. This finding is encouraging as the models presented in Columns 4–6 essentially serve as placebo tests.

4.3 | Additional specifications and robustness checks

Our results are robust to different specifications and approaches. In Table 5, we estimated a model similar to Equation (1) after adding a time trend, apart from month and year FE. Including a time trend allows us to capture the general trajectory of cardiovascular deaths over time. As shown in Columns 1–3, the relationship between economic uncertainty and mortality holds after adding the time trend, with the size of the coefficient being unchanged. We also explore whether the inclusion of the lagged dependent variable as regressor affects the estimates. According to the regression models presented Columns 4–6, the estimates of the coefficient of interest are still significant and similar in terms of magnitude. Table S3 in the Supplementary Material

TABLE 5 Different model specifications.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	**Circulatory system diseases**	**Cerebrovascular disease**	**Ischemic heart disease**	**Circulatory system diseases**	**Cerebrovascular disease**	**Ischemic heart disease**
EPUI	0.0114***	0.0094***	0.0116***	0.0101***	0.00825**	0.0101**
	(0.00352)	(0.00330)	(0.00422)	(0.00354)	(0.00335)	(0.00426)
Lagged DV	0.0731	0.1212***	0.0443			
	(0.0457)	(0.0439)	(0.0428)			
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	Yes	Yes	Yes
N	990	990	990	990	990	990
R-sq	0.876	0.924	0.893	0.877	0.924	0.895
adj. *R*-sq	0.872	0.921	0.889	0.873	0.921	0.891

Note: Controls include unemployment rate, CPIH, GDP and population size. EPUI denotes the index divided by the standard deviation. Robust standard errors in parentheses.

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

presents some additional specifications, in which we control for quadratic time trend (Columns 1–3) and time trend and lagged outcomes (Columns 4–6). Our results once again are similar to those of the baseline model and hold the same interpretation.

We also use the differences between the weekly number of deaths and the rolling average of previous periods (i.e., one month and 1 year) as dependent variables. This approach allows us to examine the potential impact of economic uncertainty on the changes in cardiovascular deaths over different time periods. The results presented in Table S4 further confirm our baseline. Our results are also robust to different scaling approaches. In Table S5, we estimate models similar to Equation 1, in which we have either controlled for the logarithm of EPUI without any adjustment or we have scaled the logarithm of economic uncertainty by the time-series standard deviation. Our results remain robust and statistically significant across all outcomes we examined. In addition, we explore the extent to which our results are driven by outliers in the distribution of cardiovascular deaths. After excluding the bottom and top 1% and 5%, we show that our findings remain consistent and quantitatively similar to the baseline results. More details are presented in Table S6 in the Supplementary Material. In Table S7, we estimate a model similar to that presented in Equation (1). Instead of using the natural logarithm of cardiovascular deaths as dependent variable, we regress the actual number of deaths (in levels) against the same set of regressors. After employing Poisson and Negative Binomial models, we confirm that our findings are insensitive to different regression modeling approaches, while the coefficients remain significant and similar in size. Pay days in the UK often fall toward the end of the month, so we also controlled for week FE as an additional robustness check. Our results, presented in Table S8, are similar to the baseline estimates in terms of significance and size of the coefficient of interest. As an additional check for the same reason, Columns 1–4 in Table S9 show the regression estimates after excluding the first, second, third and fourth week of month, respectively. The positive link between economic uncertainty and deaths persists. Finally, the weekly average of the uncertainty index might have a smoothing effect on the highly volatile daily index. While the average takes into account the overall weekly exposure to uncertainty, it might be that the peak of uncertainty is more important. We thus examined whether the weekly peak, range or median of the uncertainty index are associated with weekly deaths. In the additional regressions, that are presented in Tables S10, S11 and S12 in the Online Supplementary Material, the coefficients of the peak and range are statistically insignificant, while that of the median is positive and significant, as in the baseline model. This suggests that the overall weekly exposure to uncertainty is more relevant for cardiovascular disease deaths than its weekly maximum value.

5 | DISCUSSION

Using data from England and Wales we found that economic uncertainty is positively and significantly associated with cardiovascular disease mortality, after controlling for a number of other economic indicators. Our findings apply to all three different types of mortality: diseases of the circulatory system; ischemic heart disease and cerebrovascular disease. One standard deviation increase in economic uncertainty is associated with a 1.1% increase in deaths from circulatory system diseases. Given that the uncertainty index is volatile, and multi-fold increases in the index are not uncommon, the magnitude of the association between uncertainty and mortality can be sizable. We also show that this link is non-linear and stronger during periods of high economic uncertainty.

Contrary to the standard economic indicators, the economic uncertainty index is very volatile and reported at the weekly level, and thus captures an immediate or short-term association between the economy and health. This is particularly important when examining cardiovascular health. In cardiovascular epidemiology, there are two types of risk factors: those that "trigger" acute cardiovascular events -such as acute emotional distress- and the ones associated with long-term progression of atherosclerosis and other conditions. In this context, there are some plausible explanations for our findings. One possible explanation might be that increased uncertainty may act as a trigger, which has been found to increase the risk of cardiovascular events, even within minutes to hours after exposure to various stressors (Leor et al., 1996; Mefford et al., 2020). To add to that, our findings shows that only 1-week lagged and contemporaneous levels of economic uncertainty matter for cardiovascular disease deaths. This largely suggests that economic uncertainty acts as a trigger rather than the sole factor responsible for cardiovascular disease mortality. The biological processes and explanations behind this triggering effect under emotional stress have been widely examined (Bhattacharyya & Steptoe, 2007). There are alternative or complementary explanations for our findings. The triggering mechanism can explain an increase in the number of cardiovascular events, but our paper studies mortality rather than cardiovascular events or hospitalisations. Other explanations could be that individuals might delay seeking care when they experience a cardiovascular event, face increased ambulance response times and barriers to accessing care or receive poorer quality of care - thus worsening the chances of survival (Krumholz et al., 2009; Pell et al., 2001; Scholz et al., 2018). For example, uncertainty may cause increased demand for emergency care or ambulance services due to other conditions such as car accidents (Vandoros et al., 2018, 2019a), leading to limited capacity. All the factors mentioned above as part of a plausible mechanism may partially explain the findings simultaneously.

We subjected our results to a number of robustness checks. In particular, we tested for non-linearities; employed Poisson and Negative Binomial models and applied different model specifications in sensitivity analyses with step-wise inclusion of control variables or applying dynamic effects. Results persist when using alternative measures of uncertainty or excluding outliers. In a series of other tests, we examined whether past and future levels of economic uncertainty impact deaths. The association between uncertainty and mortality appears to be limited to the same and next week, with mortality two or 3 weeks later not being affected by earlier uncertainty. This might also be a sign of adaptation, in accordance with Bradford and Dolan (2010) and Wilson and Gilbert (2008) (Bradford & Dolan, 2010; Wilson & Gilbert, 2008).

These findings add to those of previous studies that have highlighted the association between economic conditions and cardiovascular morbidity and mortality (Birgisdóttir et al., 2020; Katz et al., 2016; Neumayer, 2004; Tapia Granados & Ionides, 2017). Our results also contribute to a growing body of literature that studies the impact of economic uncertainty on health. There appears to be robust and consistent evidence on a number of health outcomes, such as suicides (Antonakakis & Gupta, 2017; Vandoros et al., 2019a; Vandoros & Kawachi, 2021), newborn health (Kyriopoulos et al., 2019) and car crashes (Vandoros et al., 2018). Sudden events at the macro level causing uncertainty have also demonstrated an impact on health outcomes (Kavetsos et al., 2021; Metcalfe et al., 2011; Vandoros et al., 2019b). As these findings emerge, the role of uncertainty appears to be an important factor that consistently affects health outcomes. Future research can focus on additional outcomes that are yet to be explored. In addition, our results add to evidence on how exposure to population-based events and stressful circumstances trigger the onset cardiovascular events. Studies have shown that cardiovascular health deteriorates due to socio-political events, natural disasters or terrorist attacks (Mefford et al., 2020; Niiyama et al., 2014; Rosman et al., 2021; Shedd et al., 2004). In this context, our findings reveal that economic uncertainty may act, among others, as a trigger for cardiovascular events, but it is unlikely to be the sole cause of cardiovascular disease deaths.

This study is subject to limitations. We only have aggregate data on the number of deaths per week, so we could not control for individual characteristics that may contribute to cardiovascular mortality. Furthermore, we could not stratify by demographic or socioeconomic characteristics, in order to examine who is affected the most by fluctuations in economic uncertainty, as data were not available by socioeconomic or job status etc. There may be significant heterogeneity in the average effects that we have reported with respect to these characteristics. Importantly, we did not have data on cardiovascular events or hospitalisations, so we cannot be sure to what extent the mechanism acts via a triggering effect and to what extent it might be due to delays in seeking care or increased demand for healthcare. An additional limitation is that, as the number of deaths was reported weekly, we had to take the weekly average of the uncertainty index instead of using the daily measure, which possibly had a smoothing effect on the highly volatile daily index.

As cardiovascular disease is a leading cause of mortality, it is important to raise awareness among the population to take particular care especially in periods of increased uncertainty. Campaigns reminding people how to identify a stroke or heart attack and how to immediately react can intensify in such periods, and particular importance can be placed on patient adherence with regards to taking prescribed preventive treatment. In addition, hotlines can be set up to assist people experiencing acute distress during times of uncertainty.

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CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY STATEMENT

Data available on request from the authors: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

Antonakakis, N., & Collins, A. (2015). The impact of fiscal austerity on suicide mortality: Evidence across the Eurozone periphery. *Social Science and Medicine*, *145*, 63–78. https://doi.org/10.1016/J.SOCSCIMED.2015.09.033

Antonakakis, N., & Gupta, R. (2017). Is economic policy uncertainty related to suicide rates? Evidence from the United States. *Social Indicators Research*, *133*(2), 543–560. https://doi.org/10.1007/s11205-016-1384-4

Ásgeirsdóttir, T. L., Corman, H., Noonan, K., Ólafsdóttir, P., & Reichman, N. E. (2014). Was the economic crisis of 2008 good for Icelanders? Impact on health behaviors. *Economics and Human Biology*, *13*(1), 1–19. https://doi.org/10.1016/J.EHB.2013.03.005

Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring economic policy uncertainty. *Quarterly Journal of Economics*, *131*(4), 1593–1636. https://doi.org/10.1093/qje/qjw024

Baker, S. R., Bloom, N., & Davis, S. J. (2021). Economic policy uncertainty index. Retrieved from https://www.policyuncertainty.com/uk_monthly.html

Bhattacharyya, M. R., & Steptoe, A. (2007). Emotional triggers of acute coronary syndromes: Strength of evidence, biological processes, and clinical implications. *Progress in Cardiovascular Diseases*, *49*(5), 353–365. https://doi.org/10.1016/J.PCAD.2006.11.002

Birgisdóttir, K. H., Hauksdóttir, A., Ruhm, C., Valdimarsdóttir, U. A., & Ásgeirsdóttir, T. L. (2020). The effect of the economic collapse in Iceland on the probability of cardiovascular events. *Economics and Human Biology*, *37*, 100861. https://doi.org/10.1016/J.EHB.2020.100861

Böckerman, P., & Ilmakunnas, P. (2009). Unemployment and self-assessed health: Evidence from panel data. *Health Economics*, *18*(2), 161–179. https://doi.org/10.1002/HEC.1361

Bradford, W. D., & Dolan, P. (2010). Getting used to it: The adaptive global utility model. *Journal of Health Economics*, *29*(6), 811–820. https://doi.org/10.1016/j.jhealeco.2010.07.007

Bradford, W. D., & Lastrapes, W. D. (2014). A prescription for unemployment? Recessions and the demand for mental health drugs. *Health Economics*, *23*(11), 1301–1325. https://doi.org/10.1002/HEC.2983

Browning, M., Dano, A. M., & Heinesen, E. (2006). Job displacement and stress-related health outcomes. *Health Economics*, *15*(10), 1061–1075. https://doi.org/10.1002/HEC.1101

Bünnings, C., Kleibrink, J., & Weßling, J. (2017). Fear of unemployment and its effect on the mental health of spouses. *Health Economics*, *26*(1), 104–117. https://doi.org/10.1002/HEC.3279

Burgard, S. A., Brand, J. E., & House, J. S. (2009). Perceived job insecurity and worker health in the United States. *Social Science and Medicine*, *69*(5), 777–785. https://doi.org/10.1016/J.SOCSCIMED.2009.06.029

Caroli, E., & Godard, M. (2016). Does job insecurity deteriorate health? *Health Economics*, *25*(2), 131–147. https://doi.org/10.1002/hec.3122

CBO. (2021). Budget and economic data | congressional budget Office. Retrieved from https://www.cbo.gov/data/budget-economic-data

Chen, C. C., Chen, C. S., Liu, T. C., & Lin, Y. T. (2012). Stock or stroke? Stock market movement and stroke incidence in taiwan. *Social Science and Medicine*, *75*(11), 1974–1980. https://doi.org/10.1016/J.SOCSCIMED.2012.07.008

Dadgar, I., & Norström, T. (2020). Is there a link between cardiovascular mortality and economic fluctuations? *Scandinavian Journal of Public Health*, *48*(7), 770–780. https://doi.org/10.1177/1403494819890699

Ferrie, J. E., Shipley, M. J., Newman, K., Stansfeld, S. A., & Marmot, M. (2005). Self-reported job insecurity and health in the Whitehall II study: Potential explanations of the relationship. *Social Science and Medicine*, *60*(7), 1593–1602. https://doi.org/10.1016/J.SOCSCIMED.2004.08.006

Fiuzat, M., Shaw, L. K., Thomas, L., Felker, G. M., & O'Connor, C. M. (2010). United States Stock market performance and acute myocardial infarction rates in 2008–2009 (from the duke databank for cardiovascular disease). *The American Journal of Cardiology*, *106*(11), 1545–1549. https://doi.org/10.1016/J.AMJCARD.2010.07.027

Gerdtham, U.-G., & Johannesson, M. (2005). Business cycles and mortality: Results from Swedish microdata. *Social Science and Medicine*, *60*(1), 205–218. https://doi.org/10.1016/j.socscimed.2004.05.004

Gerdtham, U.-G., & Ruhm, C. J. (2006). Deaths rise in good economic times: Evidence from the OECD. *Economics and Human Biology*, *4*(3), 298–316. https://doi.org/10.1016/j.ehb.2006.04.001

Giulietti, C., Tonin, M., & Vlassopoulos, M. (2020). When the market drives you crazy: Stock market returns and fatal car accidents. *Journal of Health Economics*, *70*, 102245. https://doi.org/10.1016/J.JHEALECO.2019.102245

Haaland, V. F., & Telle, K. (2015). Pro-cyclical mortality across socioeconomic groups and health status. *Journal of Health Economics*, *39*, 248–258. https://doi.org/10.1016/J.JHEALECO.2014.08.005

Jofre-Bonet, M., Serra-Sastre, V., & Vandoros, S. (2018). The impact of the Great Recession on health-related risk factors, behaviour and outcomes in England. *Social Science and Medicine*, *197*, 213–225. https://doi.org/10.1016/j.socscimed.2017.12.010

Katz, M., Bosworth, H. B., Lopes, R. D., Dupre, M. E., Morita, F., Pereira, C., Franco, F. G. M., Prado, R. R., Pesaro, A. E., & Wajngarten, M. (2016). A time-series analysis of the relation between unemployment rate and hospital admission for acute myocardial infarction and stroke in Brazil over more than a decade. *International Journal of Cardiology*, *224*, 33–36. https://doi.org/10.1016/J.IJCARD.2016.08.309

Kavetsos, G., Kawachi, I., Kyriopoulos, I., & Vandoros, S. (2021). The effect of the Brexit referendum result on subjective well-being. *Journal of the Royal Statistical Society: Series A*, *184*(2), 707–731. https://doi.org/10.1111/RSSA.12676

Krumholz, H. M., Merrill, A. R., Schone, E. M., Schreiner, G. C., Chen, J., Bradley, E. H., Wang, Y., Wang, Y., Lin, Z., Straube, B. M., Rapp, M. T., Normand, S. L. T., & Drye, E. E. (2009). Patterns of hospital performance in acute myocardial infarction and heart failure 30-day mortality and readmission. *Circulation: Cardiovascular Quality and Outcomes*, *2*(5), 407–413. https://doi.org/10.1161/CIRCOUTCOMES.109.883256

Kyriopoulos, I., Nikoloski, Z., & Mossialos, E. (2019). Does economic recession impact newborn health? Evidence from Greece. *Social Science and Medicine*, *237*, 112451. https://doi.org/10.1016/j.socscimed.2019.112451

Leor, J., Poole, W. K., & Kloner, R. A. (1996). Sudden cardiac death triggered by an earthquake. *New England Journal of Medicine*, *334*(7), 413–419. https://doi.org/10.1056/NEJM199602153340701

Lin, H., Zhang, Y., Xu, Y., Liu, T., Xiao, J., Luo, Y., Xu, X., He, Y., & Ma, W. (2013). Large daily stock variation is associated with cardiovascular mortality in two cities of Guangdong, China. *PLoS One*, *8*(7), e68417. https://doi.org/10.1371/JOURNAL.PONE.0068417

Lopez Bernal, J. A., Gasparrini, A., Artundo, C. M., & McKee, M. (2013). The effect of the late 2000s financial crisis on suicides in Spain: An interrupted time-series analysis. *The European Journal of Public Health*, *23*(5), 732–736. https://doi.org/10.1093/EURPUB/CKT083

Ma, W., Chen, H., Jiang, L., Song, G., & Kan, H. (2011). Stock volatility as a risk factor for coronary heart disease death. *European Heart Journal*, *32*(8), 1011. https://doi.org/10.1093/EURHEARTJ/EHQ495

McInerney, M., & Mellor, J. M. (2012). Recessions and seniors' health, health behaviors, and healthcare use: Analysis of the Medicare Current Beneficiary Survey. *Journal of Health Economics*, *31*(5), 744–751. https://doi.org/10.1016/j.jhealeco.2012.06.002

Mefford, M. T., Mittleman, M. A., Li, B. H., Qian, L. X., Reynolds, K., Zhou, H., Harrison, T. N., Geller, A. C., Sidney, S., Sloan, R. P., Mostofsky, E., & Williams, D. R. (2020). Sociopolitical stress and acute cardiovascular disease hospitalizations around the 2016 presidential election. In *Proceedings of the National Academy of Sciences of the United States of America*. (Vol. 117(43), pp. 27054–27058). SAPP.PDF. https://doi.org/10.1073/PNAS.2012096117/SUPPL_FILE/PNAS.2012096117

Metcalfe, R., Powdthavee, N., & Dolan, P. (2011). Destruction and distress: Using a quasi-experiment to show the effects of the september 11 attacks on mental well-being in the United Kingdom. *The Economic Journal*, *121*(550), 81–103. https://doi.org/10.1111/j.1468-0297.2010.02416.x

Modrek, S., & Cullen, M. R. (2013). Job insecurity during recessions: Effects on survivors' work stress. *BMC Public Health*, *13*(1), 929. https://doi.org/10.1186/1471-2458-13-929

Neumayer, E. (2004). Recessions lower (some) mortality rates: Evidence from Germany. *Social Science and Medicine*, *58*(6), 1037–1047. https://doi.org/10.1016/j.socscimed.2004.02.018

Niiyama, M., Tanaka, F., Nakajima, S., Itoh, T., Matsumoto, T., Kawakami, M., Naganuma, Y., Omama, S., Komatsu, T., Onoda, T., Sakata, K., Ichikawa, T., & Nakamura, M. (2014). Population-based incidence of sudden cardiac and unexpected death before and after the 2011 earthquake and tsunami in Iwate, northeast Japan. *Journal of the American Heart Association*, *3*(3). https://doi.org/10.1161/JAHA.114.000798

Noelke, C., & Avendano, M. (2015). Who suffers during recessions? Economic downturns, job loss, and cardiovascular disease in older Americans. *American Journal of Epidemiology*, *182*(10), 873–882. https://doi.org/10.1093/AJE/KWV094

ONS. (2021). Gross domestic product (GDP) - Office for national statistics. Retrieved from https://www.ons.gov.uk/economy/grossdomesticproductgdp

Pell, J. P., Sirel, J. M., Marsden, A. K., Ford, I., & Cobbe, S. M. (2001). Effect of reducing ambulance response times on deaths from out of hospital cardiac arrest: Cohort study. *BMJ*, *322*(7299), 1385–1388. https://doi.org/10.1136/BMJ.322.7299.1385

Riumallo-Herl, C., Basu, S., Stuckler, D., Courtin, E., & Avendano, M. (2014). Job loss, wealth and depression during the Great Recession in the USA and Europe. *International Journal of Epidemiology*, *43*(5), 1508–1517. https://doi.org/10.1093/IJE/DYU048

Rosman, L., Salmoirago-Blotcher, E., Mahmood, R., Yang, H., Li, Q., Mazzella, A. J., Klein, J. L., Bumgarner, J., & Gehi, A. (2021). Arrhythmia risk during the 2016 us presidential election: The cost of stressful politics. *Journal of the American Heart Association*, *10*(11), 20559. https://doi.org/10.1161/JAHA.120.020559

Roth, G. A., Mensah, G. A., Johnson, C. O., Murray, C. J. L., Fuster, V., Baddour, L. M., Barengo, N. C., Beaton, A. Z., Benjamin, E. J., Benziger, C. P., Bonny, A., Brauer, M., Brodmann, M., Cahill, T. J., Carapetis, J., Catapano, A. L., Chugh, S. S., Cooper, L. T., & Coresh, J. (2020). Global burden of cardiovascular diseases and risk factors, 1990–2019: Update from the GBD 2019 study. *Journal of the American College of Cardiology*, *76*(25), 2982–3021. https://doi.org/10.1016/J.JACC.2020.11.010

Ruhm, C. J. (2000). Are recessions good for your health? *Quarterly Journal of Economics*, *115*(2), 617–650. https://doi.org/10.1162/003355300554872

Ruhm, C. J. (2015). Recessions, healthy no more? *Journal of Health Economics*, *42*, 17–28. https://doi.org/10.1016/j.jhealeco.2015.03.004

Scholz, K. H., Maier, S. K. G., Maier, L. S., Lengenfelder, B., Jacobshagen, C., Jung, J., Fleischmann, C., Werner, G. S., Olbrich, H. G., Ott, R., Mudra, H., Seidl, K., Schulze, P. C., Weiss, C., Haimerl, J., Friede, T., & Meyer, T. (2018). Impact of treatment delay on mortality in ST-segment elevation myocardial infarction (STEMI) patients presenting with and without haemodynamic instability: Results from the German prospective, multicentre FITT-STEMI trial. *European Heart Journal*, *39*(13), 1065–1074. https://doi.org/10.1093/EURHEARTJ/EHY004

Schwartz, B. G., Pezzullo, J. C., McDonald, S. A., Poole, W. K., & Kloner, R. A. (2012). How the 2008 stock market crash and seasons affect total and cardiac deaths in los Angeles county. *The American Journal of Cardiology*, *109*(10), 1445–1448. https://doi.org/10.1016/J.AMJCARD.2012.01.354

Shedd, O. L., Sears, S. F., Harvill, J. L., Arshad, A., Conti, J. B., Steinberg, J. S., & Curtis, A. B. (2004). The world trade center attack: Increased frequency of defibrillator shocks for ventricular arrhythmias in patients living remotely from New York city. *Journal of the American College of Cardiology*, *44*(6), 1265–1267. https://doi.org/10.1016/J.JACC.2004.04.058

Siegel, M., Bradley, E. H., Gallo, W. T., & Kasl, S. v. (2003). Impact of husbands' involuntary job loss on wives' mental health, among older adults. *The Journals of Gerontology: Series B*, *58*(1), S30–S37. https://doi.org/10.1093/GERONB/58.1.S30

Spiteri, J., & von Brockdorff, P. (2019). Economic development and health outcomes: Evidence from cardiovascular disease mortality in Europe. *Social Science and Medicine*, *224*, 37–44. https://doi.org/10.1016/J.SOCSCIMED.2019.01.050

Svensson, M. (2007). Do not go breaking your heart: Do economic upturns really increase heart attack mortality? *Social Science and Medicine*, *65*(4), 833–841. https://doi.org/10.1016/j.socscimed.2007.04.015

Tapia Granados, J. A., & Diez Roux, A. v. (2009). Life and death during the great depression. *Proceedings of the National Academy of Sciences*, *106*(41), 17290–17295. https://doi.org/10.1073/pnas.0904491106

Tapia Granados, J. A. (2005). Increasing mortality during the expansions of the US economy, 1900–1996. *International Journal of Epidemiology*, *34*(6), 1194–1202. https://doi.org/10.1093/IJE/DYI141

Tapia Granados, J. A., & Ionides, E. L. (2017). Population health and the economy: Mortality and the great recession in Europe. *Health Economics*, *26*(12), e219–e235. https://doi.org/10.1002/HEC.3495

Torbica, A., Maggioni, A. pietro, & Ghislandi, S. (2015). The economic crisis and acute myocardial infarction: New evidence using hospital-level data. *PLoS One*, *10*(11), e0142810. https://doi.org/10.1371/JOURNAL.PONE.0142810

Vandoros, S., Avendano, M., & Kawachi, I. (2018). The short-term impact of economic uncertainty on motor vehicle collisions. *Preventive Medicine*, *111*, 87–93. https://doi.org/10.1016/j.ypmed.2018.02.005

Vandoros, S., Avendano, M., & Kawachi, I. (2019a). The association between economic uncertainty and suicide in the short-run. *Social Science and Medicine*, *220*, 403–410. https://doi.org/10.1016/j.socscimed.2018.11.035. https://www.sciencedirect.com/science/article/pii/S0277953618306695

Vandoros, S., Avendano, M., & Kawachi, I. (2019b). The EU referendum and mental health in the short term: A natural experiment using antidepressant prescriptions in England. *Journal of Epidemiology & Community Health*, *73*(2), 168–175. https://doi.org/10.1136/JECH-2018-210637

Vandoros, S., Hessel, P., Leone, T., & Avendano, M. (2013). Have health trends worsened in Greece as a result of the financial crisis? A quasi-experimental approach. *The European Journal of Public Health*, *23*(5), 727–731. https://doi.org/10.1093/eurpub/ckt020

Vandoros, S., & Kawachi, I. (2021). Economic uncertainty and suicide in the United States. *European Journal of Epidemiology*, *36*(6), 641–647. https://doi.org/10.1007/S10654-021-00770-4/TABLES/3

Virtanen, M., Nyberg, S. T., Batty, G. D., Jokela, M., Heikkilä, K., Fransson, E. I., Alfredsson, L., Bjorner, J. B., Borritz, M., Burr, H., Casini, A., Clays, E., de Bacquer, D., Dragano, N., Elovainio, M., Erbel, R., Ferrie, J. E., Hamer, M., Jöckel, K. H., … & Kivimäki, M. (2013). Perceived job insecurity as a risk factor for incident coronary heart disease: Systematic review and meta-analysis. *BMJ*, *347*(7921), f4746. https://doi.org/10.1136/BMJ.F4746

WHO. (2019). ICD-10 version:2019. Retrieved from https://icd.who.int/browse10/2019/en

WHO. (2021). Cardiovascular diseases (CVDs). Retrieved from https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)

Wilson, T. D., & Gilbert, D. T. (2008). Explaining away: A model of affective adaptation. *Perspectives on Psychological Science*, *3*(5), 370–386. https://doi.org/10.1111/j.1745-6924.2008.00085.x

Yap, J., Earnest, A., Lee, V., Sng, G., Lam, C., & Yeo, K. K. (2016). Impact of stock market volatility on mortality and cardiovascular events. *International Journal of Cardiology*, *223*, 318–319. https://doi.org/10.1016/J.IJCARD.2016.08.206

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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