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Road traffic mortality and economic uncertainty: Evidence from the United States

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ABSTRACT

Previous studies have shown that financial turbulence is associated with a short-term increase in road traffic collisions, largely due to drivers' emotional state, distraction, sleep deprivation and alcohol consumption. In this paper we advance this debate by studying the association between economic uncertainty and road traffic mortality in the United States. We used a State-level uncertainty index and State fatalities for the period 2008–2017 and found that a one standard deviation increase in economic uncertainty is associated with an additional 0.013 monthly deaths per 100,000 people per State, on average (a 1.1% increase) - or 40 more monthly deaths in total nationwide. Results are robust to different model specifications. Our findings show that, similar to drink-driving, it is important to raise awareness about driving when distracted due to financial worries and during periods of economic uncertainty.

1. Introduction

1.1. Background and objectives

About 1.3 million people die every year in motor vehicle collisions (or car crashes or road traffic accidents) globally (World Health Organization, 2023). Road traffic collisions are one of the most common causes of death in the United States, with approximately 38,000 fatalities each year (Centre for Disease Prevention & Control, 2022a), and are the leading cause of death for ages 5–24 (Centre for Disease Prevention & Control, 2022b). The total annual medical and lost work cost of road traffic fatalities in the US is estimated at $55 billion (Centre for Disease Prevention & Control, 2022a).

Distraction, alcohol consumption, drug use, and sleep deprivation, among others, constitute major factors that may lead to a motor vehicle collision (Beanland et al., 2013; Dula et al., 2010; Smolensky et al., 2011). Evidence suggests that general economic conditions may also play a role in motor vehicle collisions; there is a reduction in collisions and related mortality during economic recessions (Ruhm, 2000; Wegman et al., 2017; Lloyd et al., 2015). When unemployment increases during economic downturns, fewer people commute to work, while lower disposable income may also reduce social contact and induce people to stay more at home. Others may substitute cars for public transport. Reduced economic activity means fewer goods being transported, implying fewer trucks on the road (Lloyd et al., 2015). A decrease in heavy drinking because of lower disposable income and, consequently, reduced affordability (Ruhm and Black, 2002; Lloyd et al., 2015) may contribute to fewer motor vehicle collisions during economic downturns (Ruhm, 2000). Fewer vehicles on the road, however, contribute to less congestion and may provide an opportunity for speeding, which is a collision risk factor.

While it is known that recessions are associated with fewer traffic accidents, the impact of short-term financial shocks on such accidents was unknown until recently. This has been receiving increasing attention in the literature in recent years, as a new path in this line of research. Research examining the impact of sudden financial shocks on car crashes has found that there was a 9% and 8% increase in car crashes in Greece on the first and second day, respectively, following the announcement of austerity measures. From the third day onwards, the incidence of crashes returned to previous levels, demonstrating that this is a short-term deviation from the trend due to an external shock, and that people subsequently absorb the shock and adapt (Vandoros et al., 2014). Plausible explanations for the temporary increase in crashes included distraction, anxiety, frustration, sleep deprivation due to

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worrying, alcohol consumption due to stress, and individualistic behaviour due to financial worries.

Further research has taken advantage of uncertainty indexes that are based on the frequency of the use of terms related to economic uncertainty in newspaper articles (Economic Policy Uncertainty, 2022b). Studies on this topic examined the short-term association between daily economic uncertainty and motor vehicle collisions in Britain, and found a positive and statistically significant association between the two on the same and the following day (Vandoros et al., 2018). The volume of published research studying similar associations has accelerated in recent years. Giulietti et al. (2020) found that stock returns are linked to fatal car crashes in the US, and two recent studies found an association between stock returns and crashes in the UK (Fry and Farrell, 2022; Chen and James, 2022). It is also worth noting that road traffic mortality associated with drink-driving has been shown to increase during stock market crashes (Cotti et al., 2015). These studies build partly on mechanisms related to people's emotions, put forward by earlier research, that demonstrated the increased risk of collision that drivers face when going through important life events such as divorce, the hospitalisation of a partner (Lagarde et al., 2004), attending a funeral or being involved in a family dispute (Beanland et al., 2013).

Evidence has shown that recessions and unemployment are indeed associated with fewer crashes and mortality. However, as discussed, studying uncertainty differs from this line of research, because, first, uncertainty relates to the possibility of future negative economic outcomes, which may never materialise, as opposed to recessions and unemployment which concern current circumstances; second, there are often periods of increased uncertainty even during economic expansions and low unemployment rates, such as the period following the 2016 Brexit referendum in the UK, when unemployment was very low, but uncertainty levels had increased (Office for National Statistics, 2022; Economic Policy Uncertainty, 2022a); and, third, there may be short-term deviations from road traffic collision trends in the short term in response to higher uncertainty.

Against this background, the objective of this paper is to study the association between short-term state-level economic uncertainty and road traffic mortality in the United States. The mechanism outlining that there might a relationship between the two has been put forward in the literature in different contexts: first, uncertainty may cause distraction and emotional distress while people worry about their future financial prospects, while distraction and anxiety are major car crash risk factors (Vandoros et al. 2014, 2018; Beanland et al., 2013; Dula et al., 2010); second, economic worries may cause frustration, which can lead to aggressive driving behaviour (Dahlen et al., 2005); third, stress can lead to increased drinking (Park et al., 2004), which, in turn, may be linked to higher incidence of drink-driving; fourth, economic woes may cause sleep deprivation and tiredness, an important risk factor for car crashes (Smolensky et al., 2011); and, fifth, it has been shown that when people think about their financial circumstances they tend to be more individualistic (Vohs et al., 2006), which might make them show disregard towards other drivers or pedestrians.

Economic uncertainty as an explanatory variable has increasingly been used in recent studies as a factor associated with health or health-related outcomes, particularly suicides (Abdou et al., 2022; Claveria, 2022; Vandoros and Kawachi, 2021; Vandoros et al., 2019; Antonakakis and Gupta, 2017); motor vehicle collisions (Vandoros et al., 2018) and cardiovascular mortality (Kawachi et al., 2023).

This paper contributes to this growing body of literature in two distinct ways: first, it studies the association between economic uncertainty and road traffic mortality (rather than just motor vehicle collisions); and, second, it takes advantage of within-country heterogeneity by employing state-level uncertainty and mortality data.

1.2. The US economy 2008–2017

The US suffered a macroeconomic shock of historic proportions during the study period at the time of the global financial crisis (Thomas, 2013; Chen et al., 2016; Baily et al., 2011; Kolb, 2011; Duca et al., 2010; Acharya and Richardson, 2012; Zestos, 2016). This was caused largely by the subprime mortgage crisis, which, in turn, was linked to the housing market bubble (Kolb, 2011; Acharya and Richardson, 2012; Zestos, 2016) and their effects rapidly spread into other sectors of the economy, particularly affecting the banking sector and financial institutions (Duca et al., 2010; Zestos, 2016). The housing market bubble was caused mainly by the increasing number of mortgages given to high-risk borrowers, who would not necessarily be able to repay their loans, thus causing a crisis for those banks and financial institutions that held those loans in their portfolios. The inability of banks and financial institutions to recoup these losses caused a financial crisis that affected the entire U.S. economy (Baily et al., 2011; Kolb, 2011; Zestos, 2016; Scott, 2010).

Key macroeconomic indicators clearly reflected the extent of the crisis during this period. Annual GDP growth was a meagre 0.1% in 2008 and -2.6% in 2009, recovering in 2010 and averaging 2.16% between 2010 and 2016 (US Bureau of Economic Analysis, 2022 and Figure A1). Annual unemployment stood at 5.8% of the total labour force in 2008, reaching 9.3% in 2009, peaking at 9.6% in 2010, and declining gradually subsequently, with an 6.44% on average between 2011 and 2017 (US Bureau of Labor Statistics, 2022 and Figure A2). To address the macroeconomic shock caused by the financial crisis, the U.S. government implemented three fiscal stimulus plans, notably the 2008 Economic Stimulus Act (2008), the Emergency Economic Stabilization Act (2008) and the American recovery and Reinvestment Act (2009). Together with these, the Federal Reserve put in place expansionary monetary policies reducing interest rates and implementing three rounds of quantitative easing (Zestos, 2016; Bernanke, 2015; Bernanke, 2017). As a result, total central government debt as a proportion of GDP increased dramatically from 63.82% in 2008 and to 75.84% in 2009, averaging 94.02% between 2010 and 2017.

While the financial crisis period (2008–2010) was characterised by a significant downturn and high uncertainty, the post-financial crisis period, (2011–2017), was a period of economic recovery, with moderate GDP growth, decreasing unemployment, but an increasingly higher central government debt, peaking at 98.5% in 2016 (Figure A3). The entire period between 2008 and 2017 involved significant uncertainty volatility, with the uncertainty index demonstrating spikes at key points, such as the stimulus debate, the Lehman Brothers collapse, the Debt Ceiling debate, the Government shutdown, the Brexit referendum result, and the Trump election (Economic Policy Uncertainty, 2023) and Figure A4 in the Online Appendix).

2. Data and methods

We used mortality data from the CDC-WONDER database, available through the United States Centers for Disease Control and Prevention (CDC), which provides monthly data on mortality (Centre for Disease Prevention & Control, 2023). In particular, we used data under the category of "Transport Accidents" (Codes V01–V89) to capture monthly road traffic mortality by State, for the period between January 2008–December 2017. In particular, these observations include the following deaths: V01–V09 (Pedestrian injured in transport accident); V10–V19 (Pedal cyclist injured in transport accident); V20–V29 (Motorcycle rider injured in transport accident); V30–V39 (Occupant of three-wheeled motor vehicle injured in transport accident); V40–V49 (Car occupant injured in transport accident); V50–V59 (Occupant of pick-up truck or van injured in transport accident); V60–V69 (Occupant of heavy transport vehicle injured in transport accident); V70–V79 (Bus occupant injured in transport accident); V80–V89 (Other land transport accidents) (Centre for Disease Prevention & Control, 2023). Any observations with a count below 10 are not reported by the CDC for data protection reasons. This limits our analysis to a large category, i.e. the number of monthly traffic deaths per State. Considering mortality by

smaller groups (for example stratifying by age group), would result in many observations with fewer than 10 deaths, which are not reported by the data source – leading to many missing observations. Monthly observations were the most granular level at which data were available. Figure A5 in the online appendix shows trends in road traffic deaths in the United States.

Two monthly State-level economic policy-related uncertainty indexes were used, which are available from Economic Policy Uncertainty (Economic Policy Uncertainty, 2022b; Baker et al., 2016). A range of uncertainty indexes are provided by the same source, which have been widely used in academic research (Economic Policy Uncertainty, 2022c), not only in macroeconomics or finance (Baker et al., 2020; Liow et al., 2018), but also in health and mental wellbeing (Antonakakis and Gupta, 2017; Vandoros and Kawachi, 2021; Vandoros et al., 2018; Abdou et al., 2022; Claveria, 2022). The first index captures State-level economic policy uncertainty that stems from National sources. This may relate to, among others, federal policies and national elections (Economic Policy Uncertainty, 2022b). The second index captures State-level economic policy uncertainty that stems from State/local sources, such as State legislation and regulations (Economic Policy Uncertainty, 2022b). In order to capture uncertainty, the authors of the index search local newspapers for three sets of keywords, notably economic terms, policy terms, and uncertainty terms. These do not include any national newspapers that might be published in a specific State. The database used is the Access News Newsbank Service, with 3500 local newspapers, ranging between 4 and 279 newspapers per State. The authors of the index search the database for key words from the three sets mentioned above. They subsequently calculate the percentage of articles that include such words, as a proportion of the total number of articles published in each State in a given month. The indexes are normalised based on the average ratio of articles that use terms from the State-level economic policy uncertainty that stems from National sources, in order to make indexes comparable (Economic Policy Uncertainty, 2022b). Importantly, both indexes capture State-level uncertainty, but they differ in terms of the *source* of this local uncertainty (Economic Policy Uncertainty, 2022b). The rationale behind using this uncertainty index in our study is not that people necessarily become aware of uncertainty through reading local newspapers or any of the other sources through which the economic uncertainty indexes are constructed, but that the indexes capture uncertainty, which might be evident to people through a variety of channels.

The monthly State unemployment rate for the period between January 2008–December 2017 was provided by the Bureau of Labor Statistics (US Bureau of Labor Statistics, 2022). Finally, State population estimates were provided by the US Census Bureau Population Division (US Census Bureau, 2022).

In order to study the relationship between mortality from traffic accidents and uncertainty, we follow a fixed effects econometric approach. The model is presented in Equation (1):

$$deaths_{it} = \alpha_i + \beta_1 uncert\_nat_{it} + \beta_2 uncert\_state_{it} + \beta_3 unemployment_{it} + \sum_{m=4}^{14} \beta_m month + \sum_{k=15}^{23} \beta_k year + \varepsilon_{it} \quad (1)$$

where the dependent variable $deaths_{it}$, is the number of monthly deaths per 100,000 people in each State i in month t, which we calculated by dividing the number of deaths by the State population and multiplying by 100,000. $uncert\_nat_{it}$ and $uncert\_state_{it}$ represent State level economic uncertainty from National and State level uncertainty sources, respectively. In order to normalise these, we divided them by their standard deviation, because the index volatility may not be constant throughout the study period (Giulietti et al., 2020). For robustness, we also used the natural logarithm in alternative regressions. $unemployment_{it}$ is the monthly State unemployment rate. We controlled for unemployment to rule out that any changes are due to economic fluctuations or downturns rather than uncertainty. The literature has shown that recessions are associated with fewer road traffic deaths (Ruhm, 2000; Wegman et al., 2017), possibly due to lower traffic volume (i.e. fewer vehicles at risk of crashing) and lower alcohol consumption due to lower affordability (Ruhm and Black, 2002). The model includes month and year dummies. α_i is the time-invariant State effect, and ε_{it} is the error term.

We examined whether the random effects estimator would be consistent, in order to use it in our empirical analysis. However, the Hausman test suggests that it is not consistent (chi-sq = 41.33; p-value = 0.0001), therefore, we relied on State fixed effects.

For robustness, we tried different approaches, by using logarithms instead of dividing the uncertainty index by its standard deviation, and stratified by grouping States by unemployment and personal income quartiles. Apart from considering the two uncertainty indexes jointly, we also considered them in separate regression models.

3. Results

Summary statistics are presented in Table 1, while Table A1 in the Online Appendix provides further information on the dependent variable. There were 1.177 monthly road traffic deaths per 100,000 people in each State on average during the study period. The average State-level economic policy uncertainty index from National sources was 106.036, while the average State-level economic policy uncertainty index from National sources was 75.754. The correlation coefficient between the two uncertainty indexes was 0.4211. The average monthly State unemployment rate was 6.46 percent.

Results of the baseline model are presented in Table 2. The coefficient of State-level economic uncertainty from National sources is 0.013, and is positive and statistically significant. An increase in this index by one standard deviation is associated with an additional 0.013 monthly deaths per 100,000 people per State, on average. The coefficient of State-level economic uncertainty from State sources is insignificant. We also considered the two uncertainty indexes separately in different models (Columns 2 and 3) and results are similar to those in the baseline model. The model including only uncertainty from National sources shows that the association between uncertainty and road traffic mortality is positive and significant, with a coefficient of 0.010 (column 2). The coefficient of the uncertainty index from State sources is insignificant (column 3). The coefficient of unemployment is negative and significant in all three cases.

As an alternative approach, we considered the natural logarithm of the uncertainty index as explanatory variable instead of dividing it by the standard deviation (Table 3). Results are similar to those of the baseline model. When including both indexes in the model (Column 1), the coefficient of uncertainty from National sources is 0.015 and is positive and statistically significant, while the coefficient of uncertainty

Table 1
Summary statistics.

Variable	Mean	Std. Dev.	Median	IQR	Min	Max
Road traffic deaths per 100,000 people by State (monthly)	1.177	0.484	1.099	0.64	0.209	4.097
Uncertainty index from National sources (monthly)	106.036	65.712	91.606	76.97	0	588.99
Uncertainty index from State sources (monthly)	75.754	53.462	63.874	57.98	0	651.52
State unemployment rate (monthly)	6.458	2.223	6.2	3.2	2.2	14.6

Table 2
Road traffic mortality and economic uncertainty: Baseline model.

	(1)	(2)	(3)
Dependent variable: Number of road traffic deaths per 100,000 people			
Uncertainty from National sources (divided by SD)	0.013***	0.010***	
	[0.004]	[0.004]	
Uncertainty from State sources (divided by SD)	−0.006		−0.0004
	[0.004]		[0.003]
Unemployment rate	−0.026***	−0.027***	−0.026***
	[0.004]	[0.004]	[0.004]
Month dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Constant	1.833***	1.831***	1.852***
	[0.039]	[0.039]	[0.038]
Observations	5313	5313	5313
R-squared	0.772	0.772	0.772

Robust standard errors in brackets.
*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 3
Road traffic mortality and economic uncertainty: Economic uncertainty in logarithmic form.

	(1)	(2)	(3)
Dependent variable: Number of road traffic deaths per 100,000 people			
Natural logarithm of uncertainty from National sources	0.015**	0.013**	
	[0.006]	[0.006]	
Natural logarithm of uncertainty from State sources	−0.006		−0.001
	[0.007]		[0.006]
Unemployment rate	−0.027***	−0.027***	−0.026***
	[0.004]	[0.004]	[0.004]
Month dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Constant	1.805***	1.793***	1.854***
	[0.051]	[0.047]	[0.047]
Observations	5313	5313	5313
R-squared	0.772	0.772	0.772

Robust standard errors in brackets.
*** p < 0.01, ** p < 0.05, * p < 0.1.

from State sources is insignificant. When considering each index separately, the coefficient of uncertainty from National sources is again positive and significant (Column 2), while that of uncertainty from State sources is insignificant (Column 3). The coefficient of unemployment is again negative and significant.

We also examined possible heterogeneous effects by unemployment and personal income quartiles, to investigate whether poorer economic conditions might make people more vulnerable to the effects of uncertainty. Results by unemployment quartile are presented in Table 4. When including only States in the highest unemployment quartile (Column 1), the coefficient of uncertainty from National sources is positive and statistically significant at 5% level. The coefficient in the regressions for the other three quartiles is insignificant (columns 2–4). When considering personal income quartiles (Table 5), the coefficient of uncertainty from National sources is statistically significant at 5% level for the second and third quartiles (Column 3), while it is insignificant when studying states in the other two quartiles.

Finally, we considered whether the previous month's uncertainty would be associated with the current month's road traffic mortality (Table A2 in the Online Appendix). While the coefficient of contemporary uncertainty from National sources remains positive and significant, and the coefficient of contemporary uncertainty from State sources is again insignificant, their lags are both insignificant (Column 1). The same results are observed when considering only uncertainty from National sources (Column 2) or only uncertainty from State sources (Column 3).

Table 4
Road traffic mortality and economic uncertainty: Stratification by unemployment quartile.

	(1)	(2)	(3)	(4)
	Q1 (highest)	Q2	Q3	Q4 (lowest)
Dependent variable: Number of road traffic deaths per 100,000 people				
Uncertainty from National sources (divided by SD)	0.018**	0.002	0.013	0.010
	[0.008]	[0.006]	[0.008]	[0.010]
Uncertainty from State sources (divided by SD)	−0.012	−0.006	0.006	−0.004
	[0.007]	[0.006]	[0.008]	[0.009]
Unemployment rate	−0.029***	−0.012**	−0.042***	−0.019
	[0.007]	[0.006]	[0.009]	[0.013]
Month dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Constant	1.648***	1.806***	1.851***	0.963***
	[0.072]	[0.046]	[0.064]	[0.078]
Observations	1344	1396	1489	1084
R-squared	0.763	0.855	0.793	0.644

Robust standard errors in brackets.
*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 5
Road traffic mortality and economic uncertainty: Stratification by personal income quartile.

A1B	(1)	(2)	(3)	(4)
	Q1 (highest)	Q2	Q3	Q4 (lowest)
Dependent variable: Number of road traffic deaths per 100,000 people				
Uncertainty from National sources (divided by SD)	0.001	0.020**	0.021**	0.008
	[0.006]	[0.009]	[0.008]	[0.008]
Uncertainty from State sources (divided by SD)	−0.009	−0.004	−0.006	−0.003
	[0.006]	[0.008]	[0.008]	[0.007]
Unemployment rate	−0.019**	−0.011	−0.022***	−0.037***
	[0.009]	[0.011]	[0.008]	[0.009]
Month dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Constant	1.677***	0.888***	1.266***	1.890***
	[0.071]	[0.067]	[0.063]	[0.067]
Observations	1111	1134	1521	1547
R-squared	0.875	0.734	0.628	0.614

Robust standard errors in brackets.
*** p < 0.01, ** p < 0.05, * p < 0.1.

4. Discussion

We studied the association between State-level economic uncertainty and road traffic mortality in the United States using a panel data fixed effects approach. Our results suggest that a one standard deviation increase in economic uncertainty is associated with an additional 0.013 monthly deaths per 100,000 people per State, on average (a 1.1% increase) - or 40 more monthly deaths in total nationwide. Results are robust to different specifications. We found strong evidence that State-level economic uncertainty originating from National sources appears to be a determinant of road traffic mortality, while we find no evidence on any association with State-level uncertainty originating from State sources. This shows that federal economic policies appear to be more important for people than local ones, which is not surprising given the major issues (such as changes in interest rate policy) that are determined at national level.

Additionally, the association appears to be stronger for States with higher unemployment rates, indicating that the unemployed might be most vulnerable to the effects of uncertainty. We found no evidence that the previous month's uncertainty is associated with the current month's road traffic deaths. This is not surprising, as current evidence from the literature on the relationship between economic shocks and car crashes

suggests an association lasting up to two days (Vandoros et al. 2014, 2019), possibly due to adaptation (Bradford and Dolan, 2010; Wilson and Gilbert, 2008).

Our findings are in line with Vandoros et al. (2018) who found a positive association between car crashes and uncertainty in the UK, but focused on the number of crashes rather than mortality, while the present study found that economic uncertainty is also associated with mortality. Our results also add to Giulietti et al. (2020) who found that an increase in stock market volatility in the US is associated with a 0.6% increase in road traffic mortality, and to similar findings on crashes in the UK by Chen and James (2022) and Fry and Farrell (2022). They also add to findings on an increase in crashes after the announcement of austerity measures (Vandoros et al., 2014). Further, we found that higher unemployment rates are associated with lower road traffic mortality, in line with earlier research (Ruhm, 2000; Wegman et al., 2017). Our study adds to a growing body of research that examines the effect of economic uncertainty on health outcomes (Abdou et al., 2022; Claveria, 2022; Vandoros and Kawachi, 2021; Vandoros et al., 2019; Antonakakis and Gupta, 2017; Vandoros et al., 2018; Kawachi et al., 2023).

Our study is not without limitations. CDC does not report observations with a count below 10 for data protection reasons. We were thus unable to break down our analysis by gender, ethnic group or age group, as this would lead to many missing observations, especially in States with a relatively small population. Furthermore, road traffic deaths are reported in aggregate form monthly, so we did not have information on particular conditions leading to an accident, such as drink-driving or weather conditions. Finally, our paper studies an association and our findings may not necessarily reveal a causal relationship. Future studies may seek appropriate natural experiments that may allow us to establish causality.

Our findings have important policy implications, as we observe a sizeable increase in road traffic mortality in periods of economic uncertainty. Loss of life has a profound adverse effect on the immediate family of the person who dies and is associated with significant economic and financial loss. From a public policy perspective, identifying the causes of motor vehicle-related mortality may be critical in implementing policies to mitigate these and, in so doing, reduce the direct as well as broader societal effect of such causes. In the same way as drink-driving, raising awareness about driving when distracted due to financial worries is important, and drivers should be encouraged to consider their emotional state before getting behind the wheel. Accident-prevention policies can intensify in periods of increased economic uncertainty and can include advertisements informing people of the dangers of driving when distracted, stressed or sleep-deprived. Finally, enhanced traffic safety measures should be implemented during periods of heightened economic uncertainty.

Credit author statement

Authors' contributions: Both authors contributed equally to the study (study concept and design, statistical analysis, interpretation of results, drafting of manuscript, critical revision).

Ethics approval

The dataset used included publicly available aggregated monthly data on road traffic deaths from the Centers of Disease Prevention & Control, so no individual-level data were used. Therefore, ethics approval was not required.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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