

Supplemental Online Content

Chen R, Aschmann HE, Chen Y-H, et al. Racial and ethnic disparities in estimated excess mortality from external causes in the US, March to December 2020. *JAMA Intern Med*. Published online May 9, 2022. doi:10.1001/jamainternmed.2022.1461

eTable. Underlying Causes of Death with ICD-10 Codes

This supplemental material has been provided by the authors to give readers additional information about their work.

Supplement S1.

We used the underlying cause of death monthly death count data, accessed from the CDC Wide-ranging Online Data for Epidemiologic Research database (CDC WONDER; wonder.cdc.gov, accessed on December 28th) to extract monthly death counts from January 2015 to December 2020 for overall external causes of death and by specific causes of death for the total population and all bridged-race categories. Population estimates also came from CDC WONDER and are produced by the U.S. Census Bureau in collaboration with the National Center for Health Statistics.

We fitted dynamic harmonic regression models with autoregressive integrated moving average (ARIMA) errors to monthly death count data from January 2015 to February 2020. Dynamic harmonic regressions use traditional ARIMA models in combination with a number of Fourier terms to flexibly model time series while accounting for autocorrelation, seasonality, long term trends, and potential changes in the slope. We stratified the models by specific external causes of death and by race and ethnicity. For each race/ethnicity and outcome, we iterated through models with up to 6 Fourier terms and selected the best model based on the corrected Akaike information criterion. Using the best model selected, we forecasted (i.e., out-of-sample prediction) monthly deaths from March to December 2020. We estimated excess deaths by subtracting the number of expected deaths from the number of observed deaths. We calculated total excess deaths by summing all the excess deaths and calculated corresponding 95% prediction intervals (PI) by simulating the expected deaths model 10,000 times, selecting the 2.5 and 97.5 percentiles, and subtracting them from the number of observed deaths. We calculated per capita excess death by dividing excess deaths and 95% PI by population size.

All code and data are available online at: https://github.com/mkiang/excess_external_deaths.

More information about dynamic harmonic regression can be found online at:

<https://f0nzie.github.io/hyndman-bookdown-rsuite/sec-dhr.html> or in the textbook Forecasting:

Principles and Practice by Rob J Hyndman and George Athanasopoulos.

Reference:

Hyndman RJ, Athanasopoulos G. Forecasting: Principles and Practice. 2nd ed. OTexts; 2018.

Supplemental Table. Underlying Causes of Death with ICD-10 Codes

Underlying Causes of Death	ICD-10 Code
All External Causes of Deaths	V01-Y89
Homicide	X85-Y09
Suicide	X60-X84
Transportation Accidents	V01-V99
Drug Overdose	X40-X44, X60-X64, X85, Y10-Y14