Estimating Overall and Cause-Specific Excess Mortality during the COVID-19 Pandemic: Methodological Approaches Compared

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ABSTRACT

During the COVID-19 pandemic, excess mortality has been reported worldwide, but its magnitude has varied depending on methodological differences that hinder between-study comparability. Our aim was to estimate variability attributable to different methods, focusing on specific causes of death with different pre-pandemic trends. Monthly mortality figures observed in 2020 in the Veneto Region (Italy) were compared with those forecasted using: (1) 2018-2019 monthly average number of deaths; (2) 2015-2019 monthly average age-standardized mortality rates; (3) Seasonal Autoregressive Integrated Moving Average (SARIMA) models; (4) Generalized Estimating Equations (GEE) models. We analyzed deaths due to all-causes, circulatory diseases, cancer, and neurologic/mental disorders. Excess all-cause mortality estimates in 2020 across the four approaches were: +17.2% (2018-2019 average number of deaths), +9.5% (five-year average age-standardized rates), +15.2% (SARIMA), and +15.7% (GEE). For circulatory diseases (strong pre-pandemic decreasing trend), estimates were +7.1%, -4.4%, +8.4%, and +7.2%, respectively. Cancer mortality showed no relevant variations (ranging from -1.6% to -0.1%), except for the simple comparison of age-standardized mortality rates (-5.5%). The neurologic/mental disorders (with a pre-pandemic growing trend) estimated excess corresponded to +4.0%/+5.1% based on the first two approaches, while no major change could be detected based on the SARIMA and GEE models (-1.3%/+0.3%). The magnitude of excess mortality varied largely based on the methods applied to forecast mortality figures. The comparison with average age-standardized mortality rates in the previous five years diverged from the other approaches due to the lack of control over pre-existing trends. Differences across other methods were more limited, with GEE models probably representing the most versatile option.

FULL TEXT
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