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Age-specific excess mortality patterns and transmissibility during the 1889-90 influenza pandemic in Madrid, Spain

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1889-90 influenza pandemic, Madrid, Spain, age-specific mortality, reproduction number

Abstract

Background: Although the 1889-1890 influenza pandemic was one of the most important epidemic events of the XIXth century, little is known about the mortality impact of this pandemic based on detailed respiratory mortality datasets.

Materials & Methods: We estimated excess mortality rates for the 1889-90 pandemic in Madrid from high-resolution respiratory and all-cause individual-level mortality data retrieved from the *Gazeta de Madrid*, the Official Bulletin of the Spanish government. We also generated estimates of the reproduction number from the early growth phase of the pandemic.

Results: The main pandemic wave in Madrid was evident from respiratory and all-cause mortality rates during the winter of 1889-90. Our estimates of excess mortality for this pandemic were 58.3 per 10,000 for all-cause mortality and 44.5 per 10,000 for respiratory mortality. Age-specific excess mortality rates displayed a J-shape, with school-age children 5-14 year olds (yo) experiencing the lowest respiratory excess death rates (8.8 excess respiratory deaths per 10,000) while older populations >=70 yrs. had the highest rates (367.9 per 10,000). Although seniors experienced the highest absolute excess death rates, the standardized mortality ratio was highest among young adults 15-24 yrs. The early growth phase of the pandemic displayed dynamics consistent with an exponentially growing transmission process. Using the generalized-growth method, we estimated the reproduction number in the range 1.2-1.3 assuming a 3-day mean generation interval and from 1.3-1.5 assuming a 4-day mean generation interval.

Discussion: Our study adds to our understanding of the mortality impact and transmissibility of the 1889-90 influenza pandemic using detailed individual-level mortality datasets. More quantitative studies are needed to quantify the variability of the mortality impact of this understudied pandemic at regional and global scales**.**