Estimates of global seasonal influenza-associated respiratory mortality: a modelling study

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Summary

Background Estimates of influenza-associated mortality are important for national and international decision making on public health priorities. Previous estimates of 250 000–500 000 annual influenza deaths are outdated. We updated the estimated number of global annual influenza-associated respiratory deaths using country-specific influenza-associated excess respiratory mortality estimates from 1999–2015.

Methods We estimated country-specific influenza-associated respiratory excess mortality rates (EMR) for 33 countries using time series log-linear regression models with vital death records and influenza surveillance data. To extrapolate estimates to countries without data, we divided countries into three analytic divisions for three age groups (<65 years, 65–74 years, and ≥75 years) using WHO Global Health Estimate (GHE) respiratory infection mortality rates. We calculated mortality rate ratios (MRR) to account for differences in risk of influenza death across countries by comparing GHE respiratory infection mortality rates from countries without EMR estimates with those with estimates. To calculate death estimates for individual countries within each age-specific analytic division, we multiplied randomly selected mean annual EMRs by the country's MRR and population. Global 95% credible interval (CrI) estimates were obtained from the posterior distribution of the sum of country-specific estimates to represent the range of possible influenza-associated deaths in a season or year. We calculated influenza-associated deaths for children younger than 5 years for 92 countries with high rates of mortality due to respiratory infection using the same methods.

Findings EMR-contributing countries represented 57% of the global population. The estimated mean annual influenza-associated respiratory EMR ranged from 0·1 to 6·4 per 100 000 individuals for people younger than 65 years, 2·9 to 44·0 per 100 000 individuals for people aged between 65 and 74 years, and 17·9 to 223·5 per 100 000 for people older than 75 years. We estimated that 291 243–645 832 seasonal influenza-associated respiratory deaths (4·0–8·8 per 100 000 individuals) occur annually. The highest mortality rates were estimated in sub-Saharan Africa (2·8–16·5 per 100 000 individuals), southeast Asia (3·5–9·2 per 100 000 individuals), and among people aged 75 years or older (51·3–99·4 per 100 000 individuals). For 92 countries, we estimated that among children younger than 5 years, 9243–105 690 influenza-associated respiratory deaths occur annually.

Interpretation These global influenza-associated respiratory mortality estimates are higher than previously reported, suggesting that previous estimates might have underestimated disease burden. The contribution of non-respiratory causes of death to global influenza-associated mortality should be investigated.

Funding None.

Introduction

Annual influenza epidemics result in substantial mortality, especially among adults aged 65 years and older. Previous estimates attributed to WHO[1] indicated that 250 000–500 000 influenza-associated deaths occur annually, corresponding to estimates of 3·8–7·7 deaths per 100 000 individuals calculated using 2005 UN Department of Economic and Social Affairs World Population Prospects.[2] The methods used to calculate this WHO estimate have not been published and might not have accounted for annual variability in the incidence of influenza virus infection, the age and health status of populations, or risk of influenza death across countries. A 2013 study,[3] which used data from 2005 to 2009, suggested that 148 000–249 000 annual influenza respiratory deaths might occur each year.[3] Current, reliable global and country-specific influenza-associated mortality estimates are needed to inform decisions about the value of influenza prevention and control and to inform global public health priorities.

Estimating the burden of annual influenza epidemics is challenging for many countries because of the requirement for high-quality systematic vital records and local viral surveillance data. As a result, most influenza-associated mortality estimates have been obtained from high-income countries with a temperate climate.[4–26] Many developing or recently industrialised countries have leveraged improvements in influenza surveillance data[27] to develop country-specific influenza-associated mortality estimates, which are generally higher

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