THE LANCET

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Iuliano AD, Roguski KM, Chang HH, et al. Estimates of global seasonal influenza-associated respiratory mortality: a modelling study. *Lancet* 2017; published online Dec 13. http://dx.doi.org/10.1016/S0140-6736(17)33293-2.

SUPPLEMENTARY METHODS, RESULTS, DISCUSSION ANNEX

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

Version: December 5, 2017

Global Seasonal Influenza-Associated Mortality Collaborator Network – full network author list in the final pages of the appendix.

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Appendix Methods:

Appendix Methods A: Methods for Estimating Influenza-Associated Excess Deaths with Time Series Vital Records and Viral Surveillance Data

Thirty-three EMR-contributing countries used regression models with available time series data to calculate influenza-associated excess death estimates. For the global seasonal influenza-associated respiratory mortality effort, we allowed the model selection for each country to vary based on available data, quality of the data, and appropriateness of the methodology for the individual country. Detailed methodology for each of the 33 EMR-contributing countries is available in Appendix Table 2.

As an example, we describe the methods used in the calculation of influenza-associated excess deaths for the United States (US). Prior to beginning our analyses, we plotted the viral surveillance data, which we obtained from the World Health Organization Collaborating Laboratories (generally Public Health Laboratories) and the National Respiratory and Enteric Virus Surveillance System (clinical laboratories), with the respiratory coded (ICD 9: 460-519, ICD 10: J00-J99) death data from the National Center for Health Statistics by week. Using the viral surveillance data, we calculated the percent positive by influenza virus subtype for the period before the 2009/2010 season by dividing the weekly counts positive for influenza virus type and subtype by the total number of specimens tested. Beginning in the 2009/2010 season, the overall influenza-percent positive was calculated from the weekly counts of influenza positive specimens divided by total number of specimens tested for influenza. To determine the proportion of circulating subtypes, the proportion of specimens positive for the three influenza subtypes (H1N1pdm09, H3N2, B) from Public Health Laboratories was applied to the weekly percent positive in the clinical laboratories. The figure allowed us to determine if the peaks in influenza virus circulation coincided with peaks in respiratory coded deaths (Appendix Figure 5).

Next, we began our model selection to estimate influenza-associated deaths. We assumed that the weekly count of respiratory deaths was over dispersed. We used a log-linear model with a negative binomial

distribution to account for the over dispersion. We also lagged the influenza percent positive variable by one week to better align the mortality and viral surveillance data. Our final model was:

$$Yi = \alpha \exp\{ \beta 0 + \beta 1[ti] + \beta 2[ti^2] + \beta 3[ti^3] + \beta 4[ti^4] + \beta 5[\sin(2\pi ti / 52)] + \beta 6[\cos(2\pi ti / 52)] + \beta 7[\text{lag}(\text{FluH1N1}i)] + \beta 8[\text{lag}(\text{FluH3N2}i)] + \beta 9[\text{lag}(\text{FluH1N1pdm09}i)] + \beta 10[\text{lag}(\text{FluB}i)] \}$$

The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2. Influenza-associated excess deaths were calculated by subtracting the baseline seasonal deaths by the predicted influenza-associated respiratory deaths by week. Weekly death estimates less than zero were truncated to zero since there is limited biological plausibility for negative excess deaths. We obtained the seasonal estimates by summing the weekly excess influenza-associated death counts. We also plotted the estimated baseline seasonal deaths and the predicted influenza-associated deaths by week (Appendix Figure 5) to see how our model functioned. We determined goodness of fit for the models by evaluating the Akaike information criterion (AIC) and identified the model with the lowest AIC value. In addition, to determine our final model, we also evaluated the association between our outcome variable (respiratory deaths) and our influenza viral terms for each age group to select variables for the model.

We followed a similar process for the other countries that we analyzed in-house at CDC. Our data use agreements with our partners allowed us to present aggregated results, however, detailed descriptions of analytic methods and presentation of raw data was minimized to allow partners to publish their own country-specific estimates. Partners who conducted their own analyses described their methods in publications, which were referenced in Appendix Table 2.

Appendix Methods B: Additional Methods for Influenza-Associated Death Estimates for England and Wales, Bangladesh, and India

England and Wales: Re-calculating Influenza-Associated Deaths using New Age Groups From Peer-Reviewed Published Estimates.

Table 4 (respiratory coded influenza-attributable deaths) from Green HK, Andrews N, Fleming D, Zambon M, Pebody R. Mortality attributable to influenza in England and Wales prior to, during and after the 2009 pandemic. *PLoS One* 2013; 8:e79360 was used to calculate influenza-associated respiratory excess death estimates for three age groups of interest (<65 years, 65-74 years, ≥75 years).

To calculate influenza-associated respiratory mortality for the <65 year age group:

The distribution of estimated deaths was assumed to be normal. The standard error for each influenza-associated respiratory excess mortality estimate was calculated using the 95th percent upper confidence interval (UCI) for this estimate using the following formula:

$$\text{Standard Error} = \frac{(\text{UCI} - \bar{X})}{1{\cdot}96}$$

where UCI was the 95th percent upper confidence interval for the influenza-associated death estimate and $\bar{X}$ was the influenza-associated death estimate. The lower confidence interval was not used because if the lower bound of the confidence interval was less than zero (i.e., a negative value), it was truncated to zero. The variance was then calculated using the standard error [Variance = (standard error)^2].

The number of influenza-associated respiratory deaths and the associated variances were then added across influenza virus subtypes (influenza A + influenza B) to create two age groups (<65 and ≥65 years). Adding across influenza virus subtypes (influenza A + influenza B) assumes that the estimated β from the regression models for influenza A and influenza B are independent. This assumption is reasonable given that influenza B viruses contributed to very few influenza-associated respiratory deaths with low death estimates.

To calculate rates of influenza-associated respiratory deaths for the age groups of interest, population estimates were obtained from the Public Health England webpage, as cited in the Green HK, et al. paper (source 32). Mid-year population estimates for England and Wales were obtained for each year of available influenza-associated respiratory death estimate by age group (<65, 65-74, and ≥75 years).

Annual rates and variances of influenza-associated respiratory death were calculated using the following formula for each annual estimate and age group:

$$\text{Influenza-associated Excess Death Rate} = \frac{\text{Influenza-Associated Excess Death Estimate}}{\text{Population Estimate}} \times 100{,}000$$

The standard error for annual influenza-associated respiratory excess deaths and death rates were calculated as the square root of the summed annual variances. The 95th percentile lower and upper confidence intervals were calculated using the following formula:

$$\text{UCI} = \bar{X} \pm 1{\cdot}96 \times \text{Standard Error}$$

where UCI was the 95th percent upper confidence interval for the influenza-associated death estimate and $\bar{X}$ was the influenza-associated death estimate.

To calculate influenza-associated respiratory mortality for the 65-74 and ≥75 year age groups:

To attribute deaths from the ≥65 year age group as calculated in the Green, et al., publication to the two older adult age groups of interest for this study (65-74 and ≥75 years), we needed to proportionally attribute deaths to these two groups.

Annual numbers of International Classification of Death (ICD) 10 coded death records data was retrieved from the WHO Health Statistics and Information Systems website:

http://www.who.int/healthinfo/mortality_data/en/

These data were summarized for three age groups: <65 years, 65-74 years, and ≥75 years for respiratory codes (ICD 10 codes J00-J99) only for 2001-2013. This provided the annual number of all-cause respiratory deaths by the age groups of interest.

Using the number of influenza-associated excess deaths calculated above for the ≥65 year age group, the proportion of respiratory deaths due to influenza was determined by dividing the number of influenza-associated excess deaths by the number of overall respiratory deaths for that age group for each year. To calculate the number of influenza-associated respiratory deaths for the 65-74 and ≥75 year age groups, we multiplied the proportion of respiratory deaths due to influenza from the ≥65 year age group by the number of total respiratory deaths in that age group for that season. Rates of influenza-associated excess

Bangladesh: Methods Used for Estimating Influenza-associated Respiratory Mortality:

From Ahmed M, Aleem MA, Roguski KR, et.al. Estimates of seasonal influenza-associated mortality in Bangladesh, 2010-2012. *Influenza and Other Respiratory Viruses,* 2017; in press.

Influenza sentinel surveillance was conducted among hospitalized patients with severe acute respiratory illness (SARI) for persons aged ≥5 years and severe pneumonia for children <5 years of age from 11 sites across Bangladesh to determine monthly influenza percent positivity for the 2010/2011 and 2011/2012 seasons. A community death survey was conducted concurrently in the same 11 regions to identify deaths potentially associated with acute respiratory infections (ARI). Monthly rates of influenza-associated respiratory mortality were calculated by multiplying monthly influenza percent positivity by the monthly number of ARI-associated deaths for a given age group and divided by the age-specific census population for the catchment areas where the death survey was conducted. Monthly rates of influenza-associated deaths were summed across each season to generate age- and season specific rates of influenza-associated respiratory mortality. The analytical methods were adapted from the WHO Manual for Estimating Disease Burden for Seasonal Influenza

(http://www.who.int/influenza/resources/publications/manual_burden_of_disease/en/). The following equation was used to calculate mortality rate:

$$I_{a,y} = \frac{(\sum_{m=1}^{12} D_{a,m,y} \times F_{m,y} \times 100{,}000)}{P_{a,y}}$$

$I_{a,y}$ = Rates of influenza mortality per 100,000 persons by age group (a) and year (y)

$D_{a,m,y}$ = Number of acute respiratory deaths by age group (a), month (m) and year (y)

$F_{m,y}$ = Proportion of influenza virus positive in surveillance hospitals, by month (m) and year (y)

$P_{a,y}$ = Census population by age group (a) and year (y).

To calculate 95% confidence intervals (CI) for the mortality estimates, the variance of the influenza virus proportion positive for each month was calculated assuming a negative binomial distribution and the variance around ARI-associated deaths assuming a Poisson distribution. The variance of influenza-attributed ARI-deaths for each month was computed using the following equation:

$$\text{Variance} = (N*F)+(N*F^2)+(F*N^2)$$

N = the number of respiratory deaths in the community

F = variance of influenza proportion positive

We used the following formula to generate the 95% CI for the incidence rates:

$$95\%\ \text{Confidence Interval} = I_{a,y} \pm 1{\cdot}96 *(\sqrt{\sigma})$$

$I_{a,y}$ = Influenza-associated mortality rate per 100,000 persons by age group (a) and year (y)

σ = variance of the $I_{a,y}$ (sum of monthly variances for 12 consecutive months).

These rates were then extrapolated to the entire population of Bangladesh using 2011 census population estimates. The 95% confidence intervals were calculated by assuming a negative binomial distribution of the variance around the influenza percent positivity and a Poisson distribution around the ARI-associated deaths.

The mean of the two seasons generated an overall estimate of 5,606 influenza-associated acute respiratory infections (95% CI: 4,714–6,498) in the Ahmed study. In the extrapolation model from our global seasonal influenza-associated respiratory mortality study, we estimated a 50th percentile of 7,296 influenza-associated respiratory deaths (95% CI: 693–36,625). The extrapolation model produced a wider interval range as the numerator for the mortality rate ratio was randomly selected from the distribution of respiratory infection mortality rates from all countries within analytic division 3 because WHO categorized the GHE source data as being lower quality (Appendix Figure 1) for Bangladesh. The multiplier approach to estimating influenza-associated deaths may also not have accounted for all potential sources of error, therefore producing narrower confidence intervals for the mean of the seasonal estimates.

India: Redistributing Influenza-Associated Deaths for Persons ≥65 Years of Age into 65-74 and ≥75 Year Age Groups

Using weekly national level influenza viral surveillance and vital records death data for ICD coded respiratory deaths influenza-associated deaths were estimated for persons ≥65 years of age in India for 2010-2013 using methods described in Appendix Table 2. In brief, time series models with a negative binomial distribution were used in conjunction with time terms (representing each week), harmonic terms (sine and cosine to simulate patterns in mortality), and viral surveillance terms (influenza subtype weekly percent positive to predict influenza-associated deaths) for 2010-2013 for the following age groups: <5 years, <65 years, and ≥65 years. Weekly mortality data from the Sample Registration System (SRS), which is nationally representative, was modeled and extrapolated to the national population using 2011 India Census data to estimate influenza-associated respiratory deaths. Weekly influenza percent positive for the virus subtypes came from the National Institute of Virology.

Since weekly respiratory coded death data were not available for the two older age groups of interest in this global effort (e.g., 65-74 years and ≥75 years), we had to consider an alternative method to estimate influenza-associated deaths for these age groups. While weekly death counts were not available for these

age groups, annual respiratory coded death counts were available for these age groups for 2010-2013. We used annual respiratory coded deaths for the 65-74 and ≥75 year age groups and estimated influenza-associated respiratory death estimates for the ≥65 year age group to approximate influenza-associated deaths for the 65-74 and ≥75 year age groups.

First, we calculated the annual proportion of respiratory coded deaths for the 65-74 year and 75 year age groups out of all respiratory coded deaths for persons ≥65 years:

$$\text{Proportion Respiratory Deaths}_{\text{Age Group X,year A}} = \frac{\text{Number of Respiratory Deaths}_{\text{Age Group X,year A}}}{\text{Total Respiratory Deaths}_{\geq 65 \text{ years,year A}}}$$

Then, we used these annual proportions to redistribute the annual estimated influenza-associated deaths for persons ≥65 years:

$$\text{Influenza-associated Deaths}_{\text{Age Group X,year A}} = \text{Influenza-associated Deaths}_{\geq 65 \text{ years,year A}} \times \text{Proportion Respiratory Deaths}_{\text{Age Group X,year A}}$$

The output variance for the annual estimated influenza-associated deaths for persons ≥65 years was likewise redistributed:

$$\text{Var}(\text{Influenza-associated Deaths}_{\text{Age Group X,year A}}) = \text{Var}(\text{Influenza-associated Deaths}_{\geq 65 \text{ years,year A}}) \times (\text{Proportion Respiratory Deaths}_{\text{Age Group X,year A}})^2$$

Annual rates for the 65-74 and the ≥75 year age group were then calculated using the annual SRS sampling population for each age group:

$$\text{Influenza- associated Excess Death Rate}_{\text{Age Group X,year A}}$$

$$= \frac{\text{Influenza- associated Deaths}_{\text{Age Group X,year A}}}{\text{SRS Sample Population}_{\text{Age Group X,year A}}} \times 100{,}000$$

Annual variances associated with these rates were likewise calculated using the annual SRS sampling population for each age group:

$$\text{Var}(\text{Influenza- associated Excess Death Rate}_{\text{Age Group X,year A}})$$

$$= \frac{\text{Var}(\text{Influenza- associated Deaths}_{\text{Age Group X,year A}})}{(\text{SRS Sample Population}_{\text{Age Group X,year A}})^2} \times (100{,}000)^2$$

The standard error for annual influenza-associated respiratory deaths and death rates were calculated as the square root of the annual variances:

$$\text{Standard Error}\left(\text{Influenza- associated Deaths}_{\text{Age Group X,year A}}\right) =$$

$$\sqrt{\text{Var}(\text{Influenza- associated Deaths}_{\text{Age Group X,year A}})}$$

The 95th percentile lower and upper confidence intervals were calculated using the following formula:

$$\text{95\% Confidence Interval (CI)} = \bar{}\ \text{Influenza- associated Deaths}_{\text{Age Group X,year A}} \pm 1{\cdot}96$$

$$\times \text{Standard Error}\left(\text{Influenza- associated Deaths}_{\text{Age Group X,year A}}\right)$$

where the 95th percent confidence interval (CI) was calculated for the influenza-associated death estimate using the influenza-associated death estimate plus or minus 1·96 multiplied by the standard error.

Appendix Methods C: Bayesian Hierarchical Model for Estimating Influenza-Associated Respiratory Mortality

Let $\hat{\beta}_{rt}$ denote the estimated excess mortality rate, deaths per 100,000 population, due to influenza from a participating country $r = 1, \ldots R$ during season $t = 1, \ldots, T_r$. Each estimate is associated with a corresponding variance $\hat{s}_{rt}^2$, either by the participating country or estimated via bootstrapping. We first combined estimates from participating countries in a two-level Bayesian hierarchical model:

$$\hat{\beta}_{rt} \sim \mathrm{N}(\gamma_{rt},\ \hat{s}_{rt}^2)$$

$$\gamma_{rt} \sim N(\theta_r, \tau^2)$$

where γ_{rt} is the unobserved true excess mortality rate, θ_r is the mean annual mortality rate within each country across seasons, and τ^2 is the between-season heterogeneity variance and is fixed across countries. We restricted θ_r to be strictly positive by assigning a Uniform [0, 5000] as the prior distribution. The prior for τ was assumed to follow Uniform [0, 1000]. We assumed $\hat{\beta}_{rt}$ and γ_{rt} to be independent across seasons within a country. In the presence of temporal dependence, the above model may underestimate the uncertainty in θ_r. With sufficient data, it is possible to extend the model above with another hierarchical level by making distributional assumptions on θ_r and τ^2. For example, the heterogeneity variance may take the form: $\log \tau_{rt}^2 = \alpha_t + \alpha_r$ where α_t and α_r represent, respectively, year-specific and country-specific heterogeneity. Parameters α_t and α_r can also be treated as random effects with explicit temporal (e.g. autoregressive) and temporal (e.g. exponential spatial decay in correlation) built-in.

The Bayesian hierarchical model was fitted separately for each analytic division and age group. Inference was accomplished via Markov chain Monte Carlo (MCMC) simulations using the software JAGS version 4·20 (code available upon request). We obtained a total of 25,000 MCMC iterations and 5,000 burn-in samples. We kept every fourth iteration, resulting in a total of 5,000 posterior samples for model

parameters. The 95% credible interval of θ_r is used as the Estimated Influenza-associated Respiratory Annual Death Interval in Appendix Table 14. We note that θ_r represents the mortality rate of a typical epidemic season, and does not reflect the mortality rate of any specific season. Hence country-specific estimates, and consequent extrapolations, may have limited predictive power for backcast and forecast beyond the data-contributing periods. The heterogeneity variance τ^2 describes how each season's true mortality rate deviates from a country-specific mean. 95% posterior intervals of τ is given in Appendix Table 18.

Posterior distributions of θ_r were used to perform extrapolations to countries within the same age-specific analytic division. Specifically, let θ_i be the mortality rate of country i to be extrapolated. We define $\theta_i = \lambda_{i,r}\theta_r$ where $\lambda_{i,r}$ is a multiplier that is specific to the pair of extrapolation country i and the randomly selected reference country r. We assume each EMR-contributing country has an equal probability of serving as the reference country. Hence, the distribution of θ_i, $f(\theta_i)$, is a mixture given by

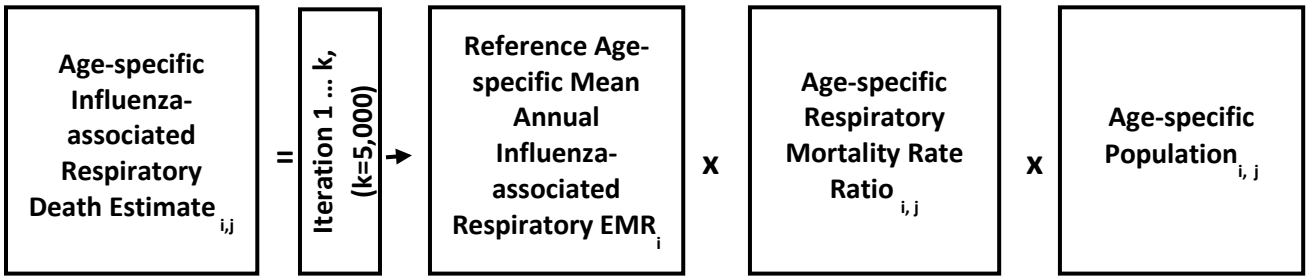
$$f(\theta_i) = \frac{1}{R}\sum_{r=1}^{R} f(\lambda_{i,r}\theta_r)$$

where $f(\lambda_{i,r}\theta_r)$ is obtained by multiplying the posterior samples of θ_r from the previous Bayesian hierarchical model and multiplier $\lambda_{i,r}$. The multiplier, $\lambda_{i,r} = R_i/R_r$, was defined as the ratio of respiratory infection mortality rates between country i and country r from the WHO Global Health Estimates (GHE). In estimating θ_i, we further accounted for uncertainties in $\lambda_{i,r}$ as follows. For countries where GHE indicated low quality source vital records data in their calculation of mortality estimates, R_i was replaced by the empirical distribution of respiratory infection mortality rates among all countries in the same age-specific analytic division. Finally, the extrapolated excess mortality deaths M_i for country i is given by $M_i = Pop_i\beta_i$, where Pop_i is the population size in 2015. To account for correlation between

posterior distributions of country-specific excess deaths in calculating global and regional totals, we first performed the summation within each posterior sample. The 95% credible intervals were then determined based on 5,000 posterior samples of the totals.

Appendix Methods D: Additional Methods for Estimating Country-specific Influenza-Associated Respiratory Deaths:

Simplified Formula:



Where i = Analytic Division, j = Country

The above formula is the general description of our extrapolation methods. In the sections below, we further explain our extrapolation approach below. The above calculation was repeated 5,000 times, each time using different values of various unknown parameters, to reflect uncertainty in the age-specific influenza-associated respiratory death estimate for each country.

This formula was applied within each age-specific analytic division to calculate influenza-associated respiratory death estimates for countries within that analytic division. To categorize countries into analytic divisions, the World Health Organization (WHO), Global Health Estimates (GHE) for respiratory infection (RI) mortality were used for each of the three age groups of interest: <65 years, 65-74 years, and ≥75 years. For each age group, countries were organized from the lowest to the highest according to their RI mortality rate, then cut-off values were calculated to classify countries into quartiles (Figure 1). Within each age group, quartile one became analytic division one and quartile two became analytic division two. However, there were very few countries that contributed influenza-associated excess mortality rates (EMR-contributing countries) in the third and fourth quartiles of each age group. Therefore, quartiles three and four were combined into one analytic division (analytic division three) resulting in three analytic divisions per age group and a total of nine age-specific analytic divisions.

The Reference **Age-specific Mean Annual Influenza-associated Respiratory EMR** was randomly chosen within each analytic division from countries within the same analytic division that contributed

influenza-associated excess mortality rates. This reference influenza-associated respiratory excess mortality rate (reference EMR) represents the reference country's age-specific mean annual influenza-associated respiratory death estimated from a Bayesian hierarchical model, and we used 5,000 Monte Carlo simulations from the posterior distribution of the reference country's estimate. Details describing this method are included in **Appendix Methods C:** Bayesian Hierarchical Model for Estimating Influenza-Associated Respiratory Mortality**.** The number of available reference EMRs depends on the number of EMR-contributing countries within the analytic division and ranged from 6-18 possible estimates from which to randomly select.

The **Age-specific Respiratory Mortality Rate Ratio** (MRR) were calculated for each of the 5,000 iterations of the extrapolation. Recall that for each extrapolation iteration, a reference EMR was randomly selected from the possible EMRs from contributing countries available in each analytic division. This randomly selected reference EMR country was used to inform the calculation of the MRR. The World Health Organization (WHO) Global Health Estimate (GHE) group classified countries based on the quality of source information provided by the country to generate their estimates.[*] These classifications were used to determine our approach to address concerns about the quality of the information by performing two different calculations of MRRs.

For those countries with higher quality source vital records information for GHE respiratory infection (RI) mortality rates (shaded green or yellow, Appendix Figure 1), the MRR was calculated by dividing their GHE RI mortality rate by the GHE RI mortality rate from the randomly selected reference EMR-contributing country in each extrapolation simulation. For these countries, the number of MRRs ranged from 6-18 depending on the number of EMR-contributing countries within the age-specific analytic division. These MRRs could be repeated throughout the 5,000 iterations based on the selected reference EMR-contributing country.

[*] http://www.who.int/healthinfo/global_burden_disease/GlobalCOD_method_2000_2015.pdf?ua=1

However, for those countries with lower quality source vital records information for GHE RI mortality rates (shaded orange or red, Appendix Figure 1), the MRR was calculated by randomly selecting a GHE RI mortality rate from within the possible values of GHE RI mortality rates within the age-specific analytic division and dividing by the GHE RI mortality rate from the randomly selected reference EMR-contributing country in each extrapolation simulation. The number of MRRs for these countries was variable and defined by the multiplication of the total number of countries in the age-specific analytic division by the number of possible reference EMR-contributing countries within the age-specific analytic division. Since there was no available information to quantify the error associated with these GHE RI mortality rates, we assumed that within an age-specific analytic division any of the estimated GHE RI mortality rates were equally possible to be true for each country. This assumption allowed us to incorporate some uncertainty in our estimation and likely generated a more conservative overall estimate.

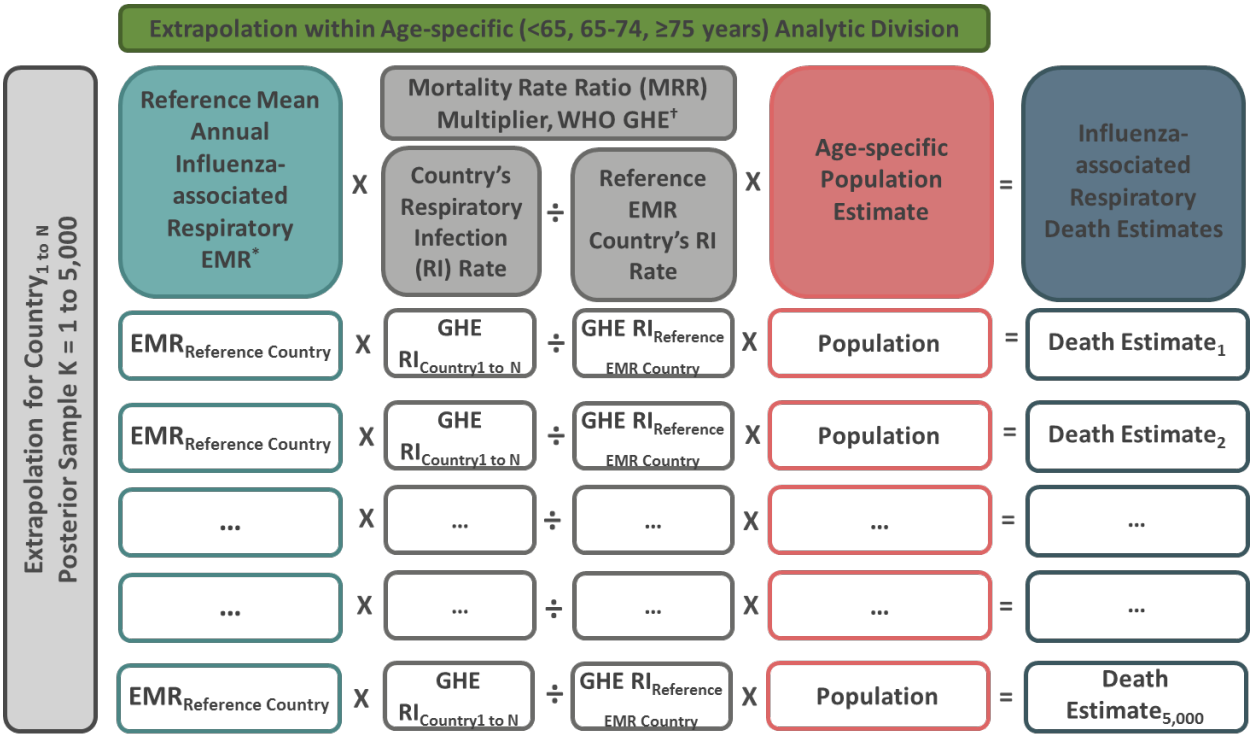
The country- and **age-specific population estimates** were obtained from the United Nations (UN) Department of Economic and Social Affairs World Population Prospect estimates for 184 countries and from the United States (US) Census Bureau mid-year population estimates for one country.

For each country, annual influenza-associated respiratory deaths were estimated by calculating the 95% credible interval of the posterior distribution of the extrapolation simulations. Global, regional, and other divisional estimates were obtained by summing each of the 5,000 iterations across countries to obtain a global, regional, or other divisional distribution. From these distributions, we calculated the 95% credible interval to generate our estimate of influenza-associated respiratory mortality.

To determine the plausibility of our extrapolated influenza-associated respiratory death estimates, we compared the extrapolated annual median influenza-associated respiratory death estimate for each country to the estimated number of GHE RI deaths for the same country and calculated the proportion of total respiratory infection deaths that were influenza-associated deaths. The median value of our extrapolated estimate of influenza-associated deaths did not exceed the GHE respiratory infection death estimates for any of the 185 countries (Appendix Table 19). In addition, we compared the proportion of total

respiratory infection deaths that were influenza-associated deaths and compared this with the same proportions derived from EMR-contributing countries using their modeled estimates of influenza-associated death and number of annual respiratory coded deaths. The proportion of our extrapolated influenza-associated respiratory deaths out of all respiratory infection deaths for the three age groups was 0·0-27.8% for <65 years, 0·0-41·8% for 65-74 years, and 2·7-27·8% for ≥75 years (Appendix Table 19). These proportions were consistent with the proportion of influenza-associated excess respiratory deaths out of all respiratory-coded deaths provided by EMR-contributing countries for the same age groups (<65 years: 0·1-32·3%, 65-74 years: 0·0-49·7%, ≥75 years: 0·0-41·8%) (Appendix Table 15). Based on these comparisons, we can conclude that our extrapolated estimates of influenza-associated respiratory deaths are reasonable because all of our extrapolated estimates were lower than the GHE RI death estimates. Further, the proportion of respiratory deaths due to influenza was consistent between our extrapolated estimates and the influenza-associated excess mortality estimates from EMR-contributing countries indicating that our extrapolation provided reasonable, consistent estimates of influenza-associated respiratory deaths.

Appendix Methods E: Simplified Example Calculation for Country-specific Influenza-Associated Respiratory Deaths:



* EMR = Excess Mortality Rate
† World Health Organization (WHO), Global Health Estimates (GHE) Respiratory Infection (RI) mortality rates per 100,000 used in calculation of Mortality Rate Ratio

Appendix Methods E Figure 1: Example of extrapolation calculation for country-specific influenza-associated respiratory death estimates (based on Main Paper, Figure 1, Box 4)

Higher Quality GHE Source Information for Death Estimate Country:

Example Country: Belarus

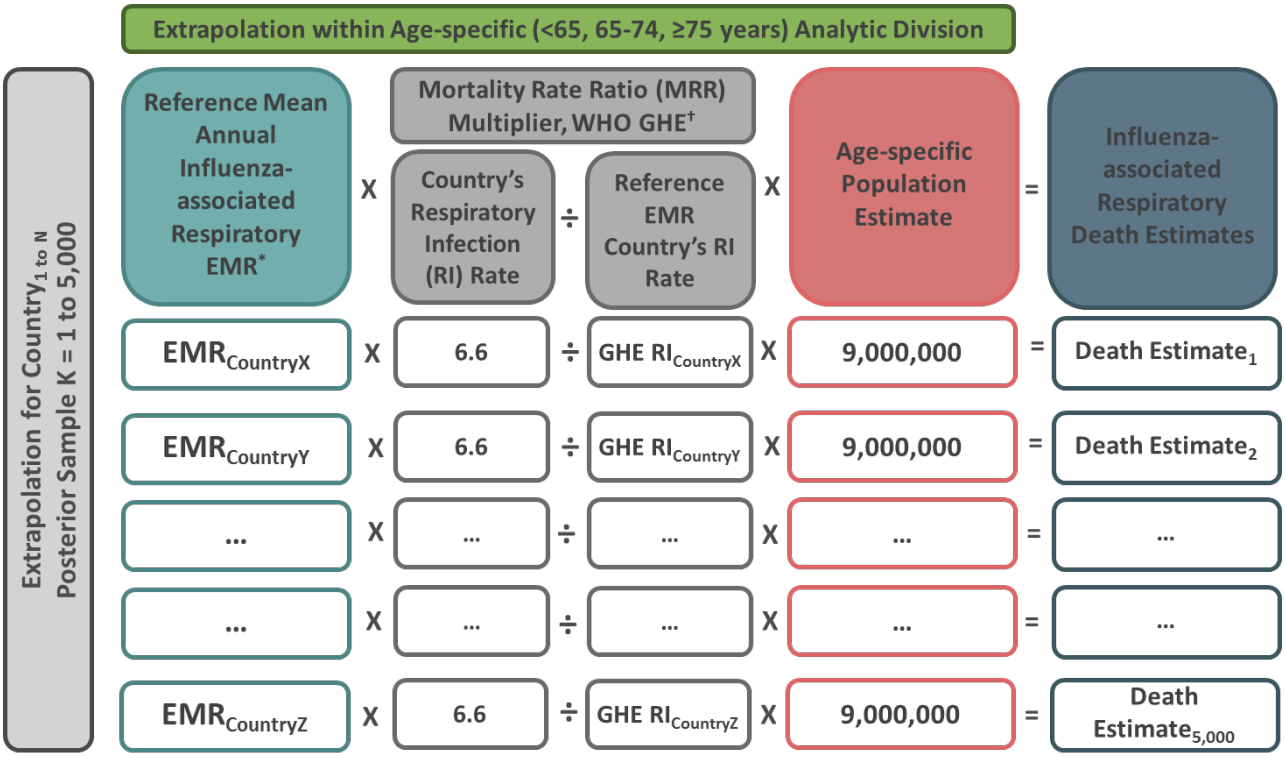
Age Group: <65 years

Analytic Division: AD2

Reference mean annual influenza-associated respiratory EMR, AD2, <65 years: ranged from **0·2–2·4** per 100,000 population.

MRR numerator (WHO GHE RI mortality rate for Belarus <65 years): **6·6** per 100,000 population. This value is the WHO GHE RI mortality rate estimate for Belarus.

MRR denominator (WHO GHE RI mortality rate of the same EMR-contributing country as the randomly selected reference EMR): Range **5·3–12·8** per 100,000 population for AD2, <65 years.



* EMR = Excess Mortality Rate
† World Health Organization (WHO), Global Health Estimates (GHE) Respiratory Infection (RI) mortality rates per 100,000 used in calculation of Mortality Rate Ratio

Appendix Methods E Figure 2: Example of extrapolation country-specific calculation for Belarus influenza-associated respiratory death estimate (based on Main Paper, Figure 1, Box 2)

A distribution of possible influenza-associated respiratory death estimates was then generated from the 5,000 extrapolated estimates. Influenza-associated respiratory deaths were calculated as the 2·5th and 97·5th percentiles of this posterior distribution resulting in a possible annual range of 14-145 influenza-associated respiratory deaths for persons <65 years in Belarus (Appendix Table 6).

Lower Quality GHE Source Information for Death Estimate Country:

Example Country: Jordan

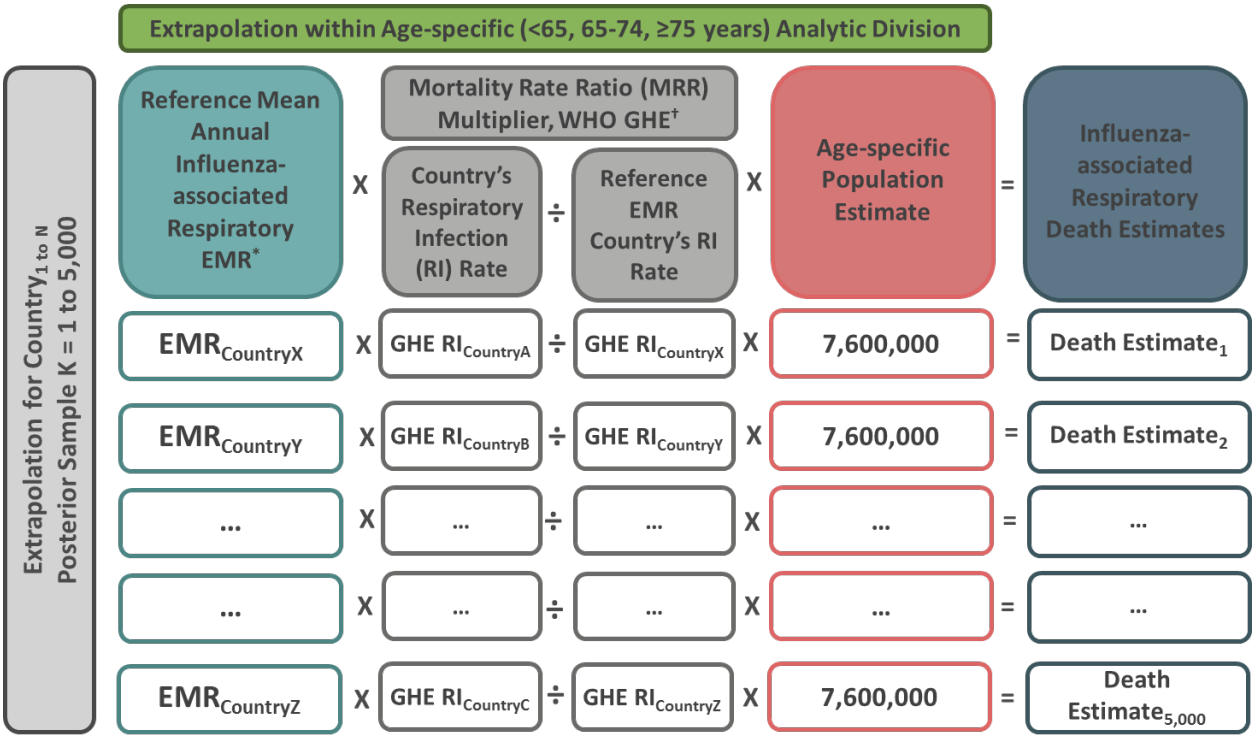
Age Group: <65 years

Analytic Division: AD2

Reference mean annual influenza-associated respiratory EMR, AD2, <65 years: ranged from **0·2–2·4** per 100,000 population.

MRR numerator (random selection of resampled distribution of the range of WHO GHE RI mortality rates in AD2 <65 years): **5·3–12·8** per 100,000 population. Source information for death estimates were considered lower quality by WHO GHE group (Appendix Figure 1), thus we accounted for uncertainty in RI mortality rate by allowing the MRR numerator to be a randomly sampled RI mortality rate from the range of possible RI mortality rates for this AD (Main Paper Figure 1, Box 4).

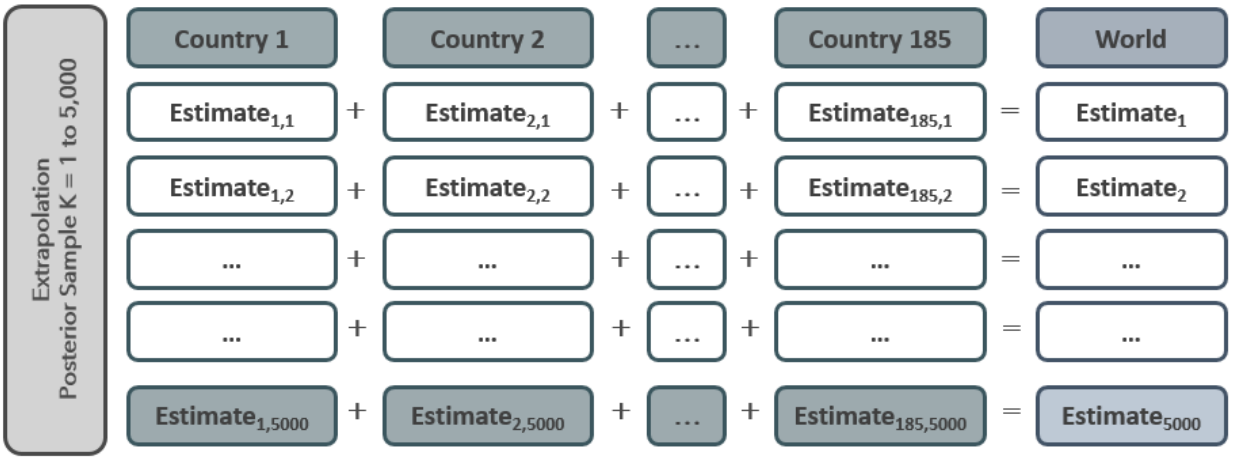
MRR denominator (WHO GHE RI mortality rate of the same EMR-contributing country as the randomly selected reference EMR): Range: **5·3–12·8** per 100,000 population for AD2, <65 years.



* EMR = Excess Mortality Rate
† World Health Organization (WHO), Global Health Estimates (GHE) Respiratory Infection (RI) mortality rates per 100,000 used in calculation of Mortality Rate Ratio

Appendix Methods E Figure 3: Example of extrapolation country-specific calculation for Jordan influenza-associated respiratory death estimate (based on Main Paper, Figure 1, Box 2)

A distribution of possible influenza-associated respiratory death estimates was generated from the 5,000 extrapolated estimates. Influenza-associated respiratory deaths were calculated as the 2·5th and 97·5th percentiles of this posterior distribution resulting in a possible annual range of 15-202 influenza-associated respiratory deaths for persons <65 years in Jordan (Appendix Table 6).



Appendix Methods E Figure 4: Example of global estimate calculation from country-specific influenza-associated respiratory death estimates (based on Main Paper, Figure 1, Box 5)

Individual country influenza-associated death estimates were summed across countries within each extrapolation iteration to generate a distribution of 5,000 global estimates of influenza-associated death. The 2·5th and 97·5th percentiles of the global distribution were used as our estimate range.

Appendix Methods F: Additional Comparison Analyses Conducted

Comparison of Mean Annual Respiratory Mortality Rates with Mean Annual Influenza-Associated Mortality Rates:

To evaluate the patterns between influenza-associated respiratory deaths and all respiratory deaths for the EMR-contributing countries, we calculated a mean annual **respiratory** mortality rate using the same methodology used to calculate the mean annual **influenza-associated** respiratory mortality rate described in Appendix Methods C for the 33 EMR-contributing countries. Then, we plotted the mean annual respiratory mortality rates against the mean annual influenza-associated death rates by country to evaluate if patterns were consistent by analytic division. We did this to determine if there was a positive correlation between these two outcomes and to ensure the directional pattern of the association was consistent within analytic division given that different methods were applied to estimate influenza-associated excess deaths. In these graphs, the slope represents the proportion of influenza-associated respiratory deaths out of all respiratory deaths. A straight line, or positive correlation, represented a constant proportion between influenza-associated excess deaths and all respiratory deaths. Clustering of the estimates within analytic divisions would imply that the EMR-contributing countries within each of the analytic divisions had similar proportions of influenza-associated excess respiratory deaths out of all respiratory deaths.

Comparison of Respiratory Infection Mortality with Estimated Influenza-associated Respiratory Mortality:

To evaluate the variability of estimates between countries and to validate our selection of analytic divisions, we plotted country-specific influenza-associated respiratory rates from our extrapolation by WHO GHE respiratory infection mortality rates by age group and analytic division. In addition, we calculated the rate-ratio between influenza-associated respiratory mortality rates from our extrapolation model and WHO GHE respiratory infection mortality rates for each age group. Then we plotted this rate-ratio comparing our extrapolated influenza-associated mortality rate estimates to WHO GHE respiratory

infection mortality rate estimates by age group and analytic division to assess what proportion of respiratory infection deaths were being attributed to influenza in each age group and analytic division using our extrapolation approach. We used an ANOVA to test if the means between the three analytic divisions for each age group were statistically significantly different from each other. Statistically significant differences would imply a difference between the mean rates of at least two analytic divisions within each age group.

Sensitivity Analysis to Explore the Impact of Analytic Division Cut-off Values on Extrapolation Model Output:

Since we observed that the removal of Argentina resulted in a change in our overall global estimate by greater than 100,000 deaths and especially impacted the <65 year age group, we decided to explore the reasons why Argentina EMR estimates substantially impacted our global estimation. First, we compared the Argentina EMR estimates for each age-group with other similar countries (e.g., within analytic division, region) and also compared the proportion of influenza-associated deaths for Argentina out of all respiratory deaths to other countries.

We also explored the impact of using analytic divisions from quartiles of WHO GHE respiratory infection mortality rates on the extrapolation model. Since we used quartiles of respiratory infection mortality to classify countries into analytic divisions, it is possible the quartile cut-off values may not represent real differences in respiratory infection mortality rates. We evaluated the impact of these cut-offs by generating alternative analytic divisions where countries near the cut-off points were shifted to another analytic division. We did this by first sorting all countries using their WHO GHE respiratory infection mortality rates from the lowest to highest rate. Next, we calculated the fold-difference in WHO GHE respiratory infection mortality rates between the last country to be categorized into AD1 and AD2 and the first countries to be classified into AD2 and AD3 until we reached a 10% fold-difference. For example, the fold difference was calculated as a ratio of the WHO GHE respiratory infection mortality rate from the first country categorized into AD2 divided by the WHO GHE respiratory infection mortality rate from

the last country categorized into AD1. Then, we decided to modify our analytic divisions by shifting countries in AD2 or AD3 with a ≤5% fold-difference from the last country in AD1 or AD2 into the lower analytic division, such that countries from AD2 with a <5% fold-difference to the last country classified into AD1 were shifted to AD1 and countries from AD3 with a <5% fold-difference to the last country classified into AD2 were shifted to AD2. Then, we conducted our extrapolation with these modified analytic divisions. In this sensitivity analysis, Argentina was one of the countries that shifted from AD3 to AD2 allowing us to evaluate the impact of Argentina's assigned analytic division had on the extrapolated influenza-associated respiratory death estimates.

Appendix Results and Discussion:

Comparison of Mean Annual Respiratory Mortality Rates with Mean Annual Influenza-Associated Mortality Rates:

In Appendix Figure 6a-c, we plotted the mean annual respiratory death rate by the mean annual influenza-associated respiratory death rate for the 33 EMR-contributing countries. We observed positive trends for each analytic division and age group, such that influenza-associated respiratory death rate increased as the respiratory death rate increased for these countries. The slope represented the proportion of influenza-associated deaths out of all respiratory deaths for each of the 33 EMR-contributing countries and indicated a constant change in the proportion when one estimate increased. In the youngest age group, the countries in AD1 and AD2 tended to cluster around the lower rates for both influenza-associated and all respiratory deaths. Countries in AD3 for the youngest age group were more diverse, but still showed a positive directional trend in the comparison rates (Appendix Figure 6a). The older two age groups showed less pronounced clustering of countries within analytic divisions. However, the positive directional trend remained and showed increasing rates of influenza-associated deaths in relation to higher respiratory death rates (Appendix Figures 6b-c). The diversity in the older two age groups may be related to competing causes of respiratory death, especially chronic respiratory diseases in these age groups, which is observed with higher mean annual all respiratory rates. Despite these differences, these plots indicated that the estimates of influenza-associated excess mortality were consistent between the contributing countries and within analytic divisions although different analytic methods were used to obtain the estimates. The findings observed in these figures supports our use of the age-specific analytic divisions and the random selection of reference EMRs for extrapolation.

Comparison of Respiratory Infection Mortality with Estimated Influenza-associated Respiratory Mortality:

Appendix Figures 7a-c plotted estimated influenza-associated respiratory mortality rate from our extrapolation model by WHO Global Health Estimates respiratory infection mortality rate for each

country and by age-specific analytic division. In each of the age groups, AD1 and AD2 had values that clustered close together and showed a positive correlation between estimated influenza-associated mortality and respiratory infection mortality. However, AD3 for all three age groups showed greater variability in the influenza-associated mortality estimates and the respiratory infection mortality estimates with limited evidence of a positive correlation between these two estimates. Influenza-associated respiratory mortality rates tended to flatten for the AD3 countries in all three age groups with higher rates than the rates for AD1 and AD2 countries. However, there were a few outliers for the oldest age group in AD3 where both the influenza-associated respiratory mortality rate and the GHE respiratory infection mortality rates were high compared with other countries in the analytic division. The flattening of the influenza-associated mortality rate compared to the GHE RI mortality rate might have been caused by the random selection of a RI mortality rate within the age-specific analytic division as the numerator for the MRR for countries with lower quality source information for the calculation of GHE RI mortality estimates, which mostly fall into AD3. These figures indicated that there was likely a consistent proportion of respiratory infection deaths that could be attributed to influenza and that this proportion was likely to be consistent for countries within each of the age-specific analytic divisions with the exception of outlier countries in AD3 where the GHE respiratory infection mortality rate was much higher than the influenza-associated mortality rate.

Box and whisker plots showing the rate-ratio between influenza-associated respiratory mortality rates from our extrapolation model out of all WHO GHE respiratory infection mortality rates for each country by analytic division are presented in Appendix Figures 8a-c. These figures provide the median and range of this rate-ratio. For AD3, where there were more respiratory infection deaths in each of the countries, the median rate-ratio of those attributable to influenza were 9% (<65 years), 10% (≥75 years), and 13% (65-74 years). However for AD1, where there were fewer respiratory infection deaths each year in these countries, the medians were 16% (<65 years), 32% (65-74 years), and 17% (≥75 years). We tested the difference in the medians for each analytic division using an ANOVA test and all three age groups had

statistically significant differences ($p<0{\cdot}001$). In all three analytic divisions, we saw a higher proportion of deaths in the older age group that was being attributed to influenza, especially in AD1 and AD2, where evidence suggests influenza is associated with more respiratory deaths. We also observed a broad range in the proportion of influenza-associated deaths out of all respiratory deaths for those aged <65 years in AD3. This was likely due to higher rates and a greater range of respiratory infection mortality for countries in this AD, as well as, differences in underlying health status of populations and access to and availability of healthcare between these countries.

The statistically significant differences between the rate-ratios comparing influenza-associated respiratory mortality rates and WHO GHE respiratory infection mortality rates observed in Figures 8a-c indicated the importance of dividing countries into analytic divisions as well using age-specific models defined by the outcome of interest.

Sensitivity Analysis to Explore the Impact of Analytic Division Cut-off Values on Extrapolation Model Output:

When the influenza-associated EMR estimates for Argentina were compared to the other influenza-associated EMR estimates, they were similar, especially among those EMR estimates from both AD2 and AD3 (Table 2). The influenza-associated EMR for Argentina for the <65 year age group was in the middle of the range of estimates from the other countries in this analytic division. The estimates of influenza-associated excess mortality from Argentina were also consistent with EMRs from other countries within the Americas region. Comparison of the proportion of influenza-associated respiratory deaths out of all respiratory coded deaths for Argentina was similar to the other EMR-contributing countries in general as well as those countries in the Americas region (Appendix Table 15). From this exploration, we concluded that the influenza-associated excess mortality rates from Argentina were consistent with influenza-associated excess mortality rates from other countries, including those similar to Argentina. Thus, the impact of Argentina on our extrapolation model was unlikely related to their EMRs for each age group.

We calculated the fold-difference in respiratory infection mortality rate from countries at the beginning of AD2 and AD3 from the respiratory infection mortality rate from the last country that was categorized in AD1 or AD2. Countries with a respiratory infection mortality rate with a less than 5% fold-difference, were shifted from AD2 into AD1 or AD3 into AD2. In the <65 year age group, Turkey, Portugal, and Taiwan shifted from AD2 to AD1 and Ecuador, Mongolia, Argentina, and Morocco shifted from AD3 to AD2. In the 65-74 year age group, Turkmenistan and Jamaica shifted from AD2 to AD1 and Egypt shifted from AD3 to AD2. In the ≥75 year age group, Poland shifted from AD2 to AD1 and Saint Lucia shifted from AD3 to AD2.

Since we were interested in understanding what factors were driving the differences in our extrapolated estimates of global influenza-associated respiratory deaths when Argentina was removed, we looked more specifically at this country. When our extrapolation model included Argentina in AD3, our estimate of annual influenza-associated respiratory deaths was 409,000 (median) with a 95% credible interval ranging from 291,000-646,000 deaths. However, there was only a 2·9% fold-difference in the RI mortality rate for Argentina compared to the last country categorized into AD2 and a 0·65% fold-difference between the RI mortality rate for Argentina and the cut-off value to be included in AD2. Based on these observations, we thought it was plausible that the categorization of Argentina into AD3 may have impacted our overall estimates. Thus, we conducted our extrapolation using the analytic divisions created after shifting those countries with a less than 5% fold-difference in the RI mortality rate.

Appendix Table 20 shows the results of our extrapolation model with the analytic division shift. With this extrapolation, we estimated a median of 409,000 annual influenza-associated respiratory deaths (95% CI: 292,000-529,000). The median and the lower-bound of the credible interval were similar to the extrapolation presented in our primary analysis in the manuscript, but the upper-bound of the credible interval was approximately 117,000 fewer deaths using the extrapolation with the shift in analytic division where Argentina was shifted to AD2.

Based on these comparisons, we determined that the difference in the credible interval was most likely related to the classification of Argentina into AD3 in our primary analysis and we will explain the reasoning. In AD3, EMR-contributing countries were extrapolated to approximately 100 countries whereas EMR-contributing countries in either AD1 or AD2 were extrapolated to approximately 50 countries. Remember, that our extrapolation was carried out within analytic divisions, but also on an individual country level. Thus, the EMR estimate for Argentina was available to be selected in the extrapolation of an additional 50 countries when categorized into AD3. Not only was it available for more individual country extrapolations, but AD3 had fewer EMR-contributing countries to randomly select EMRs, thus it was likely selected more frequently in the extrapolation iterations than country-specific EMRs from countries in AD1 or AD2. Additionally, there is greater variability in the WHO GHE respiratory infection mortality rates for countries categorized into AD3. The greater variability resulted in larger mortality rate ratios, especially when being calculated with Argentina as the reference EMR-contributing country. Argentina's 2015 RI mortality rate was 13·1, but the range of 2015 mortality rates for AD3 was 13·0-181·6. When Argentina was selected as the reference EMR-contributing country, the MRR could range from 1·0-13·9. Finally, several countries in AD3 have large populations, especially among those aged <65 years. These factors combined likely contributed to estimating higher influenza-associated death estimates when Argentina was categorized into AD3.

Evaluating both the influenza-associated EMR estimates for Argentina and the impact of our categorization of countries into analytic divisions, allowed us to understand what was driving the difference in estimates when we examined our findings from the validation exercise. Since we determined that the EMRs from Argentina were similar to other comparable countries, we had no justifiable (or unbiased) reason to exclude Argentina from the primary analysis. Further, since the median estimate of global influenza-associated respiratory deaths was similar using the original analytic divisions categorized in our primary analysis and the alternative analytic divisions with the less than 5% shift, we decided to

retain the analytic divisions from our primary analysis which were the simpler and a more straight forward division classification and avoided introducing possible bias into our extrapolation model.

Despite the impact of one country on our overall global estimates, we believe that our extrapolation model produced reasonable and realistic estimates of influenza-associated respiratory deaths for the 185 countries that were estimated, as well as, global and regional estimates of influenza-associated respiratory death. These estimates imply that influenza is an important contributor to respiratory deaths annually and the burden may be greater than previously recognized. Global and country policy makers should consider these findings in the consideration of prevention and control measures, such as vaccine introduction in certain risk populations based on the availability of resources.

Appendix Table 1. Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) checklist and brief description of information that should be included for new reports of global health estimates.

	GATHER Checklist item	Description of information	Section where reported
Objectives and funding			
1	Define the indicator(s), populations (including age, sex, and geographic entities), and time period(s) for which estimates were made.	Information provided in manuscript narrative to describe populations, geographic entities, regional groupings, and time period	Methods (main text), Table 1
2	List the funding sources for the work.	There was no funding for the global collaboration to estimate seasonal influenza-associated mortality	Funding statement in manuscript
Data Inputs			
For all data inputs from multiple sources that are synthesized as part of the study:			
3	Describe how the data were identified and how the data were accessed.	Data identification methods provided in manuscript narrative	Methods (main text)
4	Specify the inclusion and exclusion criteria. Identify all ad-hoc exclusions.	Manuscript narrative included information required to contribute excess mortality rates or annual estimates of respiratory mortality	Methods (main text)
5	Provide information on all included data sources and their main characteristics. For each data source used, report reference information or contact name/institution, population represented, data collection method, year(s) of data collection, sex and age range, diagnostic criteria or measurement method, and sample size, as relevant.	Information on data inputs into country-specific models provided in appendix tables, including information on data types, years of available data, sources of primary data, and affiliated institution(s)	Appendix Tables 2 and 3
6	Identify and describe any categories of input data that have potentially important biases (e.g., based on characteristics listed in item 5).	Summary of potential known biases described in manuscript narrative	Methods and discussion (main text) and Appendix Table 2 and 3
For data inputs that contribute to the analysis but were not synthesized as part of the study:			
7	Describe and give sources for any other data inputs.	Information on population data and WHO Global Health Estimates provided in narrative text, including references and data quality categorization (WHO GHE)	Methods (main text), Appendix Figure 1
For all data inputs:			
8	Provide all data inputs in a file format from which data can be efficiently extracted (e.g., a spreadsheet rather than a PDF), including all relevant meta-data listed in item 5. For any data inputs that cannot be shared because of ethical or legal reasons, such as third-party ownership, provide a contact name or the name of the institution that retains the right to the data.	Information on affiliated institution (third party ownership) provided for all country-specific data in appendix tables; references provided for population and WHO Global Health Estimates, which are publically available for download	Appendix Tables 2 and 3, Methods (main text)
Data analysis			
9	Provide a conceptual overview of the data analysis method. A diagram may be helpful.	Overview of data analysis and extrapolation provided in manuscript narrative and model diagram provided	Methods (main text) and Figure 1
10	Provide a detailed description of all steps of the analysis, including mathematical formulae. This description should cover, as relevant, data cleaning, data pre-processing, data adjustments and weighting of data sources, and mathematical or statistical model(s).	Country-specific model inputs and models provided in appendix table; detailed methods and formula for global model provided in appendix methods	Appendix Table 2, Appendix Methods
11	Describe how candidate models were evaluated and how the final model(s) were selected.	Description of potential other information sources for model extrapolation discussed in manuscript narrative; additional information regarding extrapolation models explored available upon request	Discussion (main text)
12	Provide the results of an evaluation of model performance, if done, as well as the results of any relevant sensitivity analysis.	Results of multiple validation analyses provided in manuscript narrative and appendix tables	Methods (main text), Results (main text), Appendix Tables 12-16
13	Describe methods for calculating uncertainty of the estimates. State which sources of uncertainty were, and were not, accounted for in the uncertainty analysis.	Description of the calculation of uncertainty around estimates described in manuscript narrative and appendix methods	Methods (main text), Appendix Methods
14	State how analytic or statistical source code used to generate estimates can be accessed.	Statistical code can be accessed upon request	Available upon request

GATHER Checklist item		Description of information	Section where reported
Results and Discussion			
15	Provide published estimates in a file format from which data can be efficiently extracted.	Global and regional seasonal influenza-associated mortality estimates provided in manuscript and country-specific estimates available in Appendix tables	Results (main text), Table 4, Appendix Table 6-8
16	Report a quantitative measure of the uncertainty of the estimates (e.g. uncertainty intervals).	95% credible intervals provided for global, regional and country-specific estimates	Results (main text), Table 4, Appendix Table 6-8
17	Interpret results in light of existing evidence. If updating a previous set of estimates, describe the reasons for changes in estimates.	Previously published global and regional estimates of seasonal influenza-associated mortality presented and discussion of methodological differences included in manuscript narrative	Discussion (main text)
18	Discuss limitations of the estimates. Include a discussion of any modelling assumptions or data limitations that affect interpretation of the estimates.	Limitations and assumptions presented and discussed in manuscript narrative	Discussion (main text)

Appendix Table 2: Excess mortality viral surveillance and vital records data sources and time series analytic methods for Excess Mortality Rate (EMR)-contributing countries

Country	Climate Information Impacting Influenza Virus Circulation Seasonality	Number of Years/Seasons of Data Available	Mortality Data			
			Data Source	Type of Data Available	Proportion of Population Coverage	Proportion of Ill-defined[a, 14]
Argentina[1]	Southern Hemisphere, Temperate	8	Pan American Health Organization regional mortality database	National monthly counts of ICD[c] 10 coded respiratory deaths	99%	8%
Australia[2]	Southern Hemisphere, Temperate	7	Australian Bureau of Statistics	National weekly counts of ICD 10 coded respiratory deaths	100%	0.5%
Austria[3]	Northern Hemisphere, Temperate	11	Statistik Austria	Daily counts of ICD 9 or ICD 10 coded respiratory deaths for Vienna	100%	0.05%
Brazil (southern)[1]	Southern Hemisphere, Tropical	8	Pan American Health Organization regional mortality database	National monthly counts of ICD 10 coded respiratory deaths	87%	10%
Canada[4]	Northern Hemisphere, Temperate	9	Canadian Vital Statistics database, Statistics Canada	national weekly counts of ICD 9 or ICD 10 coded respiratory deaths	National from 1996-2000, excludes Quebec from 2001-2009 (75% coverage).	<1%
Chile[1]	Southern Hemisphere, Temperate	8	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	99%	3%
China, Northern[5]	Northern Hemisphere, Temperate	6	Disease Surveillance Points (DSP) system, China CDC	weekly counts of ICD 10 coded respiratory deaths from 128 sites within the Disease Surveillance Points system	86%	<5%
China, Southern[5]	Northern Hemisphere, Tropical					
Czech Republic	Northern Hemisphere Temperate	12	Institute of Health Information and Statistics of the Czech Republic	National weekly counts of ICD 10 coded respiratory deaths	100%	10-15%
Denmark	Northern Hemisphere Temperate	12	Civil Register	National weekly counts of ICD 10 coded respiratory deaths	100%	<5%
Germany	Northern Hemisphere Temperate	13	Federal Statistics Office	National weekly counts of ICD 10 coded respiratory deaths	100%	unknown
Hong Kong[6]	Northern Hemisphere, Tropical	14	Census and Statistics Department of the Hong Kong Government	Territory-wide weekly counts of ICD 9 or ICD 10 coded respiratory deaths	100%	0.64-0.65%
India	Northern Hemisphere, Tropical	4	Sample Registration System[7]	Weekly counts of ICD 10 coded respiratory deaths from verbal autopsy from nationally representative sampled sites	0.6%	12.4%
Israel	Northern Hemisphere Temperate	10	Vital Records Registry	National weekly counts of ICD 10 coded respiratory deaths	100%	4.7-5.7%

Country	Climate Information Impacting Influenza Virus Circulation Seasonality	Number of Years/Seasons of Data Available	Mortality Data			
			Data Source	Type of Data Available	Proportion of Population Coverage	Proportion of Ill-defined[a, 14]
Japan	Northern Hemisphere Temperate	12	Statistics Bureau of Japan, Ministry of Internal Affairs and Communications	National weekly counts of ICD 10 coded respiratory deaths	100%	0.1-0.6%
Kenya	Southern Hemisphere, Tropical	7	Western Kenya Health and Demographic Surveillance System (HDSS)	monthly counts of ICD 10 coded respiratory deaths from verbal autopsy within the HDSS site	0.6%	0%
Mexico[1]	Northern Hemisphere, Temperate	9	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	97%	2%
Netherlands	Northern Hemisphere, Temperate	12	National vital records registry, Statistics Netherlands	National weekly counts of ICD 10 coded respiratory deaths	100%	2.2%
New Zealand	Southern Hemisphere, Temperate	12	Births, Deaths and Marriages Office (BDM), New Zealand	National weekly counts of ICD 10 coded respiratory deaths	100%	0%
Norway[8]	Northern Hemisphere Temperate	7 9	Cause of Death Registry, Norwgian Institute of Public Health	National weekly counts of ICD 10 coded respiratory deaths	100%	4%
Paraguay[1]	Southern Hemisphere, Tropical	8	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	66%	17%
Portugal	Northern Hemisphere Temperate	15	Statistics Portugal	National weekly counts of ICD 9 or ICD 10 coded respiratory deaths	100%	9.5%
Romania	Northern Hemisphere, Temperate	15	National Institute of Statistics, Romania	National weekly counts of ICD 10 coded respiratory deaths	100%	0%
Serbia	Northern Hemisphere Temperate	13	Statistical Office of the Republic of Serbia	National weekly counts of ICD 10 coded respiratory and pneumonia and influenza deaths	100%	<10%
Singapore	Tropical	8	Registry of Births and Deaths, Singapore	National weekly counts of ICD 9 or ICD 10 coded respiratory deaths	100%	0.2%
South Africa[9, 10]	Southern Hemisphere, Temperate	10 5	Vital Statistics, Mortality and Cause of Death in South Africa, Statistics South Africa	Through 2008: national monthly counts of ICD 10 coded respiratory deaths (J00-J99); Post 2008: national weekly counts of ICD 10 coded respiratory deaths (J00-J99)	> 90% > 95%	12-14%
South Korea[11]	Northern Hemisphere, Temperate	10	Korean Statistical Information Service, Korea Statistics	National weekly counts of ICD 10 coded respiratory deaths	~100%	1.4-2.6%
Spain	Northern Hemisphere Temperate	13	National Institute of Statistics, Spain	National weekly counts of ICD 10 coded respiratory deaths	100%	2-3%
Switzerland	Northern Hemisphere Temperate	15	Federal Statistical Office, Swiss Statistics	National weekly counts of ICD 10 coded respiratory deaths	100%	3.1%
Taiwan	Northern Hemisphere, Temperate (possibly tropical)	14	National Death Certificate System, Ministry of Health and Welfare, Taiwan(R.O.C.)	National weekly counts of ICD 9 or ICD 10 coded respiratory deaths	~100%	1.0-1.6%

Country	Climate Information Impacting Influenza Virus Circulation Seasonality	Number of Years/Seasons of Data Available	Mortality Data			
			Data Source	Type of Data Available	Proportion of Population Coverage	Proportion of Ill-defined[a, 14]
Thailand[12]	Tropical	6	Bureau of Policy and Strategy, Ministry of Public Health (MoPH), Thailand	National weekly counts of ICD 10 coded respiratory deaths	98%	40%
United Kingdom (England and Wales)[13]	Northern Hemisphere, Temperate	6	Office of National Statistics, UK	National weekly counts of ICD 10 coded respiratory deaths	100%	0.2%
United States	Northern Hemisphere, Temperate	16	National Center for Health Statistics, USA	National weekly counts of ICD 9 or ICD 10 coded respiratory deaths	>99.99%	0.43-0.74%
Uruguay[1]	Southern Hemisphere, Temperate	4	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	99%	8%

Country	Climate Information Impacting Influenza Virus Circulation Seasonality	Number of Years/Seasons of Data Available	Viral Surveillance Data		
			Data Source	Type of Surveillance System	Type of Data Available
Argentina[1]	Southern Hemisphere, Temperate	8	NA	NA	NA
Australia[2]	Southern Hemisphere, Temperate	7	FluNet (National Influenza Centers in Australia)	Sentinel reference laboratories (3) designated as National Influenza Centres by WHO	Weekly counts of influenza virus infections by subtype
Austria[3]	Northern Hemisphere, Temperate	11	Diagnostic Influenza Network of Austria (DINÖ); Department of Virology at the Medical University of Vienna	national sentinel in- and outpatient viral surveillance network	Daily counts of influenza virus infections by subtype
Brazil (southern)[1]	Southern Hemisphere, Tropical	8	NA	NA	NA
Canada[4]	Northern Hemisphere, Temperate	9	Respiratory Virus Detection Surveillance System, Public Health Agency Canada	FluWatch, Respiratory Virus Detection and Surveillance System (RVDSS), a laboratory surveillance network	Weekly counts of influenza virus infections by influenza type and RSV
Chile[1]	Southern Hemisphere, Temperate	8	NA	NA	NA
China, Northern[5]	Northern Hemisphere, Temperate	6	China CDC	national sentinel outpatient hospital-based influenza surveillance network	Weekly counts of influenza virus infections by subtype
China, Southern[5]	Northern Hemisphere, Tropical				
Czech Republic	Northern Hemisphere Temperate	12	National reference laboratory for influenza (National Institute of Public Health)	national sentinel outpatient influenza-like illness surveillance network	Weekly counts of influenza virus infections by influenza type and RSV
Denmark	Northern Hemisphere Temperate	12	National WHO reference laboratory for influenza, Staten Serum Institut	national sentinel outpatient influenza-like illness surveillance network	Weekly counts of influenza virus infections by subtype
Germany	Northern Hemisphere Temperate	13	Arbeitsgemeinschaft Influenza	national sentinel outpatient influenza-like illness surveillance network	Weekly counts of influenza virus infections by subtype
Hong Kong[6]	Northern Hemisphere, Tropical	14	Hong Kong Centre for Health Protection	territory-wide influenza sentinel surveillance network	Weekly counts of influenza virus infections by influenza subtype and RSV
India	Northern Hemisphere, Tropical	4	National Institute of Virology	national sentinel inpatient and outpatient influenza virology surveillance network	Weekly counts of influenza virus infections by influenza subtype
Israel	Northern Hemisphere Temperate	10	Israel Center for Disease Control	national sentinel outpatient influenza surveillance network	Weekly counts of influenza virus infections by influenza subtype and RSV
Japan	Northern Hemisphere Temperate	12	FluNet	national sentinel influenza surveillance system	Weekly counts of influenza virus infections by influenza subtype
Kenya	Southern Hemisphere, Tropical	7	Western Kenya Health and Demographic Surveillance System (HDSS), Nyanza, Province	regional inpatient and outpatient sentinel surveillance system	Weekly counts of influenza virus infections by influenza subtype and RSV and malaria
Mexico[1]	Northern Hemisphere, Temperate	9	NA	NA	NA

Country	Climate Information Impacting Influenza Virus Circulation Seasonality	Number of Years/Seasons of Data Available	Viral Surveillance Data		
			Data Source	Type of Surveillance System	Type of Data Available
Netherlands	Northern Hemisphere, Temperate	12	Weekly Virological Record System, Dutch Working Group on Clinical Virology	non-sentinel inpatient and outpatient laboratory surveillance network	Influenza Virus Type
New Zealand	Southern Hemisphere, Temperate	12	Institute of Environmental Science and Research	national sentinel surveillance network	Weekly counts of influenza virus infections by influenza type
Norway[8]	Northern Hemisphere Temperate	7	2000-2005: Norwegian Notification System for Infectious Disease (MSIS)	2000-2005: national sentinel surveillance network for influenza-like illness consultations (ILI)	Daily counts of ILI consultations; viral data not included
		9	2006-2014: Sykdomspulsen Syndromic Surveillance System	2006-2014: national syndromic surveillance system for primary care consultations (diagnosis ICPC-2 code, R80-Influenza)	Daily counts of influenza consultations; viral data not included
Paraguay[1]	Southern Hemisphere, Tropical	8	NA	NA	NA
Portugal	Northern Hemisphere Temperate	15	Rede Médicos-Sentinela	national sentinel surveillance network for influenza-like illness consultations (ILI)	NA
Romania	Northern Hemisphere, Temperate	15	National Institute of Public Health, National Center for Surveillance and Control of Communicable Diseases	national sentinel surveillance network	Weekly counts of influenza virus infections by influenza subtype
Serbia	Northern Hemisphere Temperate	13	NA	NA	NA
Singapore	Tropical	8	Ministry of Health, Singapore	The virological data collected prior to E-week 22 of year 2009 was based diagnostic samples, while the data from E-week 22 of year 2009 onwards are based on samples collected with patients with influenza-like illness (ILI) seen in government and private clinics at primary care setting.	Weekly counts of influenza virus and RSV infections
South Africa[9, 10]	Southern Hemisphere, Temperate	10	National Institute for Communicable Diseases (NICD), national database (the NHLS corporate data warehouse)	Prior to 2002, influenza-like illness sentinel surveillance for influenza virus infections by influenza subtype and from a cohort study for RSV. From 2002-2008, influenza and RSV virological data for all patients tested by the NHLS laboratory network.	Through 2008: monthly counts of influenza virus infections by influenza subtype and RSV; subtype and RSV
		5	National Institute for Communicable Diseases (NICD)	Starting in 2009, inpatient sentinel surveillance at five hospital sites.	Post 2008: weekly counts of influenza virus infections by influenza

Country	Climate Information Impacting Influenza Virus Circulation Seasonality	Number of Years/Seasons of Data Available	Viral Surveillance Data		
			Data Source	Type of Surveillance System	Type of Data Available
South Korea[11]	Northern Hemisphere, Temperate	10	Korea CDC; Korea Influenza and Respiratory Viruses Surveillance System	national network of outpatient clinics reporting influenza-like illness; national network of sentinel laboratories reporting influenza virus infection counts	Weekly counts of influenza virus infections by influenza subtype and weekly rate of ILI incidence
Spain	Northern Hemisphere Temperate	13	Spanish Influenza Surveillance System (SISS)	combination of national sentinel surveillance network with non-sentinel providers	Weekly counts of influenza virus infections by influenza subtype and RSV
Switzerland	Northern Hemisphere Temperate	15	National Reference Center of Influenza, Laboratory of Virology, University of Geneva Hospitals	national outpatient sentinel surveillance network	Weekly counts of influenza virus infections by influenza subtype
Taiwan	Northern Hemisphere, Temperate (possibly tropical)	14	Taiwan CDC	national sentinel surveillance network	Weekly counts of influenza virus infections by influenza subtype
Thailand[12]	Tropical	6	National Institute of Health, MoPH	national outpatient sentinel surveillance network	Weekly counts of influenza virus infections by influenza subtype
United Kingdom (England and Wales)[13]	Northern Hemisphere, Temperate	6	Royal College of General Practitioners Weekly Return Service (RCGP) / Specialist Microbiology Network (SMN)	national outpatient sentinel surveillance network	weekly counts of influenza virus infections by influenza subtype and weekly rate of ILI incidence
United States	Northern Hemisphere, Temperate	16	U.S. WHO Collaborating Laboratories and the National Respiratory and Enteric Virus Surveillance System	national network of clinical and public health laboratories reporting influenza laboratory results	Pre 2009: weekly counts of influenza virus infections by influenza subtype; Post 2009: weekly counts of specimens tested and influenza virus infections from clinical laboratories reporting in network and proportion of influenza virus infections by subtype reported from public health laboratories reporting in network
Uruguay[1]	Southern Hemisphere, Temperate	4	NA	NA	NA

Country	Time Series Regression Model Information							
	Statistical Model	**Seasons or Years of Data Modeled**	**Time Series**	**Type of Viral Data Included in Time Series Regression Model**	**Lagged viral data**	**Confidence Interval Calculation**	**How influenza virus circulation season was defined**	**Analyzed by[b]**
Argentina[1]	Linear regression with Serfling methods	2002-2009	Monthly	NA	NA	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Months where observed all age pneumonia and influenza mortality was greater than the upper 95% CI of expected all age baseline pneumonia and influenza mortality between May and October	CDC
Australia[2]	Generalized additive models with splines	2003-2009	Weekly	Percent positive	No lag applied	The annual influenza-attributable mortality calculations were repeated using each of the upper and lower 95% confidence limits of the parameter estimates, $\beta \pm (1.96\times$ se), where se was the standard error of the parameter estimate, β.	Viral terms included in the model	Australia
Austria[3]	Poisson regression	1999/2000-2009/2010	Daily	Percent positive	No lag applied	Confidence intervals were calculated based on the standard errors of model coefficients.	Viral terms included in the model	Austria
Brazil (southern)[1]	Linear regression with Serfling methods	2002-2009	Monthly	NA	NA	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Months where observed all age pneumonia and influenza mortality was greater than the upper 95% CI of expected all age baseline pneumonia and influenza mortality between April and October	CDC
Canada[4]	Poisson regression	1999/2000-2007/2008	Weekly	Weekly number positive	No lag applied	Confidence intervals for annual estimates were calculated based on the standard errors of model parameters, with one estimated parameter per season	Viral terms included in the model	Public Health Agency of Canada
Chile[1]	Linear regression with Serfling methods	2002-2009	Weekly	NA	NA	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Weeks where observed all age pneumonia and influenza mortality was greater than the upper 95% CI of expected all age baseline pneumonia and influenza mortality between weeks 14 and 44	CDC
China, Northern[5] China, Southern[5]	Negative binomial	2004/2005 - 2009/2010	Weekly	Percent positive	0-3 week lag	Confidence intervals were calculated based on the standard errors of model coefficients.	Viral terms included in the model	China
Czech Republic	Negative binomial	1999/2000 - 2010/2011	Weekly	Standardized percent positive	No lag applied	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC
Denmark	Negative binomial	2002/2003-2013/2014	Weekly	Weekly percent positive adjusted by ILI consultations	One week lag	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 3	Viral terms included in the model	CDC/ Denmark

Country	Time Series Regression Model Information							
	Statistical Model	**Seasons or Years of Data Modeled**	**Time Series**	**Type of Viral Data Included in Time Series Regression Model**	**Lagged viral data**	**Confidence Interval Calculation**	**How influenza virus circulation season was defined**	**Analyzed by[b]**
Germany	Linear generalized additive model	2001/2002-2013/2014	weekly	Weekly count of laboratory confirmed influenza adjusted by outpatient acute respiratory infection consultations	No lag applied	Variance-covariance matrix of the model and the residual variance was used to simulate realization of the model.	Influenza virus circulation season is defined to start when the lower confidence interval of the positivity rate for influenza in the virological NRCI data exceeds 10% for two consecutive weeks	Germany
Hong Kong[6]	Generalized linear models (GLM)	2000-2013	Weekly	Percent positive adjusted by ILI consultations	One week lag	The 95% credible intervals (CIs) for excess mortality rates were drawn from the posterior distribution.	Viral terms included in the model	Hong Kong
India	Negative binomial	2010-2013	Weekly	Percent positive	No lag applied	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	India/CDC
Israel	Negative binomial	2004/2005-2013/2014	Weekly	Percent positive	One week lag	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC
Japan	Negative binomial	1999/2000-2010/2011	Weekly	Number of positives	No lag applied	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC
Kenya	Negative binomial	2007-2013	Monthly	standardized monthly percent positive	No lag applied	The 95% confidence intervals (CI) were estimated using bootstrap sampling (with replacement) on blocks of calendar years over 1000 replications	Viral terms included in the model	Kenya
Mexico[1]	Linear regression with Serfling methods	2002/2003-2009/2010	Weekly	NA	NA	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Weeks where observed all age pneumonia and influenza mortality was greater than the upper 95% CI of expected all age baseline pneumonia and influenza mortality between weeks 37 and 19, except in 2009, where all weeks with observed all age pneumonia and influenza mortality was greater than the upper 95% CI of expected all age baseline pneumonia and influenza mortality were included	CDC

Country	Time Series Regression Model Information							
	Statistical Model	**Seasons or Years of Data Modeled**	**Time Series**	**Type of Viral Data Included in Time Series Regression Model**	**Lagged viral data**	**Confidence Interval Calculation**	**How influenza virus circulation season was defined**	**Analyzed by[b]**
Netherlands	Poisson regression	1999/2000-2010/2011	Weekly	Percentage of positives of weekly specimens	No lag applied	Confidence intervals for annual estimates were calculated based on the standard errors of model parameters, with one estimated parameter per season	Viral terms included in the model	Netherlands
New Zealand	Negative binomial	2002-2013	Weekly	Percent positive	No lag applied	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC
Norway[8]	Poisson regression	1999/2000-2005/2006 2006/2007-2014/2015	Weekly	ILI diagnosed consultations divided by total consultations; data were extrapolated to weeks when information not collected between weeks 21 and 39	ILI visits week before included in model	Confidence intervals were found using the 95% bootstrap percentiles from 2000 bootstrap samples, bootstrapping season-wise on the model residuals	Week 40 in one year to Week 20 the year after	Norway
Paraguay[1]	Linear regression with Serfling methods	2002-2009	Weekly	NA	NA	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Weeks where observed all age pneumonia and influenza mortality was greater than the expected all age baseline pneumonia and influenza mortality between weeks 39 and 19	CDC
Portugal	Linear regression with Serfling methods	1999/2000-2013/2014	Weekly	NA	NA	Confidence intervals of the excess death estimates at 95% level were calculated by approximation to the normal distribution, using as standard error the product of the square root of the number of epidemic weeks plus one, by the standard deviation of the model residual.	Weeks where observed ILI incidence was greater than and remained above for at least two consecutive weeks the upper 95% CI of expected baseline ILI incidence and ended with at least two consecutive weeks below the upper 95% CI. An additional week was added to account for eventual delay of impact.	Portugal
Romania	Negative binomial	2000/2001 - 2014/2015	Monthly	monthly percent positive	1 month lag	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC
Serbia	Linear regression with Serfling methods	2000/2001 - 2010/2011	Weekly	NA	NA	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Weeks where observed all age pneumonia and influenza mortality was greater than the expected all age baseline pneumonia and influenza mortality between weeks 40 and 20	CDC

Country	Time Series Regression Model Information							
	Statistical Model	**Seasons or Years of Data Modeled**	**Time Series**	**Type of Viral Data Included in Time Series Regression Model**	**Lagged viral data**	**Confidence Interval Calculation**	**How influenza virus circulation season was defined**	**Analyzed by[b]**
Singapore	Negative binomial with splines	2004-2011	Weekly	Percent positive	No lag applied	The 95% CI for each estimated fraction was obtained by bootstrapping the residuals and subsequently re-fitting the same model 1,000 times, with the 2.5% and 97.5% quantiles of the 1,000 replications taken as the lower and upper bounds, respectively.	Viral terms, temperature, and relative humidity included in the model	Singapore
South Africa[9, 10]	Poisson regression	1999-2009	monthly	Percent positive	No lag applied	Bootstrap resampling on blocks of calendar years over 1000 replications was used to calculate the 95% CI. Briefly, for each resampled dataset we refitted the regression model and the 95% CI obtained from the 2.5 and 97.5 percentiles of the estimated influenza- and RSV-associated mortality from the 1000 resampled datasets.	Influenza virus subtype and RSV terms included in the model	S. Africa
	Generalized additive models with splines	2009-2013	weekly					
South Korea[11]	Multiple linear regression (GAMs)	2003/2004-2013/2014	Weekly	Weekly indicator of rate of influenza virus infections derived by multiplying the proportion of ILI patients who visited sentinel clinics by the proportion of respiratory specimens testing positive for each influenza type/subtypes	One week lag	Bootstrapped CIs were obtained for each estimate by fitting the residuals in the autoregressive moving average model.		Hong Kong/ South Korea
Spain	Negative binomial	2000/2001-2012/2013	Weekly	Weekly percent positive adjusted by ILI consultations	One week lag	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC/ Spain

Country	Time Series Regression Model Information							
	Statistical Model	**Seasons or Years of Data Modeled**	**Time Series**	**Type of Viral Data Included in Time Series Regression Model**	**Lagged viral data**	**Confidence Interval Calculation**	**How influenza virus circulation season was defined**	**Analyzed by[b]**
Switzerland	Negative binomial	1999/2000 - 2013/2014	Weekly	Percent positive	One week lag	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC
Taiwan	Negative binomial	2000/2001- 2013/2014	Weekly	Percent positive	No lag applied	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms, temperature, and humidity included in the model	CDC / Taiwan
Thailand[12]	Negative binomial	2006-2011	Weekly	Percent positive	No lag applied	Confidence intervals were calculated based on the standard errors of model coefficients.	Viral terms, temperature, and humidity included in the model	Thailand
United Kingdom (England and Wales)[13]	Generalized linear models	2006/2007- 2011/2012	Weekly	Modeled indicator comprised of number of positive specimens, proportion positive, and incidence	Up to 3 week lag	Variance composed of the sum of the weekly residual variance (variance of the residuals of the final model) and weekly model prediction variance (square of the standard errors of the prediction of the final model)	Viral terms, temperature	UK
United States	Negative binomial	1999/2000 - 2014/2015	Weekly	Percent positive	One week lag	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Viral terms included in the model	CDC
Uruguay[1]	Linear regression with Serfling methods	2002 - 2009	Weekly	NA	NA	The 95% confidence intervals (CI) were estimated using bootstrap sampling using 10,000 samples with an autoregressive structure of order 2	Weeks where observed all age pneumonia and influenza mortality was greater than and remained above for at least two consecutive weeks the upper 95% CI of expected all age baseline pneumonia and influenza mortality between weeks 18 and 34	CDC

Country	Final Model selected based on fit
Argentina[1]	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 12.175)] + \beta_4[\cos(2\pi t_i / 12.175)] + \varepsilon_i$
Australia[2]	$\text{Expected (mortality rate)} = \beta_0 + \beta_1 t + \beta_2(\text{FluH1N1pdm09}) + \left[\sum_{\text{year}=2003}^{2009} \beta_{3,\text{year}}(\text{seasonal influenza A}_{\text{year}})\right] + \beta_4(\text{Flu B}) + \text{spline(t)}$
Austria[3]	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / d_i)] + \beta_4[\cos(2\pi t_i / d_i)] + \beta_5[we] + \beta_6[RSV_i] + \gamma[w] \}$ where d is days of the year; we is a Boolean for weekend, w is a dummy vector denoting if the day is or is not within the 1st to kth week of the influenza season
Brazil (southern)[1]	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 12.175)] + \beta_4[\cos(2\pi t_i / 12.175)] + \varepsilon_i$
Canada[4]	$\text{Deaths} = \sum_{m=1}^{12} \beta_{1,m}\text{mon}_m + \beta_2 \cos\left(\frac{2\pi\text{week}}{52}\right) + \beta_3 \sin\left(\frac{2\pi\text{week}}{52}\right) + \sum_{y=1996-97}^{2007-08} \beta_{4,y}\text{FY}_y + \beta_5\text{Jan1} + \sum_{1996-97}^{2007-08} \beta_{6,y}\text{FY}_y \times \text{FluA} + \beta_7\text{FluB} + \beta_9\text{RSV}_{\text{pos}}$
Chile[1]	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \varepsilon_i$
China, Northern[5]	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\text{FluH1N1}_i] + \beta_6[\text{FluH3N2}_i] + \beta_7[\text{FluH1N1pdm09}_i] + \beta_8[\text{FluB}_i] \}$
China, Southern[5]	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\sin(2\pi t_i / 26)] + \beta_6[\cos(2\pi t_i / 26)] + \beta_7[\text{FluH1N1}_i] + \beta_8[\text{FluH3N2}_i] + \beta_9[\text{FluH1N1pdm09}_i] + \beta_8[\text{FluB}_i] \}$
Czech Republic	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\text{std(FluA}_i)] + \beta_6[\text{std(FluB}_i)] + \beta_7[\text{std(RSV}_i)] \}$
Denmark	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[t_i^3] + \beta_4[\sin(2\pi t_i / 52)] + \beta_5[\cos(2\pi t_i / 52)] + \beta_6[\text{lag(IndexFluH1N1}_i)] + \beta_7[\text{lag(IndexFluH3N2}_i)] + \beta_8[\text{lag(IndexFluH1N1pdm09}_i)] + \beta_9[\text{lag(IndexFluB}_i)] \}$
Germany	In each age group: Mortality = f(calendar_week) + g(calendar_time)+h(high_temperature)+i(low_temperature) + \beta_season * INV-consultations Excess mortality = \beta_season * INV consultations
Hong Kong[6]	$\mu_B = \beta_1(\text{Week Index}_i, k=35) + \beta_2(\text{H1N1})(\text{ILI}) + \beta_3(\text{H3N2})(\text{ILI}) + \beta_4(\text{B})(\text{ILI}) + \beta_5(\text{H1N1pdm09})(\text{ILI}) + \beta_6(\text{H1N1pdm09})(\text{ILI})(\text{pandemic}) + \beta_7(\text{RSV})(\text{ILI}) + \beta_8(\text{TEMP}) + \beta_9(\text{TEMP})^2 + \beta_{10}(\text{TEMP})^3 + \beta_{11}(\text{AH}) + \beta_{12}(\text{AH})^2 + \beta_{13}(\text{AH})^3 + \beta_{14}(\text{NameChange})$ Death Rate ~ Normal(μ_D, τ_D^2)
India	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[\sin(2\pi t_i / 52)] + \beta_3[\cos(2\pi t_i / 52)] + \beta_4[\text{FluH3N2}_i] + \beta_5[\text{FluH1N1pdm09}_i] + \beta_6[\text{FluB}_i] \}$
Israel	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\text{lag(FluH1N1}_i)] + \beta_6[\text{lag(FluH3N2}_i)] + \beta_7[\text{lag(FluH1N1pdm09}_i)] + \beta_8[\text{lag(FluB}_i)] + \beta_9[\text{lag(RSV}_i)] \}$
Japan	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\text{FluH1N1}_i] + \beta_6[\text{FluH3N2}_i] + \beta_7[\text{FluH1N1pdm09}_i] + \beta_8[\text{FluB}_i] \}$
Kenya	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[t_i^3] + \beta_4[t_i^4] + \beta_5[t_i^5] + \beta_6[t_i^6] + \beta_7[\sin(2\pi t_i / 12)] + \beta_8[\cos(2\pi t_i / 12)] + \beta_9[\text{Flu}_i] + \beta_{10}[\text{RSV}_i] + \beta_{11}[\text{Malaria}_i] \}$
Mexico[1]	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \varepsilon_i$
Netherlands	Death = time + sine + cosine + influenza(per year) + RSV (Crude model - models were specific by age group with varying covariates)

Country	Final Model selected based on fit
New Zealand	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\text{IndexFluH1N1}_i] + \beta_6[\text{IndexFluH3N2}_i] + \beta_7[\text{IndexFluH1N1pdm09}_i] + \beta_8[\text{IndexFluB}_i] + \beta_9[\text{IndexRSV}_i] \}$
Norway[8]	$Y_i = \alpha \exp\{\log(\text{population}) + \beta_0 + \beta_1[\text{ILI}] + \beta_2[\text{factor(season)}] + \beta_3[\text{factor(week)}]\}$
Paraguay[1]	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \varepsilon_i$
Portugal	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[t_i^3] + \beta_4[\sin(2\pi t_i / 52)] + \beta_5[\cos(2\pi t_i / 52)] + \varepsilon_i$
Romania	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 12.175)] + \beta_4[\cos(2\pi t_i / 12.175)] + \beta_5[\text{Lag(FluH1N1}_i)] + \beta_6[\text{Lag(FluH3N2}_i)] + \beta_7[\text{Lag(FluH1N1pdm09}_i)] + \beta_8[\text{Lag(FluB}_i)] + \beta_9[\text{Lag(RSV}_i)]\}$
Serbia	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[t_i^3] + \beta_4[\sin(2\pi t_i / 52)] + \beta_5[\cos(2\pi t_i / 52)] + \varepsilon_i$
Singapore	$Y_t = \text{ns}(t) + \text{factor(year)} + \text{flu}_t + \text{RSV}_t + \text{ns}(\text{temperature}_t) + \text{ns}(\text{relative humdity}_t)$
South Africa[9, 10]	$E(Y_i) = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[t_i^3] + \beta_4[t_i^4] + \beta_5[\sin(2t_i\pi/12)] + \beta_6[\cos(2t_i\pi/12)] + \beta_7[\text{Seasonal\_Influenza}_i] + \beta_8[\text{A(H1N1)pdm09}_i] + \beta_9[\text{RSV}_i] + \varepsilon_i$ $E(\text{mortality rate}) = \beta_0 + \beta_1 t + \left[\sum_{y=2009}^{2013} \beta_{2,y}(\text{Influenza A(H1N1)pdm09})\right] + \left[\sum_{y=2009}^{2013} \beta_{3,y}(\text{Influenza A(H3N2)})\right] + \left[\sum_{y=2009}^{2013} \beta_{4,y}(\text{Influenza B})\right] + \left[\sum_{y=2009}^{2013} \beta_{5,y}(\text{RSV})\right] + \text{spline}(t)$
South Korea[11]	$M(t) \approx \sum_i \lambda_i(1 + A_1(t - t_0))(\text{Flu}_i(t)) + \beta_{pH1}(P)(\text{Flu}_{pH1}(t)) + \beta_B(P)(\text{Flu}_B(t)) + \text{Baseline}(t)$ $\text{Baseline}(t) = f(t, df) + f(H_t, df)$
Spain	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\text{lag(IndexFluH1N1}_i)] + \beta_6[\text{lag(IndexFluH3N2}_i)] + \beta_7[\text{lag(IndexFluH1N1pdm09}_i)] + \beta_8[\text{lag(IndexFluB}_i)] + \beta_9[\text{lag(IndexRSV}_i)] \}$
Switzerland	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \beta_5[\text{FluH1N1}_i] + \beta_6[\text{lag(FluH3N2}_i)] + \beta_7[\text{lag(FluH1N1pdm09}_i)] + \beta_8[\text{lag(FluB}_i)] \}$
Taiwan	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\text{temperature}_i] + \beta_4[\text{humidity}_i] + \beta_5[\text{FluH1N1}_i] + \beta_6[\text{FluH3N2}_i] + \beta_7[\text{FluH1N1pdm09}_i] + \beta_8[\text{FluB}_i] + \beta_9[\text{period}_i] + \beta_{10}[\text{FluH1N1}_i\text{*period}_i] + \beta_{11}[\text{FluH3N2}_i\text{*period}_i] + \beta_{12}[\text{FluB}_i\text{*period}_i] \}$
Thailand[12]	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\text{NCS(Temperature)}] + \beta_4[\text{NCS(Humidity)}] + \beta_5[\text{FluH1N1}_i] + \beta_6[\text{FluH3N2}_i] + \beta_7[\text{FluH1N1pdm09}_i] + \beta_8[\text{FluB}_i] \}$
United Kingdom (England and Wales)[13]	$E(Y_t) = \beta_{\text{baseline}} + (\beta_{\text{year}_i} + \sum_{i=0}^{3}(\beta_{\text{flua}_{i,l}}(\text{flua}_{t-l})))(\text{year}_i) + \sum_{i=0}^{3}(\beta_{\text{flub}_{i,l}}(\text{flub}_{t-l})) + \sum_{i=0}^{3}(\beta_{\text{rsv}_{i,l}}(\text{rsv}_{t-l})) + \sum_{i=0}^{3}(s(\text{temp}_t - l, 1, 4)) + s(\text{week}_i, 3, 9) + \varepsilon_t$
United States	$Y_i = \alpha \exp\{ \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[t_i^3] + \beta_4[t_i^4] + \beta_5[\sin(2\pi t_i / 52)] + \beta_6[\cos(2\pi t_i / 52)] + \beta_7[\text{lag(FluH1N1}_i)] + \beta_8[\text{lag(FluH3N2}_i)] + \beta_9[\text{lag(FluH1N1pdm09}_i)] + \beta_{10}[\text{lag(FluB}_i)] \}$

Country	Final Model selected based on fit
Uruguay[1]	$Y_i = \beta_0 + \beta_1[t_i] + \beta_2[t_i^2] + \beta_3[\sin(2\pi t_i / 52)] + \beta_4[\cos(2\pi t_i / 52)] + \varepsilon_i$

1 - Cheng et al. (2015) Burden of influenza-associated deaths in the Americas, 2002–2008. Influenza and Other Respiratory Viruses 9(Suppl. S1), 13–21.
2 - Muscatello DJ, Newall AT, Dwyer DE, MacIntyre CR (2013) Mortality Attributable to Seasonal and Pandemic Influenza, Australia, 2003 to 2009, Using a Novel Time Series Smoothing Approach. PLoS ONE 8(6): e64734.
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7 - Sample Registration System. Government of India, 2011. http://www.censusindia.gov.in/2011-Common/Sample_Registration_System.html.
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12 - Aungkulanon et al. (2015) Influenza-associated mortality in Thailand, 2006–2011. Influenza and Other Respiratory Viruses 9(6), 298–304.
13 - Green et al. (2013) Mortality attributable to influenza in England and Wales prior to, during and after the 2009 pandemic. PLoS ONE 8(12): e79360.
14 - Mathers et al. (2005) Counting the dead and what they died from: an assessment of the global status of cause of death data. Bull World Health Organ 83(3): 171-177.

a - Ill-defined deaths, or garbage codes, are deaths coded to symptoms, signs, ill-defined conditions, and incompletely recorded deaths[14]
b - 15 countries were unable to share weekly raw data with external researchers due to data access agreements and performed the analysis in house
c - International Classification of Disease

Appendix Table 3: Data sources for validation countries

Country	Climate Information Impacting Influenza Virus Circulation Seasonality	Number of Years/Seasons of Data Available	Mortality Data			
			Data Source	Type of Data Available	Proportion of Population Coverage	Proportion of Ill-defined[a]
Bangladesh[1]	Northern Hemisphere, Tropical	2	Nationally representative hospital based influenza surveillance (HBIS) at 11 tertiary level hospitals	Monthly counts of acute respiratory infection-associated deaths from verbal autopsy within catchment areas of sentinel sites	~14%	0%
Colombia	Tropical	7	Pan American Health Organization regional mortality database	National weekly counts of ICD[b] 10 coded respiratory deaths	80·5%	1·7%
Costa Rica	Northern Hemisphere, Tropical	8	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	87·8%	1·9%
Cuba	Northern Hemisphere, Tropical	3	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	105·7%	1·7%
Ecuador	Tropical	8	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	85·9%	11·2%
El Salvador	Northern Hemisphere, Tropical	8	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	78·6%	14·4%
Guatemala	Northern Hemisphere, Tropical	5	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	96·6%	6·1%
Indonesia	Tropical	1	Sample Registration System, National Institute of Health Research and Development, Indonesia and Statistics Indonesia	Annual counts of ICD 10 coded respiratory deaths from verbal autopsy from nationally representative sampled sites	73%	6%
Kuwait	Northern Hemisphere, Temperate	12	Ministry of Planning, Central Statistical Bureau and Ministry of Health	National annual counts of ICD 10 coded respiratory deaths	100%	4 – 7%
Mongolia	Northern Hemisphere, Temperate	9	Mongolian National Statistics Office	National monthly counts of ICD 10 coded respiratory deaths	100%	0·2 – 0·7%
Morocco	Northern Hemisphere, Temperate	4	Ministry of Health, Morocco	National annual counts of ICD 10 coded respiratory deaths	~100%	20 – 22·3%
Panama	Northern Hemisphere, Tropical	5	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	88·8%	3·1%
Peru	Southern Hemisphere, Tropical	3	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	57·8%	0·3%
Venezuela	Northern Hemisphere, Tropical	3	Pan American Health Organization regional mortality database	National weekly counts of ICD 10 coded respiratory deaths	89·9%	0·7%

1 - Ahmed M et al. (2017) Seasonal Influenza-associated Mortality in Bangladesh, 2010-12. in press: Influenza Other Respir Viruses.
2 - Mathers et al. (2005) Counting the dead and what they died from: an assessment of the global status of cause of death data. Bull World Health Organ 83(3): 171-177.

a - Ill-defined deaths, or garbage codes, are deaths coded to symptoms, signs, ill-defined conditions, and incompletely recorded deaths[2]

b - International Classification of Disease

Appendix Table 4. Population estimates and proportion of 2015 population represented worldwide and in analytic divisions and by excess mortality rate (EMR)-contributing countries within analytic divisions.

Age Group	Analytic Division (AD)	Number of Countries	Population Estimates[a]	Proportion of World Population Represented by Countries	Number of EMR-Contributing Countries	Population Estimates for EMR-Contributing Countries	Proportion of AD Population Represented by EMR-Contributing Countries
				Worldwide[b]			
<5 Years	--	183	668,235,242	--	--	--	--
All Ages	--	185	7,335,457,097	--	33	4,153,487,759	57%
				Analytic Division			
<5 Years[c]	3	92	443,893,900	67%	4	137,172,341	31%
	1	46	1,854,018,200	28%	18	1,665,773,351	90%
	2	46	1,204,631,347	18%	9	633,548,001	53%
<65 Years	3	93	3,669,813,994	55%	6	1,449,576,637	40%
	1	46	61,709,758	17%	13	31,440,174	51%
	2	46	197,275,032	54%	12	144,982,368	73%
65-74 Years	3	93	108,562,270	30%	7	68,991,564	64%
	1	46	123,821,633	52%	11	87,684,748	71%
	2	46	45,210,799	19%	11	15,713,421	35%
≥75 Years	3	93	70,414,064	29%	10	55,777,495	79%

[a]Population estimates obtained from United Nations World Population Prospects data (http://esa.un.org/unpd/wpp/) for 184 countries and United States Census Bureau International Population Estimates (http://www.census.gov/population/international/data/idb/informationGateway.php) for one country

[b]For purposes of this analysis, the world was defined as World Health Organization Member States or territories with respiratory infection mortality rates, 185 countries for all ages and 183 for children <5 years. This selection was necessary since these countries had requisite data to calculate global influenza-associated respiratory death estimates. Remaining Member States excluded comprise 0.006% of world population

[c]The overall estimate was only for 92 countries, which fell into the 3rd and 4th quartiles (analytic division 3), when the Global Health Estimate (GHE) rates for respiratory infection mortality were ranked. Quartiles were generated from 183 countries with GHE rates of respiratory infection mortality for the under 5 year old age group. GHE rates of respiratory infection mortality for the under 5 year age group were not available for the following countries: Hong Kong SAR (China) and Taiwan (China)

Appendix Table 5. Analytic divisions, range of possible mean annual influenza-associated respiratory excess mortality rates, range of possible mortality rate ratios, and population estimates by age group and country.

Country	WHO Region[b]	Analytic Division			Range of Possible Mean Annual Influenza-associated Respiratory Excess Mortality Rates (EMRs) Used in Extrapolation Simulations			Range of Possible Mortality Rate Ratios (MRRs) Used in Extrapolation Simulations			Population Estimates		
		<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years
Afghanistan	EMRO	3	3	2	0·6 – 6·4	12·0 – 44·0	20·4 – 199·5	0·3 – 13·8	0·3 – 8·3	0·5 – 1·8	31,723,452	602,246	200,864
Albania	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·2 – 5·8	0·1 – 5·1	0·03 – 2·9	2,537,597	214,538	144,544
Algeria	AFRO	3	2	2	0·6 – 6·4	3·2 – 40·6	20·4 – 199·5	0·3 – 13·8	0·5 – 2·0	0·5 – 1·8	37,311,106	1,407,920	947,493
Angola	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	24,443,098	414,588	164,288
Antigua and Barbuda	AMRO	2	2	3	0·2 – 2·4	3·2 – 40·6	27·5 – 223·5	0·7 – 1·7	0·8 – 1·6	0·4 – 1·0	85,240	3,769	2,809
Argentina[a]	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 1·0	0·6 – 1·7	0·6 – 1·4	38,672,800	2,686,282	2,057,673
Armenia	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·2 – 5·8	0·1 – 5·1	0·03 – 2·9	2,691,015	147,000	179,697
Australia[a]	WPRO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·3 – 2·0	0·4 – 1·8	0·8 – 2·4	20,362,871	2,042,384	1,563,718
Austria[a]	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·2 – 1·0	0·3 – 1·3	0·3 – 1·0	6,941,696	858,168	744,722
Azerbaijan	EURO	3	1	1	0·6 – 6·4	2·9 – 30·4	17·9 – 112·7	0·3 – 13·8	0·1 – 5·1	0·03 – 2·9	9,205,201	269,917	278,850
Bahamas	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·9 – 2·3	0·8 – 1·5	0·7 – 1·3	355,889	20,234	11,896
Bahrain	EMRO	1	2	2	0·1 – 2·4	3·2 – 40·6	20·4 – 199·5	0·2 – 5·8	0·5 – 2·0	0·5 – 1·8	1,344,034	22,736	10,467
Bangladesh	SEARO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·3 – 13·8	0·5 – 2·0	0·03 – 2·9	152,988,433	5,048,817	2,958,392
Barbados	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·4 – 1·5	0·6 – 1·6	0·7 – 1·8	243,959	22,998	17,258
Belarus	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·5 – 1·2	0·2 – 0·9	0·0 – 0·1	8,168,222	661,467	666,137
Belgium	EURO	1	2	2	0·1 – 2·4	3·2 – 40·6	20·4 – 199·5	0·9 – 5·3	0·7 – 1·3	0·9 – 1·7	9,239,935	1,047,081	1,012,176
Belize	AMRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·8 – 2·0	0·5 – 1·5	0·8 – 1·8	345,769	8,825	4,693
Benin	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	10,565,275	232,819	81,735
Bhutan	SEARO	3	3	2	0·6 – 6·4	12·0 – 44·0	20·4 – 199·5	0·3 – 13·8	0·3 – 8·3	0·5 – 1·8	735,602	24,696	14,532
Bolivia (Plurinational State of)	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	10,031,306	406,150	287,249
Bosnia and Herzegovina	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·2 – 5·8	0·1 – 5·1	0·03 – 2·9	3,221,937	329,160	259,319
Botswana	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	2,181,079	55,847	25,559
Brazil[a]	AMRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	1·0 – 2·4	0·5 – 1·3	0·5 – 1·1	191,542,565	10,156,963	6,148,000
Brunei Darussalam	WPRO	1	2	3	0·1 – 2·4	3·2 – 40·6	27·5 – 223·5	1·0 – 5·7	0·8 – 1·6	0·4 – 0·9	404,485	12,600	6,103
Bulgaria	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·7 – 1·7	1·0 – 4·7	0·6 – 1·7	5,717,865	837,547	594,375
Burkina Faso	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	17,672,248	320,307	113,015

Country	WHO Region[b]	Analytic Division			Range of Possible Mean Annual Influenza-associated Respiratory Excess Mortality Rates (EMRs) Used in Extrapolation Simulations			Range of Possible Mortality Rate Ratios (MRRs) Used in Extrapolation Simulations			Population Estimates		
		<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years
Burundi	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	10,902,659	189,529	86,733
Cambodia	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	14,936,410	451,718	189,771
Cameroon	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	22,595,862	512,610	235,707
Canada[a]	AMRO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 2·4	0·5 – 2·5	0·7 – 2·1	30,140,740	3,304,378	2,494,809
Cape Verde	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	496,659	10,872	12,971
Central African Republic	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	4,711,346	129,592	59,336
Chad	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	13,693,450	241,455	102,567
Chile[a]	AMRO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·6 – 3·6	1·0 – 4·9	0·9 – 1·6	15,973,305	1,137,109	837,727
China, Hong Kong SAR[a,c]	WPRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·5 – 1·3	0·4 – 1·0	0·8 – 2·0	6,190,375	577,843	519,765
China[a]	WPRO	1	2	1	0·1 – 2·4	3·2 – 40·6	17·9 – 112·7	0·2 – 5·8	0·5 – 2·0	0·03 – 2·9	1,244,619,666	84,913,547	46,515,730
Colombia	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·7 – 1·6	0·7 – 1·4	0·6 – 1·0	44,833,883	2,177,550	1,217,271
Comoros	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	766,448	15,301	6,725
Congo	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	4,451,187	114,291	54,852
Costa Rica	AMRO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	1·0 – 5·7	0·8 – 4·1	0·8 – 2·5	4,379,901	262,524	165,425
Côte d'Ivoire	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	22,014,399	517,183	169,974
Croatia	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·6 – 3·1	0·5 – 2·7	0·4 – 1·2	3,437,325	420,856	382,136
Cuba	AMRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·6 – 1·4	0·3 – 0·9	0·4 – 0·9	9,798,116	878,661	712,785
Cyprus	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·2 – 5·8	0·1 – 5·1	0·03 – 2·9	1,015,612	88,281	61,407
Czech Republic[a]	EURO	1	2	2	0·1 – 2·4	3·2 – 40·6	20·4 – 199·5	1·0 – 5·7	0·5 – 1·0	0·6 – 1·0	8,637,401	1,168,326	737,459
Democratic People's Republic of Korea	SEARO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	22,755,641	1,628,379	771,297
Democratic Republic of the Congo	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	74,976,675	1,630,638	659,501
Denmark[a]	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·5 – 2·8	0·9 – 4·2	0·8 – 1·4	4,594,255	650,026	424,800
Djibouti	EMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	850,690	26,116	11,055
Dominican Republic	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	9,827,973	404,907	295,511
Ecuador	AMRO	3	2	3	0·6 – 6·4	3·2 – 40·6	27·5 – 223·5	0·3 – 1·0	1·1 – 2·0	0·4 – 1·0	15,062,014	649,602	432,747
Egypt	EMRO	3	3	2	0·6 – 6·4	12·0 – 44·0	20·4 – 199·5	0·3 – 13·8	0·3 – 8·3	0·5 – 1·8	86,731,123	3,247,923	1,529,038
El Salvador	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	5,625,931	290,335	210,317
Equatorial Guinea	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	820,672	16,048	8,340

Country	WHO Region[b]	Analytic Division			Range of Possible Mean Annual Influenza-associated Respiratory Excess Mortality Rates (EMRs) Used in Extrapolation Simulations			Range of Possible Mortality Rate Ratios (MRRs) Used in Extrapolation Simulations			Population Estimates		
		<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years
Eritrea	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	5,090,228	104,288	33,275
Estonia	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·6 – 1·4	0·9 – 4·4	0·4 – 1·1	1,066,326	124,045	122,187
Ethiopia	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	95,928,085	2,396,958	1,065,707
Fiji	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·4 – 1·4	0·5 – 1·3	0·4 – 0·9	840,124	38,087	13,934
Finland	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·2 – 1·2	0·1 – 0·6	0·2 – 0·6	4,376,504	647,418	479,535
France	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·5 – 2·9	0·5 – 2·7	0·6 – 1·0	52,082,626	6,223,139	6,089,580
Gabon	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	1,637,217	54,316	33,759
Gambia	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	1,944,857	33,153	12,914
Georgia	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 2·4	0·1 – 5·1	0·03 – 2·9	3,438,812	271,848	289,152
Germany[a]	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·7 – 3·8	0·8 – 4·1	0·8 – 2·2	63,549,772	8,386,439	8,752,334
Ghana	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	26,479,563	647,782	282,548
Greece	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·5 – 2·7	0·6 – 3·1	0·8 – 2·3	8,610,706	1,130,874	1,213,037
Grenada	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·5 – 1·5	0·8 – 2·1	0·9 – 2·2	99,177	4,134	3,514
Guatemala	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·6 – 1·9	0·6 – 1·7	0·7 – 1·6	15,550,833	484,677	307,387
Guinea	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	12,222,336	283,770	102,484
Guinea-Bissau	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	1,785,889	43,928	14,508
Guyana	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·5 – 1·6	0·5 – 1·5	0·6 – 1·4	728,681	27,304	11,100
Haiti	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	10,215,053	324,187	171,827
Honduras	AMRO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 2·4	0·1 – 5·1	0·03 – 2·9	7,683,156	231,556	160,348
Hungary	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·6 – 3·4	0·4 – 2·1	0·3 – 1·0	8,099,065	995,098	760,860
Iceland	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·2 – 0·9	0·2 – 1·2	0·6 – 1·0	284,248	25,384	19,793
India[a]	SEARO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	1,237,420,485	49,147,797	24,482,245
Indonesia	SEARO	3	2	2	0·6 – 6·4	3·2 – 40·6	20·4 – 199·5	0·3 – 13·8	0·5 – 2·0	0·5 – 1·8	244,238,161	9,137,218	4,188,436
Iran (Islamic Republic of)	EMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·5 – 1·1	0·6 – 1·1	0·7 – 1·2	75,105,461	2,485,359	1,518,452
Iraq	EMRO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·3 – 13·8	0·5 – 2·0	0·03 – 2·9	35,310,210	736,804	376,381
Ireland	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·3 – 1·7	0·6 – 2·9	0·8 – 1·4	4,072,424	368,352	247,689
Israel[a]	EURO	1	2	2	0·1 – 2·4	3·2 – 40·6	20·4 – 199·5	0·6 – 3·4	0·6 – 1·2	0·9 – 1·6	7,157,718	505,185	401,133
Italy	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·3 – 1·6	0·4 – 1·8	0·6 – 1·9	46,397,098	6,566,138	6,834,449
Jamaica	AMRO	1	2	2	0·1 – 2·4	3·2 – 40·6	20·4 – 199·5	1·0 – 5·8	0·5 – 1·0	0·6 – 1·1	2,538,055	138,546	116,734

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		<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years
Japan[a]	WPRO	1	2	3	0·1 – 2·4	3·2 – 40·6	27·5 – 223·5	1·0 – 5·6	0·7 – 1·4	0·5 – 1·2	93,231,478	17,222,928	16,119,075
Jordan	EMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	7,307,025	189,988	97,534
Kazakhstan	EURO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·5 – 1·6	0·8 – 1·5	0·6 – 1·7	16,438,037	672,027	515,162
Kenya[a]	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	44,759,768	871,975	418,559
Kiribati	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	108,259	2,886	1,278
Kuwait	EMRO	1	3	3	0·1 – 2·4	12·0 – 44·0	27·5 – 223·5	1·0 – 5·8	0·7 – 2·0	0·8 – 2·0	3,815,436	56,093	20,586
Kyrgyzstan	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	1·0 – 2·3	0·4 – 2·0	0·2 – 0·6	5,688,889	136,020	115,053
Lao People's Democratic Republic	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	6,542,826	176,656	82,541
Latvia	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	1·0 – 2·3	0·9 – 4·5	0·3 – 1·0	1,588,860	196,728	184,915
Lebanon	EMRO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·2 – 5·8	0·1 – 5·1	0·03 – 2·9	5,374,746	288,012	187,985
Lesotho	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	2,046,583	56,251	32,188
Liberia	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	4,367,820	99,547	36,071
Libya	EMRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·4 – 2·4	0·3 – 8·3	0·3 – 4·4	5,993,354	185,937	99,147
Lithuania	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·7 – 1·6	0·8 – 4·1	0·4 – 1·2	2,335,889	267,910	274,606
Luxembourg	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 2·2	0·8 – 3·8	1·0 – 2·9	487,820	41,986	37,304
Madagascar	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	23,547,634	467,824	219,932
Malawi	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	16,622,788	419,801	172,643
Malaysia	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	28,554,996	1,219,709	556,302
Maldives	SEARO	1	2	2	0·1 – 2·4	3·2 – 40·6	20·4 – 199·5	0·2 – 5·8	0·5 – 2·0	0·5 – 1·8	346,561	10,076	7,020
Mali	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	17,156,242	322,320	121,132
Malta	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·6 – 3·4	0·7 – 3·7	0·9 – 1·7	338,084	49,503	31,083
Mauritania	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	3,936,997	93,095	37,472
Mauritius	AFRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·7 – 1·7	0·5 – 1·0	0·7 – 1·3	1,151,454	79,810	41,948
Mexico[a]	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·6 – 1·4	0·6 – 1·2	0·6 – 1·0	118,803,034	4,865,080	3,349,110
Micronesia (Federated States of)	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	99,909	3,099	1,452
Mongolia	WPRO	3	1	1	0·6 – 6·4	2·9 – 30·4	17·9 – 112·7	0·3 – 1·0	0·7 – 3·6	0·4 – 1·1	2,839,472	77,789	41,873
Montenegro	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 2·5	0·5 – 2·3	0·4 – 1·2	540,393	47,817	37,571
Morocco	EMRO	3	3	2	0·6 – 6·4	12·0 – 44·0	20·4 – 199·5	0·3 – 13·8	0·3 – 8·3	0·5 – 1·8	32,257,024	1,308,812	811,675

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		<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years
Mozambique	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	27,040,971	652,825	284,067
Myanmar	SEARO	3	3	2	0·6 – 6·4	12·0 – 44·0	20·4 – 199·5	0·3 – 13·8	0·3 – 8·3	0·5 – 1·8	51,008,443	1,947,664	941,047
Namibia	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	2,372,153	59,498	27,179
Nepal	SEARO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	26,932,007	1,108,584	473,109
Netherlands[a]	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·4 – 2·5	0·7 – 3·2	0·6 – 1·2	13,839,435	1,793,126	1,292,368
New Zealand[a]	WPRO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·3 – 1·9	0·2 – 1·0	1·0 – 2·9	3,855,519	395,022	277,985
Nicaragua	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	5,772,739	177,308	131,985
Niger	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	19,385,709	390,148	123,263
Nigeria	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	177,215,605	3,869,982	1,116,375
Norway[a]	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·4 – 2·3	0·6 – 3·2	0·9 – 1·6	4,359,864	495,272	355,831
Oman	EMRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·4 – 2·4	0·3 – 8·3	0·3 – 4·4	4,374,638	81,784	34,119
Pakistan	EMRO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·3 – 13·8	0·5 – 2·0	0·03 – 2·9	180,437,649	5,703,883	2,783,342
Panama	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·8 – 1·9	0·7 – 1·3	0·7 – 1·3	3,629,258	176,220	123,663
Papua New Guinea	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	7,390,003	168,571	60,747
Paraguay[a]	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	6,239,417	249,269	150,437
Peru	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	29,235,167	1,291,837	849,666
Philippines	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·8 – 2·6	1·2 – 3·4	1·3 – 3·2	96,087,720	3,170,351	1,441,324
Poland	EURO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·6 – 1·4	0·7 – 1·3	0·5 – 0·9	32,614,099	3,285,882	2,711,813
Portugal[a]	EURO	2	2	3	0·2 – 2·4	3·2 – 40·6	27·5 – 223·5	0·4 – 1·0	0·6 – 1·2	0·4 – 1·0	8,197,927	1,102,547	1,049,329
Qatar	EMRO	1	2	1	0·1 – 2·4	3·2 – 40·6	17·9 – 112·7	0·2 – 5·8	0·5 – 2·0	0·03 – 2·9	2,208,909	17,571	8,875
Republic of Korea[a]	WPRO	1	2	2	0·1 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·3	0·6 – 1·1	0·9 – 1·6	43,691,460	3,817,648	2,784,331
Republic of Moldova	EURO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·5 – 1·7	0·6 – 1·1	0·3 – 0·8	3,663,719	229,038	176,140
Romania[a]	EURO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·4 – 1·2	0·8 – 1·6	0·7 – 2·2	16,133,134	1,814,289	1,563,901
Russian Federation	EURO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·6 – 1·9	0·7 – 1·4	0·6 – 1·7	124,282,692	9,823,254	9,350,972
Rwanda	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	11,285,773	226,031	97,862
Saint Lucia	AMRO	2	2	3	0·2 – 2·4	3·2 – 40·6	27·5 – 223·5	0·7 – 1·8	0·9 – 1·7	0·3 – 0·8	168,354	9,300	7,345
Saint Vincent and the Grenadines	AMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·5 – 1·6	0·6 – 1·6	0·4 – 1·1	101,436	4,554	3,472
Samoa	WPRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·4 – 2·4	0·3 – 8·3	0·3 – 4·4	183,115	6,134	3,979
Sao Tome and Principe	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	184,471	3,014	2,859

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		<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years
Saudi Arabia	EMRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·4 – 2·4	0·3 – 8·3	0·3 – 4·4	30,637,590	595,353	307,429
Senegal	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	14,685,452	308,863	134,958
Serbia[a]	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·7 – 4·0	0·7 – 3·2	0·4 – 1·3	7,339,019	883,747	628,209
Seychelles	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·5 – 1·7	1·0 – 2·7	0·7 – 1·8	89,835	3,532	3,104
Sierra Leone	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	6,280,917	136,513	35,754
Singapore[a]	WPRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·8 – 1·9	0·6 – 1·7	1·0 – 2·4	4,949,183	406,058	248,499
Slovakia	EURO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·6 – 1·5	0·8 – 1·5	0·7 – 1·3	4,674,989	453,101	298,168
Slovenia	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·3 – 2·0	0·4 – 2·1	0·7 – 1·3	1,696,025	194,843	176,658
Solomon Islands	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	563,778	14,023	5,790
Somalia	EMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	10,482,472	215,101	89,531
South Africa[a]	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·9 – 2·8	1·0 – 2·8	0·6 – 1·6	51,747,707	1,707,726	1,034,973
South Sudan	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	11,912,304	302,828	124,680
Spain[a]	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 2·2	0·4 – 2·2	0·8 – 2·4	37,455,678	4,334,037	4,331,984
Sri Lanka	SEARO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	18,787,841	1,331,141	596,028
Sudan	EMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	38,895,847	927,381	411,654
Suriname	AMRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	1·0 – 2·3	0·4 – 1·1	0·4 – 0·9	505,587	23,153	14,235
Swaziland	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	1,240,860	32,392	13,718
Sweden	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·5 – 2·8	0·8 – 4·1	0·7 – 1·2	7,829,211	1,120,437	829,778
Switzerland[a]	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 2·5	0·5 – 2·4	0·8 – 2·4	6,801,431	807,308	689,924
Syrian Arab Republic	EMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	17,750,420	485,281	266,712
Taiwan[a,c,d]	WPRO	2	2	3	0·2 – 2·4	3·2 – 40·6	27·5 – 223·5	0·4 – 1·0	0·9 – 1·6	0·4 – 1·0	20,493,314	1,611,597	1,310,215
Tajikistan	EURO	3	3	2	0·6 – 6·4	12·0 – 44·0	20·4 – 199·5	0·3 – 13·8	0·3 – 8·3	0·5 – 1·8	8,226,866	147,597	107,392
Thailand[a]	SEARO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	60,842,743	4,308,895	2,807,721
The former Yugoslav Republic of Macedonia	EURO	1	1	1	0·1 – 2·4	2·9 – 30·4	17·9 – 112·7	0·5 – 2·7	0·4 – 2·1	0·2 – 0·5	1,822,329	157,333	98,791
Timor-Leste	SEARO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	1,118,654	52,375	13,736
Togo	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	7,102,623	151,515	50,440
Tonga	WPRO	2	3	3	0·2 – 2·4	12·0 – 44·0	27·5 – 223·5	0·4 – 2·4	0·3 – 8·3	0·3 – 4·4	99,934	3,513	2,723
Trinidad and Tobago	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·9 – 2·1	1·0 – 1·9	0·7 – 1·3	1,232,079	83,940	44,069
Tunisia	EMRO	2	3	2	0·2 – 2·4	12·0 – 44·0	20·4 – 199·5	0·4 – 2·4	0·3 – 8·3	0·5 – 1·8	10,399,174	502,560	351,820

Country	WHO Region[b]	Analytic Division			Range of Possible Mean Annual Influenza-associated Respiratory Excess Mortality Rates (EMRs) Used in Extrapolation Simulations			Range of Possible Mortality Rate Ratios (MRRs) Used in Extrapolation Simulations			Population Estimates		
		<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years	<65 Years	65-74 Years	≥75 Years
Turkey	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·4 – 1·0	0·9 – 4·5	0·9 – 2·6	72,735,451	3,642,720	2,287,659
Turkmenistan	EURO	3	2	1	0·6 – 6·4	3·2 – 40·6	17·9 – 112·7	0·3 – 13·8	0·5 – 2·0	0·03 – 2·9	5,150,229	132,694	90,579
Uganda	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	38,060,910	671,360	300,113
Ukraine	EURO	2	1	1	0·2 – 2·4	2·9 – 30·4	17·9 – 112·7	0·8 – 1·9	0·4 – 2·1	0·1 – 0·3	37,962,954	3,466,198	3,394,613
United Arab Emirates	EMRO	1	3	3	0·1 – 2·4	12·0 – 44·0	27·5 – 223·5	0·2 – 5·8	0·3 – 8·3	0·3 – 4·4	9,052,768	83,222	20,973
United Kingdom (England and Wales)[a]	EURO	1	1	2	0·1 – 2·4	2·9 – 30·4	20·4 – 199·5	0·7 – 3·7	0·9 – 4·2	1·0 – 1·8	53,222,043	6,353,158	5,140,609
United Republic of Tanzania	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	51,758,314	1,154,373	557,733
United States of America[a]	AMRO	2	2	1	0·2 – 2·4	3·2 – 40·6	17·9 – 112·7	0·5 – 1·1	0·6 – 1·1	0·9 – 2·7	274,195,959	27,456,240	20,121,432
Uruguay[a]	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·5 – 1·3	0·8 – 1·5	0·9 – 1·7	2,936,227	255,712	239,616
Uzbekistan	EURO	3	1	1	0·6 – 6·4	2·9 – 30·4	17·9 – 112·7	0·5 – 1·7	1·0 – 5·0	0·3 – 1·0	28,501,128	767,146	625,214
Vanuatu	WPRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	253,539	7,852	3,261
Venezuela (Bolivarian Republic of)	AMRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·7 – 1·6	0·7 – 1·3	0·8 – 1·4	29,158,541	1,246,905	702,637
Viet Nam	WPRO	2	2	2	0·2 – 2·4	3·2 – 40·6	20·4 – 199·5	0·4 – 2·4	0·5 – 2·0	0·5 – 1·8	87,148,759	3,263,723	3,035,119
Yemen	EMRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	26,084,397	559,609	188,209
Zambia	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	15,740,226	320,425	151,116
Zimbabwe	AFRO	3	3	3	0·6 – 6·4	12·0 – 44·0	27·5 – 223·5	0·3 – 13·8	0·3 – 8·3	0·3 – 4·4	15,140,203	288,852	173,696

[a]EMR-contributing country

[b]WHO Region=World Health Organization Region; AFRO=Sub-Saharan Africa; AMRO=Americas; EMRO=Eastern Mediterranean; EURO=Europe; SEARO=Southeast Asia; WPRO=Western Pacific

[c]The analytic divisions for Hong Kong and Taiwan were based on vital records data from the Census and Statistics Department of the Hong Kong Government and the Ministry of Health and Welfare in Taiwan, as WHO Global Health Estimates did not generate estimates for Hong Kong or Taiwan

[d]Population estimates were derived from the US Census Bureau Estimates for 2015. Population estimates for all other countries were derived from the United Nations Census Estimates for 2015

Appendix Table 6. Estimated annual influenza-associated respiratory deaths and rates by age group and country.

	Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)[a]						Influenza-associated Respiratory Annual Death Estimates[a]					
	<65 Years		65-74 Years		≥75 Years		<65 Years		65-74 Years		≥75 Years	
Country	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Afghanistan	3·8	0·4 – 23·2	37·2	7·8 – 136·5	64·2	8·9 – 180·7	1,190	139 – 7,348	224	47 – 822	129	18 – 363
Albania	0·4	0·1 – 3·2	7·5	0·9 – 32·2	24·9	2·8 – 148·1	11	2 – 81	16	2 – 69	36	4 – 214
Algeria	3·8	0·5 – 23·4	9·3	1·6 – 35·2	64·0	8·9 – 182·3	1,428	170 – 8,730	131	23 – 496	606	84 – 1,727
Angola	3·8	0·4 – 22·5	37·1	7·2 – 137·0	113·8	18·3 – 401·1	938	106 – 5,498	154	30 – 568	187	30 – 659
Antigua and Barbuda	1·2	0·0 – 2·3	0·0	0·0 – 26·5	71·2	0·0 – 142·4	1	0 – 2	0	0 – 1	2	0 – 4
Argentina[b]	3·0	1·8 – 4·1	43·9	28·3 – 59·7	223·5	134·1 – 312·7	1,155	715 – 1,592	1,179	759 – 1,602	4,598	2,759 – 6,435
Armenia	0·4	0·1 – 3·2	7·5	0·7 – 32·7	25·0	3·3 – 149·1	12	2 – 87	11	1 – 48	45	6 – 268
Australia[b]	0·5	0·2 – 0·8	3·4	0·6 – 7·1	20·1	3·9 – 42·9	103	37 – 167	68	13 – 145	315	61 – 671
Austria[b]	1·0	0·4 – 1·8	11·6	4·6 – 19·8	63·6	45·0 – 82·6	71	26 – 126	100	40 – 170	474	335 – 615
Azerbaijan	3·6	0·4 – 22·9	7·4	0·7 – 33·7	25·1	2·9 – 147·7	334	40 – 2,105	20	2 – 91	70	8 – 412
Bahamas	1·4	0·3 – 3·4	9·9	0·0 – 34·6	67·2	8·4 – 168·1	5	1 – 12	2	0 – 7	8	1 – 20
Bahrain	0·4	0·1 – 3·1	8·8	0·0 – 35·2	66·9	9·6 – 191·1	6	1 – 42	2	0 – 8	7	1 – 20
Bangladesh	3·7	0·4 – 22·8	9·4	1·7 – 35·7	24·9	2·4 – 149·7	5,679	671 – 34,930	475	84 – 1,801	737	72 – 4,428
Barbados	2·5	0·4 – 4·9	26·1	4·3 – 47·8	127·5	23·2 – 295·5	6	1 – 12	6	1 – 11	22	4 – 51
Belarus	0·7	0·2 – 1·8	2·6	0·5 – 9·1	1·5	0·5 – 6·9	60	14 – 145	17	3 – 60	10	3 – 46
Belgium	0·8	0·2 – 5·3	9·3	1·6 – 31·9	82·0	11·4 – 209·8	73	16 – 492	97	17 – 334	830	115 – 2,124
Belize	1·2	0·3 – 2·9	22·7	11·3 – 45·3	127·8	21·3 – 298·3	4	1 – 10	2	1 – 4	6	1 – 14
Benin	3·7	0·4 – 22·1	37·4	7·3 – 137·0	112·6	19·6 – 384·2	392	44 – 2,335	87	17 – 319	92	16 – 314
Bhutan	3·7	0·4 – 23·1	36·4	8·1 – 137·7	61·9	6·9 – 178·9	27	3 – 170	9	2 – 34	9	1 – 26
Bolivia (Plurinational State of)	3·7	0·4 – 22·2	37·4	7·6 – 137·7	109·3	18·1 – 395·1	376	44 – 2,231	152	31 – 559	314	52 – 1,135
Bosnia and Herzegovina	0·4	0·1 – 3·1	7·6	0·9 – 32·5	25·5	2·3 – 151·6	14	2 – 100	25	3 – 107	66	6 – 393
Botswana	3·7	0·4 – 22·6	37·6	7·2 – 137·9	111·5	19·6 – 395·2	80	9 – 493	21	4 – 77	29	5 – 101
Brazil	1·4	0·3 – 3·4	18·8	4·8 – 35·6	80·2	14·1 – 188·7	2,698	634 – 6,564	1,911	483 – 3,615	4,933	868 – 11,599
Brunei Darussalam	0·7	0·2 – 5·7	7·9	0·0 – 39·7	65·5	16·4 – 147·5	3	1 – 23	1	0 – 5	4	1 – 9
Bulgaria	1·0	0·2 – 2·4	12·8	2·0 – 45·6	26·9	7·4 – 121·0	56	13 – 136	107	17 – 382	160	44 – 719
Burkina Faso	3·7	0·5 – 21·8	37·5	7·5 – 136·8	113·3	18·6 – 403·5	648	80 – 3,856	120	24 – 438	128	21 – 456
Burundi	3·8	0·5 – 23·1	38·0	7·4 – 140·9	111·8	18·4 – 394·3	417	50 – 2,516	72	14 – 267	97	16 – 342
Cambodia	3·8	0·4 – 22·4	37·2	7·7 – 140·6	111·7	18·4 – 402·1	562	64 – 3,349	168	35 – 635	212	35 – 763

Country	Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)[a]						Influenza-associated Respiratory Annual Death Estimates[a]					
	<65 Years		65-74 Years		≥75 Years		<65 Years		65-74 Years		≥75 Years	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Cameroon	3·7	0·4 – 23·1	37·3	8·0 – 138·9	112·9	18·7 – 400·5	835	96 – 5,226	191	41 – 712	266	44 – 944
Canada[b]	0·4	0·1 – 0·6	6·1	1·7 – 10·5	44·5	19·0 – 70·3	108	45 – 172	201	55 – 347	1,110	474 – 1,754
Cape Verde	3·6	0·4 – 21·5	36·8	9·2 – 138·0	107·9	15·4 – 400·9	18	2 – 107	4	1 – 15	14	2 – 52
Central African Republic	3·7	0·4 – 21·3	37·8	7·7 – 137·4	112·9	20·2 – 391·0	174	21 – 1,003	49	10 – 178	67	12 – 232
Chad	3·7	0·4 – 22·6	36·9	7·0 – 139·6	112·1	18·5 – 380·2	513	60 – 3,101	89	17 – 337	115	19 – 390
Chile[b]	1·4	1·1 – 1·7	30·2	18·1 – 43·7	187·1	108·8 – 269·3	219	170 – 272	344	206 – 497	1,568	912 – 2,256
China, Hong Kong SAR[b,c]	0·4	0·3 – 0·5	11·9	9·5 – 14·5	84·5	66·4 – 103·1	24	18 – 29	69	55 – 84	439	345 – 536
China[b]	0·7	0·2 – 1·2	19·0	5·9 – 33·7	114·0	45·0 – 182·4	8,328	2,079 – 15,229	16,156	4,983 – 28,640	53,038	20,954 – 84,822
Colombia	0·9	0·2 – 2·3	9·8	1·7 – 33·7	51·0	7·1 – 130·5	417	98 – 1,013	214	38 – 734	621	86 – 1,589
Comoros	3·8	0·4 – 21·7	39·2	6·5 – 137·2	119·0	14·9 – 401·5	29	3 – 166	6	1 – 21	8	1 – 27
Congo	3·7	0·4 – 22·6	37·6	7·0 – 139·1	111·2	18·2 – 399·3	166	20 – 1,008	43	8 – 159	61	10 – 219
Costa Rica	0·9	0·2 – 5·8	11·0	1·9 – 40·0	39·3	10·9 – 175·3	38	8 – 252	29	5 – 105	65	18 – 290
Côte d'Ivoire	3·7	0·4 – 22·3	36·9	7·9 – 140·4	111·8	18·8 – 383·6	807	98 – 4,918	191	41 – 726	190	32 – 652
Croatia	0·5	0·1 – 3·2	7·4	1·2 – 26·1	19·1	5·2 – 85·3	16	3 – 109	31	5 – 110	73	20 – 326
Cuba	0·8	0·2 – 2·0	14·1	3·5 – 26·7	64·3	11·4 – 151·2	79	19 – 192	124	31 – 235	458	81 – 1,078
Cyprus	0·4	0·1 – 3·2	7·9	1·1 – 31·7	25·2	1·6 – 149·8	4	1 – 33	7	1 – 28	16	1 – 92
Czech Republic[b]	0·5	0·3 – 0·7	5·5	3·9 – 7·3	20·1	14·3 – 28·0	42	30 – 58	64	46 – 85	148	105 – 207
Democratic People's Republic of Korea	1·0	0·2 – 2·7	9·4	1·6 – 36·0	64·8	8·7 – 187·2	218	47 – 605	153	26 – 586	500	67 – 1,444
Democratic Republic of the Congo	3·7	0·4 – 22·4	37·1	7·5 – 135·5	113·9	19·1 – 415·7	2,801	322 – 16,819	605	123 – 2,210	751	126 – 2,741
Denmark[b]	0·6	0·3 – 0·9	4·1	1·4 – 7·6	50·8	23·0 – 79·8	26	14 – 41	26	9 – 49	216	98 – 339
Djibouti	3·6	0·5 – 22·5	38·3	7·7 – 137·8	108·5	18·1 – 398·0	31	4 – 191	10	2 – 36	12	2 – 44
Dominican Republic	0·9	0·2 – 2·7	9·1	1·7 – 36·1	64·8	8·8 – 185·1	93	21 – 261	37	7 – 146	192	26 – 547
Ecuador	1·5	0·2 – 3·3	14·2	2·5 – 48·5	72·1	12·7 – 169·6	231	33 – 490	92	16 – 315	312	55 – 734
Egypt	3·9	0·4 – 22·9	36·9	7·4 – 135·3	65·1	9·0 – 184·5	3,365	389 – 19,887	1,200	239 – 4,393	996	137 – 2,821
El Salvador	3·7	0·4 – 21·9	37·2	6·5 – 137·8	112·7	18·1 – 379·9	211	25 – 1,231	108	19 – 400	237	38 – 799
Equatorial Guinea	3·8	0·5 – 22·4	37·4	6·2 – 137·1	107·9	24·0 – 395·7	31	4 – 184	6	1 – 22	9	2 – 33
Eritrea	3·6	0·4 – 21·4	36·4	7·7 – 141·9	111·2	18·0 – 414·7	185	21 – 1,090	38	8 – 148	37	6 – 138
Estonia	0·8	0·2 – 2·1	12·1	1·6 – 42·7	16·4	4·9 – 75·3	9	2 – 22	15	2 – 53	20	6 – 92
Ethiopia	3·7	0·4 – 23·2	37·5	7·0 – 139·9	112·7	18·6 – 389·4	3,529	419 – 22,225	898	169 – 3,354	1,202	198 – 4,150

Country	Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)[a]						Influenza-associated Respiratory Annual Death Estimates[a]					
	<65 Years		65-74 Years		≥75 Years		<65 Years		65-74 Years		≥75 Years	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Fiji	2·1	0·4 – 4·5	21·0	5·3 – 36·8	64·6	14·4 – 143·5	18	3 – 38	8	2 – 14	9	2 – 20
Finland	0·2	0·0 – 1·3	1·7	0·3 – 6·2	9·0	2·5 – 40·7	8	2 – 55	11	2 – 40	43	12 – 195
France	0·4	0·1 – 3·0	7·3	1·2 – 26·1	49·3	6·8 – 126·1	231	50 – 1,549	455	75 – 1,627	3,002	417 – 7,680
Gabon	3·7	0·4 – 21·6	36·8	7·4 – 138·1	109·6	17·8 – 405·8	61	7 – 353	20	4 – 75	37	6 – 137
Gambia	3·8	0·5 – 21·5	36·2	9·0 – 138·8	108·4	15·5 – 410·4	74	9 – 418	12	3 – 46	14	2 – 53
Georgia	1·0	0·2 – 2·7	7·7	1·1 – 32·7	24·9	2·4 – 150·8	33	7 – 92	21	3 – 89	72	7 – 436
Germany[b]	0·4	0·1 – 0·6	2·9	0·6 – 5·6	20·8	6·4 – 37·1	229	93 – 371	245	53 – 466	1,820	557 – 3,245
Ghana	3·7	0·5 – 22·3	37·4	8·2 – 136·8	110·4	18·8 – 382·3	978	121 – 5,902	243	53 – 886	312	53 – 1,080
Greece	0·4	0·1 – 2·8	8·2	1·3 – 29·4	36·4	10·0 – 163·6	35	8 – 237	93	15 – 333	442	121 – 1,984
Grenada	2·0	0·0 – 5·0	24·2	0·0 – 48·4	142·3	28·5 – 369·9	2	0 – 5	1	0 – 2	5	1 – 13
Guatemala	3·0	0·4 – 6·3	24·8	6·2 – 46·8	112·2	19·8 – 263·8	459	65 – 972	120	30 – 227	345	61 – 811
Guinea	3·8	0·5 – 22·3	36·6	7·0 – 140·6	112·2	19·5 – 411·8	461	58 – 2,726	104	20 – 399	115	20 – 422
Guinea-Bissau	3·8	0·4 – 21·6	36·4	6·8 – 141·1	110·3	20·7 – 392·9	67	8 – 386	16	3 – 62	16	3 – 57
Guyana	2·6	0·4 – 5·4	22·0	7·3 – 43·9	99·1	18·0 – 225·2	19	3 – 39	6	2 – 12	11	2 – 25
Haiti	3·8	0·5 – 23·2	36·7	7·1 – 135·1	110·6	19·2 – 380·0	385	46 – 2,368	119	23 – 438	190	33 – 653
Honduras	1·0	0·2 – 2·7	7·8	0·9 – 32·8	24·9	2·5 – 143·4	73	16 – 205	18	2 – 76	40	4 – 230
Hungary	0·5	0·1 – 3·4	5·7	0·9 – 20·5	15·4	4·2 – 69·0	41	9 – 277	57	9 – 204	117	32 – 525
Iceland	0·0	0·0 – 1·1	3·9	0·0 – 11·8	50·5	5·1 – 131·4	0	0 – 3	1	0 – 3	10	1 – 26
India[b]	2·1	0·6 – 4·2	35·1	13·4 – 61·5	87·1	33·5 – 149·4	25,741	7,281 – 52,259	17,262	6,567 – 30,247	21,319	8,213 – 36,565
Indonesia	3·8	0·4 – 22·3	9·4	1·6 – 35·5	63·9	8·8 – 186·3	9,279	1,087 – 54,421	858	142 – 3,248	2,678	367 – 7,804
Iran (Islamic Republic of)	0·7	0·2 – 1·6	7·6	1·3 – 26·0	58·7	8·2 – 150·1	496	117 – 1,208	188	33 – 647	891	124 – 2,279
Iraq	3·8	0·4 – 22·1	9·5	1·6 – 36·0	25·5	2·7 – 151·4	1,359	155 – 7,789	70	12 – 265	96	10 – 570
Ireland	0·2	0·0 – 1·7	7·9	1·4 – 28·2	68·2	9·7 – 174·8	10	2 – 70	29	5 – 104	169	24 – 433
Israel[b]	0·2	0·1 – 0·3	3·2	1·7 – 5·0	29·1	20·1 – 39·5	15	10 – 22	16	9 – 25	117	81 – 158
Italy	0·2	0·1 – 1·7	5·0	0·8 – 17·8	29·6	8·1 – 132·7	114	25 – 766	326	54 – 1,167	2,021	551 – 9,072
Jamaica	0·9	0·2 – 5·8	6·5	1·4 – 23·1	52·3	7·7 – 134·5	22	5 – 148	9	2 – 32	61	9 – 157
Japan[b]	0·2	0·2 – 0·3	3·5	2·7 – 4·3	27·5	21·9 – 33·3	207	162 – 258	596	469 – 740	4,427	3,529 – 5,370
Jordan	1·0	0·2 – 2·8	9·5	1·6 – 35·3	64·6	9·2 – 191·7	70	15 – 202	18	3 – 67	63	9 – 187
Kazakhstan	2·4	0·3 – 5·2	10·1	1·8 – 35·0	27·4	7·4 – 122·7	401	57 – 849	68	12 – 235	141	38 – 632

Country	Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)[a]						Influenza-associated Respiratory Annual Death Estimates[a]					
	<65 Years		65-74 Years		≥75 Years		<65 Years		65-74 Years		≥75 Years	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Kenya	3·8	0·4 – 24·1	36·8	7·6 – 138·4	112·3	18·2 – 409·5	1,696	199 – 10,783	321	66 – 1,207	470	76 – 1,714
Kiribati	3·7	0·0 – 23·1	34·7	0·0 – 138·6	78·2	0·0 – 391·2	4	0 – 25	1	0 – 4	1	0 – 5
Kuwait	0·9	0·2 – 5·8	30·3	7·1 – 57·0	140·9	24·3 – 335·2	33	7 – 222	17	4 – 32	29	5 – 69
Kyrgyzstan	1·3	0·3 – 3·3	5·1	0·7 – 19·1	9·6	2·6 – 44·3	76	18 – 185	7	1 – 26	11	3 – 51
Lao People's Democratic Republic	3·7	0·4 – 22·0	37·4	7·4 – 134·7	112·7	19·4 – 382·9	239	29 – 1,441	66	13 – 238	93	16 – 316
Latvia	1·3	0·3 – 3·3	12·2	2·0 – 43·7	15·1	4·3 – 68·7	21	5 – 52	24	4 – 86	28	8 – 127
Lebanon	0·4	0·1 – 3·3	7·6	1·0 – 32·6	25·5	2·7 – 154·8	23	4 – 176	22	3 – 94	48	5 – 291
Lesotho	3·8	0·4 – 23·1	37·3	7·1 – 140·4	111·8	18·6 – 400·8	77	9 – 473	21	4 – 79	36	6 – 129
Liberia	3·8	0·5 – 22·0	37·2	8·0 – 134·6	113·7	19·4 – 421·6	168	20 – 959	37	8 – 134	41	7 – 152
Libya	1·0	0·2 – 2·7	37·1	7·5 – 139·3	110·9	19·2 – 377·3	57	12 – 159	69	14 – 259	110	19 – 374
Lithuania	0·9	0·2 – 2·3	11·2	1·9 – 39·9	19·3	5·5 – 87·4	22	5 – 54	30	5 – 107	53	15 – 240
Luxembourg	0·4	0·0 – 2·3	9·5	2·4 – 35·7	45·6	13·4 – 206·5	2	0 – 11	4	1 – 15	17	5 – 77
Madagascar	3·8	0·4 – 23·3	36·1	7·9 – 138·9	112·1	19·6 – 389·7	886	96 – 5,484	169	37 – 650	247	43 – 857
Malawi	3·8	0·4 – 22·4	37·2	7·4 – 138·9	111·8	18·5 – 391·0	627	71 – 3,729	156	31 – 583	193	32 – 675
Malaysia	3·8	0·4 – 22·0	37·9	7·8 – 136·0	111·9	18·5 – 424·1	1,072	123 – 6,278	462	95 – 1,659	623	103 – 2,359
Maldives	0·6	0·0 – 3·2	9·9	0·0 – 39·7	71·2	14·2 – 185·2	2	0 – 11	1	0 – 4	5	1 – 13
Mali	3·7	0·4 – 22·0	37·9	7·8 – 140·5	108·1	19·0 – 391·3	634	72 – 3,770	122	25 – 453	131	23 – 474
Malta	0·6	0·0 – 3·5	10·1	2·0 – 36·4	83·6	12·9 – 212·3	2	0 – 12	5	1 – 18	26	4 – 66
Mauritania	3·8	0·4 – 23·0	36·5	7·5 – 138·6	113·4	18·7 – 384·3	148	17 – 904	34	7 – 129	43	7 – 144
Mauritius	1·0	0·3 – 2·4	7·5	1·3 – 25·1	64·4	9·5 – 164·5	11	3 – 28	6	1 – 20	27	4 – 69
Mexico[b]	1·4	0·9 – 2·0	19·2	10·1 – 28·1	68·2	25·6 – 116·2	1,685	1,019 – 2,378	935	491 – 1,369	2,283	859 – 3,892
Micronesia (Federated States of)	4·0	0·0 – 23·0	32·3	0·0 – 129·1	137·7	0·0 – 413·2	4	0 – 23	1	0 – 4	2	0 – 6
Mongolia	1·5	0·2 – 3·3	10·3	1·3 – 34·7	16·7	4·8 – 78·9	44	6 – 93	8	1 – 27	7	2 – 33
Montenegro	0·4	0·0 – 2·6	6·3	0·0 – 20·9	18·6	5·3 – 82·6	2	0 – 14	3	0 – 10	7	2 – 31
Morocco	3·7	0·4 – 22·3	37·2	7·1 – 138·1	64·6	8·6 – 186·7	1,195	134 – 7,202	487	93 – 1,808	525	70 – 1,515
Mozambique	3·8	0·5 – 22·6	37·3	7·2 – 133·7	113·0	18·7 – 384·1	1,033	123 – 6,110	244	47 – 873	321	53 – 1,091
Myanmar	3·7	0·4 – 23·0	37·2	7·3 – 138·7	64·4	8·7 – 186·9	1,906	229 – 11,743	724	143 – 2,701	606	82 – 1,759
Namibia	3·7	0·4 – 23·1	37·0	8·4 – 137·9	114·1	18·4 – 393·7	88	10 – 548	22	5 – 82	31	5 – 107
Nepal	3·9	0·5 – 23·7	36·9	7·4 – 134·9	114·8	19·9 – 387·4	1,040	126 – 6,380	410	82 – 1,495	543	94 – 1,833

Country	Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)[a]						Influenza-associated Respiratory Annual Death Estimates[a]					
	<65 Years		65-74 Years		≥75 Years		<65 Years		65-74 Years		≥75 Years	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Netherlands[b]	0·4	0·2 – 0·6	12·6	7·4 – 17·7	91·2	52·4 – 132·2	53	28 – 79	226	133 – 317	1,179	678 – 1,708
New Zealand[b]	0·3	0·2 – 0·5	4·7	2·6 – 7·4	36·7	21·4 – 52·0	12	8 – 18	19	10 – 29	102	59 – 145
Nicaragua	0·9	0·2 – 2·7	9·6	1·7 – 36·1	64·4	8·3 – 187·9	54	12 – 154	17	3 – 64	85	11 – 248
Niger	3·7	0·5 – 22·3	37·7	7·2 – 139·4	112·8	16·2 – 382·1	710	93 – 4,319	147	28 – 544	139	20 – 471
Nigeria	3·8	0·4 – 21·9	37·0	7·8 – 142·2	113·9	18·5 – 409·6	6,653	746 – 38,790	1,433	301 – 5,502	1,271	207 – 4,572
Norway[b]	0·9	0·6 – 1·3	8·8	6·0 – 14·2	74·6	60·3 – 92·1	38	25 – 55	44	29 – 70	265	215 – 328
Oman	1·0	0·2 – 2·7	37·9	7·3 – 134·5	108·4	17·6 – 384·0	42	9 – 120	31	6 – 110	37	6 – 131
Pakistan	3·7	0·4 – 22·5	9·3	1·7 – 35·6	25·2	2·2 – 146·2	6,609	783 – 40,547	533	96 – 2,028	701	60 – 4,068
Panama	1·1	0·2 – 2·6	9·1	1·7 – 31·8	63·9	8·9 – 164·2	40	9 – 96	16	3 – 56	79	11 – 203
Papua New Guinea	3·7	0·5 – 22·5	38·0	7·7 – 135·8	111·9	19·8 – 403·4	277	34 – 1,663	64	13 – 229	68	12 – 245
Paraguay[b]	2·2	0·8 – 3·8	24·9	12·5 – 39·8	116·0	39·8 – 204·7	135	50 – 236	62	31 – 99	174	60 – 308
Peru	3·7	0·4 – 22·8	37·3	8·1 – 140·3	112·3	18·6 – 393·1	1,080	125 – 6,657	482	104 – 1,813	954	158 – 3,340
Philippines	4·0	0·6 – 8·5	50·8	12·9 – 96·1	225·0	39·6 – 529·0	3,878	549 – 8,211	1,612	408 – 3,048	3,243	571 – 7,624
Poland	0·8	0·2 – 2·0	8·7	1·6 – 29·9	45·8	6·4 – 117·0	266	63 – 647	287	51 – 984	1,241	173 – 3,174
Portugal[b]	0·6	0·3 – 0·8	10·3	3·8 – 16·7	92·0	48·1 – 138·0	47	27 – 67	114	42 – 184	966	505 – 1,448
Qatar	0·5	0·1 – 3·3	11·4	0·0 – 34·1	22·5	0·0 – 146·5	10	2 – 73	2	0 – 6	2	0 – 13
Republic of Korea[b]	0·1	0·1 – 0·2	3·7	2·0 – 5·7	24·7	11·8 – 39·5	57	28 – 86	141	75 – 220	688	329 – 1,099
Republic of Moldova	2·6	0·4 – 5·5	7·9	1·3 – 27·1	13·1	3·4 – 57·4	95	13 – 202	18	3 – 62	23	6 – 101
Romania[b]	0·6	0·4 – 0·8	6·7	4·7 – 8·9	20·2	13·2 – 27·6	97	67 – 135	122	84 – 161	316	207 – 432
Russian Federation	2·9	0·4 – 6·2	9·6	1·7 – 33·1	26·5	7·2 – 119·0	3,658	517 – 7,745	946	168 – 3,248	2,480	676 – 11,130
Rwanda	3·8	0·4 – 22·2	37·2	8·0 – 136·3	111·4	18·4 – 406·7	430	49 – 2,508	84	18 – 308	109	18 – 398
Saint Lucia	1·2	0·0 – 2·4	10·8	0·0 – 43·0	54·5	13·6 – 136·1	2	0 – 4	1	0 – 4	4	1 – 10
Saint Vincent and the Grenadines	2·0	0·0 – 4·9	22·0	0·0 – 43·9	86·4	0·0 – 172·8	2	0 – 5	1	0 – 2	3	0 – 6
Samoa	1·1	0·0 – 2·7	32·6	0·0 – 130·4	100·5	25·1 – 402·1	2	0 – 5	2	0 – 8	4	1 – 16
Sao Tome and Principe	3·8	0·5 – 23·3	33·2	0·0 – 132·7	104·9	35·0 – 384·7	7	1 – 43	1	0 – 4	3	1 – 11
Saudi Arabia	0·9	0·2 – 2·7	37·3	7·2 – 134·0	111·6	19·2 – 397·2	288	63 – 828	222	43 – 798	343	59 – 1,221
Senegal	3·7	0·5 – 22·3	36·6	7·4 – 135·7	111·9	17·8 – 388·3	544	67 – 3,278	113	23 – 419	151	24 – 524
Serbia[b]	0·7	0·3 – 1·1	6·5	2·6 – 11·4	17·4	7·6 – 29·9	49	23 – 81	58	23 – 101	110	48 – 188
Seychelles	2·2	0·0 – 5·6	28·3	0·0 – 84·9	128·9	32·2 – 289·9	2	0 – 5	1	0 – 3	4	1 – 9

Country	Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)[a]						Influenza-associated Respiratory Annual Death Estimates[a]					
	<65 Years		65-74 Years		≥75 Years		<65 Years		65-74 Years		≥75 Years	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Sierra Leone	3·6	0·5 – 22·3	36·6	7·3 – 137·7	111·9	16·8 – 386·0	229	29 – 1,403	50	10 – 188	40	6 – 138
Singapore[b]	1·5	1·2 – 1·8	39·5	31·2 – 47·6	188·6	155·7 – 217·1	73	57 – 87	160	127 – 193	469	387 – 539
Slovakia	0·9	0·2 – 2·2	10·2	1·8 – 35·1	65·4	9·1 – 167·0	42	10 – 102	46	8 – 159	195	27 – 498
Slovenia	0·3	0·1 – 2·0	5·6	1·0 – 20·5	63·4	9·1 – 162·5	5	1 – 34	11	2 – 40	112	16 – 287
Solomon Islands	3·7	0·4 – 21·6	35·7	7·1 – 135·5	103·6	17·3 – 414·5	21	2 – 122	5	1 – 19	6	1 – 24
Somalia	3·8	0·4 – 23·2	37·2	7·4 – 140·0	110·6	17·9 – 418·9	400	45 – 2,430	80	16 – 301	99	16 – 375
South Africa[b]	5·1	4·4 – 6·0	37·4	29·9 – 45·3	123·1	108·1 – 137·8	2,661	2,258 – 3,110	638	511 – 773	1,274	1,118 – 1,426
South Sudan	3·7	0·4 – 22·6	37·0	7·3 – 136·1	110·7	20·1 – 383·4	446	51 – 2,687	112	22 – 412	138	25 – 478
Spain[b]	0·3	0·2 – 0·4	6·8	3·7 – 9·9	54·5	25·9 – 85·4	121	77 – 166	293	159 – 431	2,360	1,121 – 3,702
Sri Lanka	0·9	0·2 – 2·7	9·4	1·6 – 36·1	64·3	8·4 – 186·9	177	40 – 512	125	21 – 480	384	50 – 1,114
Sudan	3·6	0·4 – 22·8	36·4	7·9 – 139·2	113·1	18·7 – 392·1	1,411	172 – 8,857	338	73 – 1,291	466	77 – 1,614
Suriname	1·4	0·4 – 3·4	17·3	4·3 – 30·2	63·2	14·0 – 154·5	7	2 – 17	4	1 – 7	9	2 – 22
Swaziland	3·8	0·5 – 22·2	37·0	6·2 – 138·9	116·6	21·9 – 386·5	47	6 – 275	12	2 – 45	16	3 – 53
Sweden	0·4	0·1 – 2·8	11·2	1·9 – 40·1	59·7	8·3 – 152·7	33	7 – 220	125	21 – 449	495	69 – 1,267
Switzerland[b]	0·3	0·3 – 0·4	4·7	3·5 – 6·0	33·2	21·4 – 46·0	23	19 – 28	38	28 – 49	229	148 – 317
Syrian Arab Republic	1·0	0·2 – 2·7	9·3	1·6 – 35·9	64·1	8·2 – 184·1	169	35 – 471	45	8 – 174	171	22 – 491
Taiwan[b,c,d]	0·2	0·1 – 0·3	3·4	1·7 – 5·6	33·1	21·2 – 46·7	33	17 – 55	54	28 – 90	434	277 – 612
Tajikistan	3·7	0·4 – 21·7	37·3	7·5 – 136·9	64·3	9·3 – 188·1	309	35 – 1,783	55	11 – 202	69	10 – 202
Thailand[b]	1·3	0·1 – 3·6	22·6	1·7 – 60·5	111·7	8·0 – 288·4	783	49 – 2,176	976	72 – 2,607	3,136	224 – 8,097
The former Yugoslav Republic of Macedonia	0·4	0·1 – 2·7	5·7	0·6 – 20·3	8·1	2·0 – 38·5	7	2 – 49	9	1 – 32	8	2 – 38
Timor-Leste	3·7	0·4 – 22·4	36·3	7·6 – 137·5	116·5	14·6 – 393·1	42	5 – 251	19	4 – 72	16	2 – 54
Togo	3·8	0·4 – 21·5	37·6	7·3 – 138·6	113·0	19·8 – 394·5	269	31 – 1,527	57	11 – 210	57	10 – 199
Tonga	1·0	0·0 – 3·0	28·5	0·0 – 142·3	110·2	0·0 – 404·0	1	0 – 3	1	0 – 5	3	0 – 11
Trinidad and Tobago	1·2	0·3 – 3·0	13·1	2·4 – 44·1	63·5	9·1 – 165·6	15	4 – 37	11	2 – 37	28	4 – 73
Tunisia	1·0	0·2 – 2·7	37·0	8·0 – 139·7	64·8	9·1 – 187·0	99	21 – 281	186	40 – 702	228	32 – 658
Turkey	0·6	0·1 – 1·4	12·2	2·0 – 43·6	40·8	11·1 – 183·1	425	100 – 1,033	444	73 – 1,588	933	255 – 4,188
Turkmenistan	3·8	0·4 – 21·6	9·8	1·5 – 36·9	24·3	2·2 – 150·1	194	23 – 1,111	13	2 – 49	22	2 – 136
Uganda	3·7	0·5 – 22·3	36·9	7·9 – 136·7	112·0	19·3 – 399·5	1,403	172 – 8,495	248	53 – 918	336	58 – 1,199
Ukraine	1·1	0·3 – 2·6	5·7	1·0 – 20·5	4·7	1·3 – 21·2	411	97 – 1,000	198	33 – 709	161	44 – 721

Country	Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)[a]						Influenza-associated Respiratory Annual Death Estimates[a]					
	<65 Years		65-74 Years		≥75 Years		<65 Years		65-74 Years		≥75 Years	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
United Arab Emirates	0·4	0·1 – 3·3	37·2	7·2 – 137·0	114·4	19·1 – 405·4	40	6 – 303	31	6 – 114	24	4 – 85
United Kingdom (England and Wales)[b]	2·1	0·1 – 6·9	15·1	0·9 – 48·8	62·5	7·0 – 154·3	1,097	56 – 3,670	958	58 – 3,100	3,214	361 – 7,933
United Republic of Tanzania	3·8	0·4 – 22·5	37·0	7·3 – 137·9	113·3	19·4 – 399·5	1,950	229 – 11,645	427	84 – 1,592	632	108 – 2,228
United States of America[b]	0·6	0·4 – 0·7	8·6	6·6 – 10·6	49·3	37·1 – 61·9	1,523	1,187 – 1,880	2,354	1,802 – 2,923	9,929	7,457 – 12,460
Uruguay[b]	1·8	0·4 – 9·1	31·9	5·0 – 142·6	169·2	21·2 – 585·4	52	11 – 266	82	13 – 365	405	51 – 1,403
Uzbekistan	2·7	0·4 – 5·6	13·4	2·2 – 48·1	15·4	4·2 – 69·3	760	107 – 1,609	103	17 – 369	96	26 – 433
Vanuatu	3·9	0·4 – 22·5	38·2	12·7 – 127·7	122·7	30·7 – 398·7	10	1 – 57	3	1 – 10	4	1 – 13
Venezuela (Bolivarian Republic of)	0·9	0·2 – 2·3	9·1	1·6 – 31·4	70·2	9·8 – 179·5	273	64 – 663	114	20 – 392	493	69 – 1,261
Viet Nam	1·0	0·2 – 2·6	9·3	1·6 – 35·8	63·6	8·9 – 185·1	829	177 – 2,306	304	53 – 1,169	1,932	269 – 5,618
Yemen	3·7	0·4 – 22·2	37·7	7·7 – 130·8	112·6	19·7 – 385·2	976	114 – 5,786	211	43 – 732	212	37 – 725
Zambia	3·8	0·4 – 22·3	37·1	7·2 – 137·3	113·8	19·2 – 393·1	591	70 – 3,515	119	23 – 440	172	29 – 594
Zimbabwe	3·7	0·4 – 22·1	36·4	6·9 – 139·9	111·1	19·6 – 400·1	555	66 – 3,345	105	20 – 404	193	34 – 695

[a]The estimated annual death interval estimate for each country was calculated from the Bayesian Hierarchical extrapolation model using influenza-associated excess mortality information from all excess mortality rate (EMR)-contributing countries

[b]EMR-contributing country; extrapolated estimates were replaced with mean annual influenza-associated respiratory EMRs and death estimates

[c]The analytic divisions for Hong Kong and Taiwan were based on vital records data from the Census and Statistics Department of the Hong Kong Government and the Ministry of Health and Welfare in Taiwan, as WHO Global Health Estimates did not generate estimates for Hong Kong or Taiwan

[d]Population estimates were derived from the US Census Bureau Estimates for 2015. Population estimates for all other countries were derived from the United Nations Census Estimates for 2015

Appendix Table 7. Estimated annual influenza-associated respiratory death median, interval, and rate per 100,000 population by age group, World Health Organization regions, and World Bank income classification.

	<65 Years					65-74 Years				
	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]
	Median	95% Credible Interval	Median	95% Credible Interval		Median	95% Credible Interval	Median	95% Credible Interval	
Worldwide	175,303	67,255 – 342,576	2·6	1·0 – 5·1	42%	72,720	48,810 – 102,187	19·8	13·3 – 27·8	17%
World Health Organization Regions										
Sub-Saharan Africa	51,767	9,607 – 127,569	5·4	1·0 – 13·3	29%	8,841	2,648 – 17,744	40·1	12·0 – 80·4	13%
Americas	12,778	7,027 – 20,203	1·4	0·8 – 2·3	8%	9,160	6,236 – 12,776	15·4	10·5 – 21·5	13%
Europe	10,476	4,179 – 19,518	1·4	0·5 – 2·5	6%	6,566	3,732 – 12,753	8·8	5·0 – 17·2	9%
Eastern Mediterranean	23,648	4,468 – 71,208	3·8	0·7 – 11·6	13%	4,753	1,349 – 9,905	25·9	7·4 – 54·1	7%
South-East Asia	51,412	21,044 – 119,561	2·8	1·2 – 6·6	32%	21,782	10,499 – 35,014	29·5	14·2 – 47·5	30%
Western Pacific	16,951	7,197 – 28,946	1·0	0·4 – 1·7	10%	20,425	8,903 – 33,078	17·1	7·4 – 27·7	28%
World Bank Income Classifications										
High Income	9,531	5,312 – 16,208	0·9	0·5 – 1·5	6%	9,639	7,161 – 14,078	8·2	6·1 – 12·0	13%
Upper Middle Income	30,848	17,221 – 48,991	1·4	0·8 – 2·2	18%	26,328	14,242 – 39,974	19·6	10·6 – 29·8	36%
Lower Middle Income	83,604	30,191 – 184,009	3·3	1·2 – 7·3	49%	28,442	15,467 – 43,723	30·7	16·7 – 47·3	39%
Low Income	45,848	6,731 – 119,752	5·3	0·8 – 13·9	26%	7,793	2,047 – 15,378	34·0	8·9 – 67·0	11%

	≥75 Years					All Age				
	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]
	Median	95% Credible Interval	Median	95% Credible Interval		Median	95% Credible Interval	Median	95% Credible Interval	
Worldwide	172,420	122,876 – 237,933	72·0	51·3 – 99·4	41%	409,111	291,243 – 645,832	5·6	4·0 – 8·8	--
World Health Organization Regions										
Sub-Saharan Africa	11,874	3,477 – 27,502	123·9	36·3 – 286·9	7%	69,359	27,813 – 163,074	7·0	2·8 – 16·5	17%
Americas	29,908	21,624 – 43,777	72·2	52·2 – 105·7	17%	51,674	41,007 – 71,710	5·2	4·2 – 7·3	12%
Europe	27,509	15,679 – 47,438	41·0	23·4 – 70·7	16%	44,774	28,457 – 72,627	4·9	3·1 – 8·0	11%
Eastern Mediterranean	5,777	2,035 – 12,114	61·9	21·8 – 129·9	3%	33,528	13,350 – 86,490	5·2	2·1 – 13·4	8%
South-East Asia	30,936	16,602 – 48,618	83·0	44·6 – 130·5	18%	105,167	68,258 – 178,049	5·5	3·5 – 9·2	25%
Western Pacific	66,529	33,858 – 99,617	89·0	45·3 – 133·2	38%	103,728	67,728 – 141,436	5·5	3·6 – 7·5	25%
World Bank Income Classifications										
High Income	45,372	34,309 – 59,355	44·8	33·9 – 58·6	26%	64,680	51,083 – 83,623	4·9	3·9 – 6·4	16%
Upper Middle Income	78,997	44,854 – 113,418	100·1	56·8 – 143·7	45%	136,017	97,776 – 181,157	5·5	4·0 – 7·3	32%
Lower Middle Income	38,418	21,438 – 64,775	79·4	44·3 – 133·9	23%	148,105	90,738 – 270,831	5·6	3·4 – 10·2	36%
Low Income	10,099	2,980 – 22,685	93·2	27·5 – 209·4	6%	60,979	22,143 – 150,010	6·8	2·5 – 16·7	15%

[a]After applying extrapolation approach to all countries, excess mortality rate (EMR)-contributing country extrapolated estimates were replaced with mean annual influenza-associated respiratory EMRs and death estimates, except for Brazil and Kenya

[b]Estimates do not add across all age groups as age specific models were run separately and were not additive. Estimated proportions were calculated for each of 5,000 extrapolation simulations and the median proportion from the 5,000 simulations is presented

Appendix Table 8. Estimated annual influenza-associated respiratory death median, interval, and rate per 100,000 population by age group and analytic division.

	<65 Years					65-74 Years				
	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]
	Median	95% Credible Interval	Median	95% Credible Interval		Median	95% Credible Interval	Median	95% Credible Interval	
Worldwide	175,303	67,255 – 342,576	2·6	1·0 – 5·1	42%	72,720	48,810 – 102,187	19·8	13·3 – 27·8	17%
Analytic Division 1	12,116	5,448 – 20,021	0·7	0·3 – 1·1	7%	5,045	2,597 – 11,150	8·2	4·2 – 18·1	7%
Analytic Division 2	11,278	5,354 – 22,343	0·9	0·4 – 1·9	7%	26,564	13,190 – 44,018	13·5	6·7 – 22·3	37%
Analytic Division 3	150,629	44,798 – 319,410	4·1	1·2 – 8·7	86%	39,964	22,205 – 60,925	36·8	20·5 – 56·1	56%

	≥75 Years					All Age				
	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]	Influenza-associated Respiratory Annual Deaths[a]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[a]		Estimated Proportion of Total Influenza-associated Respiratory Deaths[b]
	Median	95% Credible Interval	Median	95% Credible Interval		Median	95% Credible Interval	Median	95% Credible Interval	
Worldwide	172,420	122,876 – 237,933	72·0	51·3 – 99·4	41%	409,111	291,243 – 645,832	5·6	4·0 – 8·8	--
Analytic Division 1	81,215	47,266 – 120,236	65·6	38·2 – 97·1	47%	98,457	63,448 – 139,923	4·8	3·1 – 6·9	24%
Analytic Division 2	28,301	12,343 – 56,575	62·6	27·3 – 125·1	17%	67,601	43,252 – 104,490	4·7	3·0 – 7·2	17%
Analytic Division 3	61,540	36,791 – 99,946	87·4	52·3 – 141·9	36%	243,743	138,766 – 457,695	6·3	3·6 – 11·9	60%

[a]After applying extrapolation approach to all countries, excess mortality rate (EMR)-contributing country extrapolated estimates were replaced with mean annual influenza-associated respiratory EMRs and death estimates, except for Brazil and Kenya

[b]Estimates do not add across all age groups as age specific models were run separately and were not additive. Estimated proportions were calculated for each of 5,000 extrapolation simulations and the median proportion from the 5,000 simulations is presented

Appendix Table 9. Proportion of median influenza-associated respiratory death estimates derived from excess mortality rate estimates from (EMR)-contributing countries or derived from extrapolation model by age group, analytic divisions, World Health Organization regions, and World Bank income classification.

	<5 Years[a]						<65 Years					
	Country-specific EMRs			Extrapolation Model			Country-specific EMRs			Extrapolation Model		
	Number of Countries[b]	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths	Number of Countries	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths	Number of Countries[c]	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths	Number of Countries	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths
Worldwide	--	--	--	--		--	31	45,172	27%	154	128,749	73%
Analytic Divisions												
Analytic Division 1	--	--	--	--	--	--	18	10,994	93%	28	814	7%
Analytic Division 2	--	--	--	--	--	--	8	3,590	32%	38	7,710	68%
Analytic Division 3	3	12,706	29%	89	31,622	71%	5	30,512	21%	88	118,962	79%
World Health Organization Regions												
Sub-Saharan Africa	1	514	3%	44	15,800	97%	1	2,661	5%	46	49,048	95%
Americas	0	0	0%	11	792	100%	7	4,901	39%	26	7,842	61%
Europe	1	1	1%	6	500	99%	13	1,914	19%	37	8,467	81%
Eastern Mediterranean	0	0	0%	10	6,274	100%	0	0	0%	21	23,648	100%
South-East Asia	1	12,187	73%	7	4,453	27%	2	26,578	54%	9	23,047	46%
Western Pacific	0	0	0%	11	1,741	100%	8	8,820	53%	15	7,899	47%
World Bank Income Classifications												
High Income	0	0	0%	1	9	100%	22	4,206	45%	31	5,326	55%
Upper Middle Income	2	515	22%	13	2,013	78%	7	14,826	49%	43	15,779	51%
Lower Middle Income	1	12,187	45%	41	15,342	55%	2	25,886	32%	46	56,387	68%
Low Income	0	0	0%	34	13,281	100%	0	0	0%	34	45,848	100%

	65-74 Years						≥75 Years					
	Country-specific EMRs			Extrapolation Model			Country-specific EMRs			Extrapolation Model		
	Number of Countries[c]	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths	Number of Countries	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths	Number of Countries[c]	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths	Number of Countries	Median Influenza-Associated Annual Respiratory Deaths	Proportion of Estimated Influenza-Associated Respiratory Deaths
Worldwide	31	43,811	61%	154	27,456	39%	31	117,561	68%	154	53,911	32%
Analytic Divisions												
Analytic Division 1	13	2,635	54%	33	2,288	46%	11	69,860	88%	35	8,997	12%
Analytic Division 2	12	20,741	80%	34	5,052	20%	11	10,401	37%	35	17,773	63%
Analytic Division 3	6	20,380	51%	87	18,618	49%	9	37,139	61%	84	24,761	39%
World Health Organization Regions												
Sub-Saharan Africa	1	638	7%	46	8,209	93%	1	1,274	11%	46	10,590	89%
Americas	7	5,185	57%	26	3,946	43%	7	20,151	67%	26	9,950	33%
Europe	13	2,317	36%	37	4,078	64%	13	11,475	43%	37	15,847	57%
Eastern Mediterranean	0	0	0%	21	4,753	100%	0	0	0%	21	5,777	100%
South-East Asia	2	18,313	85%	9	3,186	15%	2	24,507	80%	9	6,055	20%
Western Pacific	8	17,248	85%	15	2,959	15%	8	59,974	90%	15	6,388	10%
World Bank Income Classifications												
High Income	22	6,265	66%	31	3,243	34%	22	31,066	61%	31	14,095	31%
Upper Middle Income	7	20,193	77%	43	5,772	23%	7	64,822	82%	43	13,661	18%
Lower Middle Income	2	17,322	61%	46	10,738	39%	2	21,509	56%	46	16,683	44%
Low Income	0	0	0%	34	7,793	100%	0	0	0%	34	10,099	100%

[a]For the <5 year analysis, the overall estimate of influenza-associated respiratory deaths was for 92 countries, which fell into the 3rd and 4th quartiles (analytic division 3), when the Global Health Estimate (GHE) rates for respiratory infection mortality rates for children <5 years of age were ranked. Quartiles were generated from 183 countries with available WHO GHE respiratory infection mortality rates for children <5 years of age

[b]There were four EMR-contributing countries in the <5 year analysis, however, in overall worldwide estimate of influenza-associated respiratory deaths for children <5 years, one EMR-contributing country (Kenya) was not replaced because the estimate was not nationally representative

[c]There were 33 EMR-contributing countries, however, in the overall worldwide estimate of influenza-associated respiratory deaths for each of the age groups, two EMR-contributing countries (South Brazil and Kenya) were not replaced because the estimate was not nationally representative

Appendix Table 10. Range of possible mortality rate ratios (MRRs) for extrapolation simulations, population estimates, and estimated annual influenza-associated respiratory death interval and rate for children less than 5 years of age by country.

Country	WHO Region[b]	Range of Possible Mortality Rate Ratios (MRRs)	Population Estimate, <5 Years of Age	Influenza-associated Respiratory Annual Death Estimates		Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)	
				Median	95% Credible Interval	Median	95% Credible Interval
Overall Estimate[a]		--	443,893,900	44,888	9,243 – 105,690	10·1	2·1 – 23·8
Afghanistan	EMRO	0·3 – 13·0	4,950,250	334	5 – 2,156	6·7	0·1 – 43·6
Algeria	AFRO	0·3 – 13·0	4,589,813	313	4 – 2,026	6·8	0·1 – 44·1
Angola	AFRO	0·3 – 13·0	4,717,892	323	4 – 1,932	6·8	0·1 – 41·0
Azerbaijan	EURO	0·3 – 13·0	930,423	62	1 – 410	6·7	0·1 – 44·1
Bangladesh	SEARO	0·3 – 13·0	15,331,344	1,038	14 – 6,408	6·8	0·1 – 41·8
Benin	AFRO	0·3 – 13·0	1,707,733	116	1 – 762	6·8	0·1 – 44·6
Bhutan	SEARO	0·3 – 13·0	65,934	4	0 – 29	6·1	0·0 – 44·0
Bolivia (Plurinational State of)	AMRO	0·3 – 13·0	1,185,563	81	1 – 500	6·8	0·1 – 42·2
Botswana	AFRO	0·3 – 13·0	266,262	18	0 – 115	6·8	0·0 – 43·2
Burkina Faso	AFRO	0·3 – 13·0	3,143,912	215	3 – 1,319	6·8	0·1 – 42·0
Burundi	AFRO	0·3 – 13·0	2,061,897	141	2 – 876	6·8	0·1 – 42·5
Cambodia	WPRO	0·3 – 13·0	1,771,553	121	2 – 747	6·8	0·1 – 42·2
Cameroon	AFRO	0·3 – 13·0	3,737,925	247	3 – 1,632	6·6	0·1 – 43·7
Cape Verde	AFRO	0·3 – 13·0	53,589	4	0 – 23	7·5	0·0 – 42·9
Central African Republic	AFRO	0·3 – 13·0	708,095	48	1 – 308	6·8	0·1 – 43·5
Chad	AFRO	0·3 – 13·0	2,632,347	171	3 – 1,134	6·5	0·1 – 43·1
Comoros	AFRO	0·3 – 13·0	119,289	8	0 – 51	6·7	0·0 – 42·8
Congo	AFRO	0·3 – 13·0	759,042	50	1 – 330	6·6	0·1 – 43·5
Côte d'Ivoire	AFRO	0·3 – 13·0	3,667,067	245	3 – 1,612	6·7	0·1 – 44·0
Democratic People's Republic of Korea	SEARO	0·3 – 13·0	1,747,397	119	2 – 754	6·8	0·1 – 43·2
Democratic Republic of the Congo	AFRO	0·3 – 13·0	13,875,564	929	12 – 5,917	6·7	0·1 – 42·6
Djibouti	EMRO	0·3 – 13·0	102,054	7	0 – 45	6·9	0·0 – 44·1
Dominican Republic	AMRO	0·3 – 13·0	1,062,223	72	1 – 466	6·8	0·1 – 43·9
Ecuador	AMRO	0·4 – 0·9	1,610,333	48	1 – 125	3·0	0·1 – 7·8
Egypt	EMRO	0·3 – 13·0	12,116,075	825	11 – 5,179	6·8	0·1 – 42·7
El Salvador	AMRO	0·3 – 13·0	519,884	35	0 – 218	6·7	0·0 – 41·9
Equatorial Guinea	AFRO	0·3 – 13·0	128,218	9	0 – 55	7·0	0·0 – 42·9
Eritrea	AFRO	0·3 – 13·0	814,756	55	1 – 347	6·8	0·1 – 42·6
Ethiopia	AFRO	0·3 – 13·0	14,601,687	973	13 – 6,630	6·7	0·1 – 45·4
Fiji	WPRO	0·4 – 0·9	88,080	3	0 – 7	3·4	0·0 – 7·9
Gabon	AFRO	0·3 – 13·0	239,080	16	0 – 104	6·7	0·0 – 43·5
Gambia	AFRO	0·3 – 13·0	366,225	25	0 – 156	6·8	0·0 – 42·6
Ghana	AFRO	0·3 – 13·0	4,055,985	268	4 – 1,741	6·6	0·1 – 42·9
Guatemala	AMRO	0·7 – 1·8	2,089,433	120	2 – 311	5·7	0·1 – 14·9
Guinea	AFRO	0·3 – 13·0	2,045,642	138	2 – 865	6·7	0·1 – 42·3
Guinea-Bissau	AFRO	0·3 – 13·0	288,795	19	0 – 125	6·6	0·0 – 43·3
Guyana	AMRO	0·5 – 1·3	67,137	3	0 – 7	4·5	0·0 – 10·4
Haiti	AMRO	0·3 – 13·0	1,237,543	84	1 – 536	6·8	0·1 – 43·3

Country	WHO Region[b]	Range of Possible Mortality Rate Ratios (MRRs)	Population Estimate, <5 Years of Age	Influenza-associated Respiratory Annual Death Estimates		Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)	
				Median	95% Credible Interval	Median	95% Credible Interval
Honduras	AMRO	0·3 – 13·0	815,929	55	1 – 360	6·7	0·1 – 44·1
India[c]	SEARO	0·3 – 13·0	123,711,487	12,187	2,814 – 34,071	9·9	2·3 – 27·5
Indonesia	SEARO	0·3 – 13·0	24,863,562	1,690	21 – 10,927	6·8	0·1 – 43·9
Iran (Islamic Republic of)	EMRO	0·3 – 0·8	6,855,319	173	2 – 448	2·5	0·0 – 6·5
Iraq	EMRO	0·3 – 13·0	5,727,445	393	6 – 2,391	6·9	0·1 – 41·7
Kenya	AFRO	0·3 – 13·0	7,166,489	482	6 – 3,069	6·7	0·1 – 42·8
Kiribati	WPRO	0·3 – 13·0	14,757	1	0 – 6	6·8	0·0 – 40·7
Kyrgyzstan	EURO	0·4 – 1·1	780,368	28	0 – 74	3·6	0·0 – 9·5
Lao People's Democratic Republic	WPRO	0·3 – 13·0	838,800	56	1 – 352	6·7	0·1 – 42·0
Lesotho	AFRO	0·3 – 13·0	278,395	19	0 – 118	6·8	0·0 – 42·4
Liberia	AFRO	0·3 – 13·0	701,125	47	1 – 312	6·7	0·1 – 44·5
Madagascar	AFRO	0·3 – 13·0	3,770,130	261	4 – 1,646	6·9	0·1 – 43·7
Malawi	AFRO	0·3 – 13·0	2,953,595	197	3 – 1,235	6·7	0·1 – 41·8
Mali	AFRO	0·3 – 13·0	3,271,256	218	3 – 1,366	6·7	0·1 – 41·8
Mauritania	AFRO	0·3 – 13·0	601,082	39	1 – 268	6·5	0·2 – 44·6
Micronesia (Federated States of)	WPRO	0·3 – 13·0	11,570	1	0 – 5	8·6	0·0 – 43·2
Mongolia	WPRO	0·5 – 1·2	337,864	13	0 – 34	3·8	0·0 – 10·1
Morocco	EMRO	0·3 – 13·0	3,420,734	226	3 – 1,473	6·6	0·1 – 43·0
Mozambique	AFRO	0·3 – 13·0	4,816,063	322	4 – 2,092	6·7	0·1 – 43·4
Myanmar	SEARO	0·3 – 13·0	4,564,913	306	4 – 2,006	6·7	0·1 – 43·9
Namibia	AFRO	0·3 – 13·0	338,241	23	0 – 147	6·8	0·0 – 43·5
Nepal	SEARO	0·3 – 13·0	2,807,130	189	3 – 1,227	6·7	0·1 – 43·7
Nicaragua	AMRO	0·3 – 13·0	605,548	40	1 – 274	6·6	0·2 – 45·2
Niger	AFRO	0·3 – 13·0	4,144,755	275	4 – 1,884	6·6	0·1 – 45·5
Nigeria	AFRO	0·3 – 13·0	31,109,162	2,054	25 – 13,876	6·6	0·1 – 44·6
Pakistan	EMRO	0·3 – 13·0	24,663,726	1,699	21 – 10,386	6·9	0·1 – 42·1
Panama	AMRO	0·3 – 0·8	368,407	9	0 – 25	2·4	0·0 – 6·8
Papua New Guinea	WPRO	0·3 – 13·0	995,731	67	1 – 449	6·7	0·1 – 45·1
Paraguay	AMRO	0·3 – 13·0	673,789	46	1 – 300	6·8	0·1 – 44·5
Philippines	WPRO	0·7 – 1·9	11,254,961	682	9 – 1,768	6·1	0·1 – 15·7
Republic of Moldova	EURO	0·3 – 0·9	222,931	6	0 – 16	2·7	0·0 – 7·2
Romania[c]	EURO	0·4 – 1·0	924,244	1	0 – 4	0·1	0·0 – 0·4
Rwanda	AFRO	0·3 – 13·0	1,694,881	114	2 – 738	6·7	0·1 – 43·5
Sao Tome and Principe	AFRO	0·3 – 13·0	29,576	2	0 – 13	6·8	0·0 – 44·0
Senegal	AFRO	0·3 – 13·0	2,601,312	180	2 – 1,110	6·9	0·1 – 42·7
Sierra Leone	AFRO	0·3 – 13·0	1,004,248	67	1 – 443	6·7	0·1 – 44·1
Solomon Islands	WPRO	0·3 – 13·0	81,736	6	0 – 35	7·3	0·0 – 42·8
Somalia	EMRO	0·3 – 13·0	1,971,023	132	2 – 891	6·7	0·1 – 45·2
South Africa[c]	AFRO	0·9 – 2·3	5,370,121	514	386 – 651	9·6	7·2 – 12·1
South Sudan	AFRO	0·3 – 13·0	1,955,821	131	2 – 849	6·7	0·1 – 43·4
Sudan	EMRO	0·3 – 13·0	5,952,169	413	6 – 2,627	6·9	0·1 – 44·1

Country	WHO Region[b]	Range of Possible Mortality Rate Ratios (MRRs)	Population Estimate, <5 Years of Age	Influenza-associated Respiratory Annual Death Estimates		Influenza-associated Respiratory Annual Mortality Rate Estimates (per 100,000)	
				Median	95% Credible Interval	Median	95% Credible Interval
Swaziland	AFRO	0·3 – 13·0	173,392	12	0 – 73	6·9	0·0 – 42·1
Tajikistan	EURO	0·3 – 13·0	1,175,607	79	1 – 525	6·7	0·1 – 44·7
Timor-Leste	SEARO	0·3 – 13·0	203,732	14	0 – 90	6·9	0·0 – 44·2
Togo	AFRO	0·3 – 13·0	1,160,024	79	1 – 500	6·8	0·1 – 43·1
Turkmenistan	EURO	0·3 – 13·0	527,727	36	0 – 234	6·8	0·0 – 44·3
Uganda	AFRO	0·3 – 13·0	7,277,920	485	6 – 3,108	6·7	0·1 – 42·7
United Republic of Tanzania	AFRO	0·3 – 13·0	9,398,450	633	9 – 4,138	6·7	0·1 – 44·0
Uzbekistan	EURO	0·8 – 2·2	3,194,935	218	3 – 565	6·8	0·1 – 17·7
Vanuatu	WPRO	0·3 – 13·0	34,768	2	0 – 15	5·8	0·0 – 43·1
Viet Nam	WPRO	0·3 – 13·0	7,740,845	521	7 – 3,273	6·7	0·1 – 42·3
Yemen	EMRO	0·3 – 13·0	3,924,578	261	4 – 1,740	6·7	0·1 – 44·3
Zambia	AFRO	0·3 – 13·0	2,850,804	193	3 – 1,244	6·8	0·1 – 43·6
Zimbabwe	AFRO	0·3 – 13·0	2,504,682	171	2 – 1,067	6·8	0·1 – 42·6

[a]The overall estimate was only for 92 countries, which fell into the 3rd and 4th quartiles (analytic division 3), when the Global Health Estimate (GHE) rates for respiratory infection mortality were ranked. Quartiles were generated from 183 countries with GHE rates of respiratory infection mortality for the under 5 year old age group. GHE rates of respiratory infection mortality for the under 5 year age group were not available for the following countries: Hong Kong SAR (China) and Taiwan (China)

[b]WHO Region=World Health Organization Region; AFRO=Sub-Saharan Africa; AMRO=Americas; EMRO=Eastern Mediterranean; EURO=Europe; SEARO=Southeast Asia; WPRO=Western Pacific

[c]Excess mortality rate (EMR)-contributing country; extrapolated estimates were replaced with mean annual influenza-associated respiratory EMRs and death estimates

Appendix Table 11. Number of countries with World Health Organization (WHO) Global Health Estimates (GHE) of respiratory infection deaths and included in extrapolation and the proportion of respiratory infection deaths from countries included in extrapolation out of all respiratory infection deaths, and estimated global annual influenza-associated respiratory death median, interval, and rate per 100,000 population by WHO regions and World Bank income classification for children <5 years.

	Number of Countries			WHO GHE RI Deaths			Estimated Influenza-associated Respiratory Annual Deaths[c]			
	Total[a]	Included in Extrapolation[b]	Proportion of Countries Included in Extrapolation Compared to Total	All Countries	Countries Included in Extrapolation	Proportion of Deaths for Countries Included in Extrapolation Compared with All Countries	Median	95% Credible Interval	95% Credible Interval Rate Estimates (per 100,000)[c]	Estimated Proportion of Total Influenza-associated Respiratory Deaths[d]
Overall Estimate	183	92	50%	918,528	876,121	95%	44,888	9,243 – 105,690	2·1 – 23·8	--
World Health Organization Regions										
Sub-Saharan Africa	47	45	96%	461,079	461,057	>99%	16,305	721 – 46,336	0·5 – 29·0	36%
Americas[e]	33	11	33%	23,730	10,561	45%	792	10 – 2,338	0·1 – 22·8	2%
Europe[e]	50	7	14%	12,923	8,955	69%	502	7 – 1,519	0·1 – 19·6	1%
Eastern Mediterranean[e]	21	10	48%	139,618	137,822	99%	6,274	85 – 20,109	0·1 – 28·9	13%
South-East Asia	11	8	73%	235,398	234,359	>99%	16,940	5,565 – 42,536	3·2 – 24·5	40%
Western Pacific	21	11	52%	45,780	23,367	51%	1,741	23 – 5,632	0·1 – 24·3	4%
World Bank Income Classifications										
High Income[e]	51	1	2%	3,970	417	10%	9	0 – 55	0·0 – 42·9	0%
Upper Middle Income[e]	50	15	30%	91,861	54,078	59%	2,530	521 – 6,931	1·6 – 20·6	6%
Lower Middle Income	48	42	88%	515,915	514,845	>99%	27,789	7,386 – 68,416	2·6 – 24·2	65%
Low Income	34	34	100%	306,783	306,783	100%	13,281	180 – 37,917	0·1 – 29·7	29%

[a]GHE respiratory infection death estimates for children <5 years of age for 183 countries. GHE rates of respiratory infection mortality for the under 5 year age group were not available for Hong Kong SAR (China) and Taiwan (China)

[b]Only countries which fell into the 3rd and 4th quartiles (analytic division 3) when the GHE rates for respiratory infection mortality rates for children <5 years of age were ranked were included in this analysis. Quartiles were generated from 183 countries with available GHE respiratory infection mortality rates for children <5 years of age

[c]After applying extrapolation approach to all countries, excess mortality rate (EMR)-contributing country extrapolated estimates were replaced with mean annual influenza-associated respiratory EMRs and death estimates, except for Kenya

[d]Estimates do not add across all age groups as age specific models were run separately and were not additive. Estimated proportions were calculated for each of 5,000 extrapolation simulations and the median proportion from the 5,000 simulations is presented

[e]Extrapolation carried out for less than 50% of countries represented in these regions, thus estimates of influenza-associated respiratory deaths for children <5 years of age in these regions may be underestimated

Appendix Table 12. Comparison of estimated worldwide annual influenza-associated respiratory death median and interval by age group removing one excess mortality rate (EMR)-contributing country in each extrapolation simulation.

EMR-contributing Country Excluded from Extrapolation Simulation	Influenza-associated Respiratory Annual Death Estimates[a]						Fold Difference Comparing Death Estimate Removing EMR-contributing Country with Death Estimate Using All EMR-contributing Countries[b]		
	<65 Years		65-74 Years		≥75 Years				
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	<65 Years	65-74 Years	≥75 Years
No Country Excluded	207,142	44,991 – 552,727	71,388	24,838 – 149,088	153,215	60,067 – 325,165	--	--	--
Argentina	187,074	41,059 – 410,635	68,475	23,302 – 129,057	150,711	71,794 – 269,060	0·90	0·96	0·98
Australia	206,788	44,115 – 562,465	70,044	24,535 – 153,688	153,346	51,232 – 437,131	1·00	0·98	1·00
Austria	205,416	43,508 – 538,734	70,592	26,355 – 146,341	153,552	50,695 – 294,585	0·99	0·99	1·00
Brazil, Southern	207,227	43,558 – 554,643	72,537	23,648 – 156,280	148,701	72,892 – 342,443	1·00	1·02	0·97
Canada	211,142	44,409 – 551,816	70,959	25,541 – 146,545	159,718	48,573 – 322,640	1·02	0·99	1·04
Chile	207,165	45,114 – 539,801	71,659	26,124 – 143,654	154,287	65,075 – 311,933	1·00	1·00	1·01
China	205,515	45,489 – 540,287	70,720	26,819 – 133,902	149,298	49,256 – 314,794	0·99	0·99	0·97
Czech Republic	208,172	45,108 – 548,364	71,452	26,190 – 144,415	156,795	57,889 – 334,683	1·00	1·00	1·02
Denmark	205,122	44,202 – 535,503	71,241	26,498 – 148,935	154,799	55,191 – 335,373	0·99	1·00	1·01
Germany	205,652	43,106 – 552,993	70,727	25,987 – 150,359	153,977	75,697 – 317,654	0·99	0·99	1·00
Hong Kong	208,915	42,215 – 546,828	75,845	23,587 – 147,870	156,957	69,581 – 330,021	1·01	1·06	1·02
India	215,781	38,299 – 561,246	73,614	25,426 – 148,135	151,926	69,790 – 320,060	1·04	1·03	0·99
Israel	208,395	42,949 – 554,870	72,904	27,572 – 152,488	157,052	59,594 – 345,577	1·01	1·02	1·03
Japan	211,087	46,473 – 553,280	73,582	27,110 – 148,528	159,561	76,986 – 327,950	1·02	1·03	1·04
Kenya[c]	195,373	36,086 – 542,589	--	--	--	--	0·94	--	--
Mexico	205,959	42,752 – 549,521	66,953	23,649 – 149,842	150,562	65,423 – 321,225	0·99	0·94	0·98
Netherlands	207,219	46,615 – 558,983	70,989	24,285 – 148,605	147,364	54,919 – 324,388	1·00	0·99	0·96
New Zealand	209,664	44,038 – 552,259	71,843	24,721 – 148,694	152,287	71,371 – 312,464	1·01	1·01	0·99
Norway	205,694	43,692 – 542,161	71,937	26,427 – 149,672	151,381	58,321 – 345,670	0·99	1·01	0·99
Paraguay	208,151	44,672 – 551,058	70,463	26,969 – 150,066	150,912	62,188 – 313,877	1·00	0·99	0·98
Portugal	209,471	45,372 – 543,373	69,544	26,843 – 149,933	152,963	52,522 – 337,219	1·01	0·97	1·00
Romania	234,283	39,927 – 570,131	73,632	26,937 – 150,033	154,399	75,402 – 323,327	1·13	1·03	1·01
Serbia	209,301	42,990 – 576,264	73,451	27,951 – 145,746	155,102	73,400 – 315,187	1·01	1·03	1·01
Singapore	209,359	43,920 – 543,603	67,326	24,958 – 142,891	155,542	48,929 – 328,812	1·01	0·94	1·02
South Africa	190,559	41,529 – 559,528	72,648	35,150 – 146,080	150,063	54,530 – 329,765	0·92	1·02	0·98
South Korea	212,257	41,646 – 546,480	72,488	26,831 – 148,114	156,950	61,769 – 319,436	1·02	1·02	1·02
Spain	208,017	45,524 – 559,317	70,820	25,495 – 148,222	147,933	69,539 – 317,059	1·00	0·99	0·97
Switzerland	209,863	43,853 – 567,426	72,898	25,078 – 149,442	159,074	47,577 – 320,783	1·01	1·02	1·04
Taiwan	212,419	48,302 – 542,139	73,713	29,479 – 155,790	164,657	50,084 – 332,951	1·03	1·03	1·07
Thailand	231,670	51,356 – 556,312	73,470	38,109 – 150,043	156,406	50,676 – 312,337	1·12	1·03	1·02
United Kingdom (England and Wales)	206,636	42,296 – 547,929	71,834	26,690 – 151,402	157,394	53,114 – 325,255	1·00	1·01	1·03
Uruguay	204,693	43,895 – 540,814	66,584	25,203 – 149,504	148,129	58,032 – 331,721	0·99	0·93	0·97
USA	207,717	41,062 – 567,503	71,932	28,242 – 149,045	153,465	72,143 – 313,462	1·00	1·01	1·00

[a]For validation comparisons, the global interval estimates presented include the EMR-contributing country estimates calculated by applying the extrapolation approach rather than global estimates with replacement for EMR-contributing countries with mean annual influenza-associated respiratory death estimates

[b]The fold difference was calculated as the 50th percentile (median) of the interval with the EMR-contributing country removed divided by the 50th percentile of the interval with all EMR-contributing countries included

[c]For Kenya, estimates were only available for the <65 year age group

Appendix Table 13. Comparison of estimated annual influenza-associated respiratory death intervals extrapolated using all excess mortality rate (EMR)-contributing countries with death intervals removing one EMR-contributing country by age group, analytic division (AD) and World Health Organization Region.

	<65 Years							
	Analytic Division Comparison				WHO Region Comparison			
		Influenza-associated Respiratory Annual Death 95% Credible Interval Estimates[a]				Influenza-associated Respiratory Annual Death 95% Credible Interval Estimates[a]		
EMR-contributing Country Excluded from Extrapolation Simulation	AD	Estimates using All EMR-contributing Countries	Estimates Removing EMR-contributing Country	Fold Difference[b]	WHO Region[c]	Estimates using All EMR-contributing Countries	Estimates Removing EMR-contributing Country	Fold Difference[b]
Argentina	3	27,565 – 524,104	26,545 – 382,920	0·87	AMRO	3,306 – 21,865	3,332 – 22,306	0·87
Australia	1	1,663 – 59,013	1,728 – 57,079	0·97	WPRO	4,204 – 57,760	3,993 – 56,834	1·02
Austria	1	1,663 – 59,013	1,584 – 35,942	0·95	EURO	2,922 – 23,942	2,769 – 17,717	1·01
Brazil	2	2,547 – 26,288	2,409 – 25,942	1·06	AMRO	3,306 – 21,865	3,029 – 21,747	1·01
Canada	1	1,663 – 59,013	1,646 – 58,995	0·99	AMRO	3,306 – 21,865	3,345 – 21,501	1·01
Chile	1	1,663 – 59,013	1,736 – 61,128	0·94	AMRO	3,306 – 21,865	3,371 – 21,411	1·01
China	1	1,663 – 59,013	1,646 – 63,594	1·00	WPRO	4,204 – 57,760	4,231 – 61,665	1·01
Czech Republic	1	1,663 – 59,013	1,677 – 60,201	1·05	EURO	2,922 – 23,942	2,649 – 24,959	1·01
Denmark	1	1,663 – 59,013	1,619 – 66,246	0·96	EURO	2,922 – 23,942	2,766 – 24,212	1·01
Germany	1	1,663 – 59,013	1,688 – 62,853	1·01	EURO	2,922 – 23,942	2,735 – 24,284	1·01
Hong Kong	2	2,547 – 26,288	2,471 – 26,360	1·09	WPRO	4,204 – 57,760	3,902 – 61,148	1·02
India	3	27,565 – 524,104	23,266 – 528,356	1·05	SEARO	11,517 – 336,023	9,594 – 348,112	1·01
Israel	1	1,663 – 59,013	1,618 – 63,219	1·04	EURO	2,922 – 23,942	2,756 – 24,731	1·00
Japan	1	1,663 – 59,013	2,078 – 59,099	1·04	WPRO	4,204 – 57,760	4,723 – 58,183	1·03
Kenya[d]	3	27,565 – 524,104	20,847 – 508,927	0·94	AFRO	7,191 – 129,148	5,514 – 130,146	0·95
Mexico	2	2,547 – 26,288	2,518 – 26,279	0·92	AMRO	3,306 – 21,865	3,142 – 21,183	0·97
Netherlands	1	1,663 – 59,013	1,689 – 59,094	1·03	EURO	2,922 – 23,942	2,870 – 24,684	1·00
New Zealand	1	1,663 – 59,013	1,603 – 58,404	0·96	WPRO	4,204 – 57,760	4,193 – 57,410	0·99
Norway	1	1,663 – 59,013	1,635 – 66,578	0·93	EURO	2,922 – 23,942	2,763 – 25,201	1·01
Paraguay	2	2,547 – 26,288	2,527 – 25,915	0·94	AMRO	3,306 – 21,865	3,205 – 21,250	1·02
Portugal	2	2,547 – 26,288	2,364 – 26,132	1·01	EURO	2,922 – 23,942	2,746 – 23,906	1·02
Romania	3	27,565 – 524,104	24,853 – 532,531	1·14	EURO	2,922 – 23,942	2,524 – 24,938	1·08
Serbia	1	1,663 – 59,013	1,635 – 61,538	1·00	EURO	2,922 – 23,942	2,802 – 24,070	1·03
Singapore	2	2,547 – 26,288	2,482 – 26,688	0·92	WPRO	4,204 – 57,760	4,137 – 59,001	1·01
South Africa	3	27,565 – 524,104	20,148 – 530,133	0·91	AFRO	7,191 – 129,148	5,965 – 133,056	0·90
South Korea	1	1,663 – 59,013	1,908 – 60,721	1·06	WPRO	4,204 – 57,760	4,401 – 60,575	1·04
Spain	1	1,663 – 59,013	1,668 – 60,232	1·01	EURO	2,922 – 23,942	2,826 – 24,971	1·00
Switzerland	1	1,663 – 59,013	1,683 – 61,888	1·03	EURO	2,922 – 23,942	2,871 – 24,916	1·01
Taiwan	2	2,547 – 26,288	4,184 – 26,767	1·09	WPRO	4,204 – 57,760	4,970 – 56,337	1·02
Thailand	3	27,565 – 524,104	37,798 – 523,504	1·12	SEARO	11,517 – 336,023	15,393 – 332,476	1·13
United Kingdom (England and Wales)	1	1,663 – 59,013	1,648 – 57,220	0·96	EURO	2,922 – 23,942	2,849 – 24,233	0·98
Uruguay	2	2,547 – 26,288	2,409 – 20,111	0·90	AMRO	3,306 – 21,865	3,800 – 18,532	0·93
USA	2	2,547 – 26,288	2,480 – 27,071	1·08	AMRO	3,306 – 21,865	4,008 – 22,723	0·97

EMR-contributing Country Excluded from Extrapolation Simulation	65-74 Years							
	Analytic Division Comparison				WHO Region Comparison			
		Influenza-associated Respiratory Annual Death 95% Credible Interval Estimates[a]				Influenza-associated Respiratory Annual Death 95% Credible Interval Estimates[a]		
	AD	Estimates using All EMR-contributing Countries	Estimates Removing EMR-contributing Country	Fold Difference[b]	WHO Region[c]	Estimates using All EMR-contributing Countries	Estimates Removing EMR-contributing Country	Fold Difference[b]
Argentina	3	9,942 – 103,611	8,552 – 88,001	0·88	AMRO	2,861 – 16,377	2,672 – 14,263	0·95
Australia	1	833 – 18,293	802 – 18,866	1·08	WPRO	3,966 – 42,696	3,963 – 40,918	0·97
Austria	1	833 – 18,293	828 – 12,540	0·96	EURO	2,630 – 18,339	1,890 – 15,343	0·99
Brazil	3	9,942 – 103,611	8,769 – 107,575	0·98	AMRO	2,861 – 16,377	2,720 – 17,044	1·04
Canada	1	833 – 18,293	863 – 19,449	1·04	AMRO	2,861 – 16,377	2,905 – 16,348	1·00
Chile	1	833 – 18,293	839 – 19,414	0·94	AMRO	2,861 – 16,377	2,958 – 15,979	1·00
China	2	3,154 – 64,096	2,956 – 56,898	0·88	WPRO	3,966 – 42,696	4,036 – 37,112	0·94
Czech Republic	2	3,154 – 64,096	3,020 – 63,303	1·05	EURO	2,630 – 18,339	2,975 – 18,534	1·00
Denmark	1	833 – 18,293	898 – 19,121	1·11	EURO	2,630 – 18,339	3,270 – 19,301	1·06
Germany	1	833 – 18,293	1,177 – 19,423	1·10	EURO	2,630 – 18,339	3,337 – 19,175	1·06
Hong Kong	3	9,942 – 103,611	7,719 – 105,453	1·06	WPRO	3,966 – 42,696	4,035 – 41,617	1·02
India	3	9,942 – 103,611	9,745 – 103,463	1·01	SEARO	5,917 – 76,094	5,671 – 75,052	1·01
Israel	2	3,154 – 64,096	3,623 – 65,704	1·09	EURO	2,630 – 18,339	3,001 – 19,696	1·03
Japan	2	3,154 – 64,096	3,532 – 64,765	1·06	WPRO	3,966 – 42,696	4,108 – 43,061	1·05
Kenya[d]	3	--	--	--	AFRO	--	--	--
Mexico	2	3,154 – 64,096	3,222 – 64,792	0·88	AMRO	2,861 – 16,377	2,767 – 16,906	0·94
Netherlands	1	833 – 18,293	819 – 19,039	0·96	EURO	2,630 – 18,339	3,056 – 18,749	0·94
New Zealand	1	833 – 18,293	784 – 19,388	0·96	WPRO	3,966 – 42,696	3,939 – 42,208	0·99
Norway	1	833 – 18,293	775 – 19,519	0·99	EURO	2,630 – 18,339	3,032 – 19,076	1·04
Paraguay	2	3,154 – 64,096	3,293 – 64,320	0·89	AMRO	2,861 – 16,377	3,062 – 17,184	0·97
Portugal	2	3,154 – 64,096	4,129 – 62,450	0·81	EURO	2,630 – 18,339	1,985 – 18,881	1·00
Romania	2	3,154 – 64,096	2,985 – 63,456	1·10	EURO	2,630 – 18,339	2,292 – 19,434	1·04
Serbia	1	833 – 18,293	893 – 18,974	1·08	EURO	2,630 – 18,339	2,930 – 18,682	1·13
Singapore	3	9,942 – 103,611	9,677 – 95,702	0·91	WPRO	3,966 – 42,696	4,098 – 43,006	0·99
South Africa	3	9,942 – 103,611	9,486 – 107,723	1·05	AFRO	2,177 – 18,377	2,379 – 18,144	1·06
South Korea	2	3,154 – 64,096	3,184 – 64,998	1·11	WPRO	3,966 – 42,696	3,917 – 43,187	1·08
Spain	1	833 – 18,293	812 – 18,932	0·99	EURO	2,630 – 18,339	3,088 – 18,678	0·96
Switzerland	1	833 – 18,293	734 – 19,227	1·10	EURO	2,630 – 18,339	1,905 – 19,268	1·06
Taiwan	2	3,154 – 64,096	3,429 – 64,533	1·08	WPRO	3,966 – 42,696	4,531 – 42,998	1·08
Thailand	3	9,942 – 103,611	20,849 – 105,253	1·05	SEARO	5,917 – 76,094	10,050 – 76,910	1·04
United Kingdom (England and Wales)	1	833 – 18,293	901 – 19,113	1·03	EURO	2,630 – 18,339	3,161 – 18,754	1·01
Uruguay	2	3,154 – 64,096	3,122 – 59,763	0·88	AMRO	2,861 – 16,377	2,948 – 16,713	0·91
USA	2	3,154 – 64,096	2,988 – 64,623	0·87	AMRO	2,861 – 16,377	3,265 – 16,704	0·98

EMR-contributing Country Excluded from Extrapolation Simulation	≥75 Years							
	Analytic Division Comparison				WHO Region Comparison			
		Influenza-associated Respiratory Annual Death 95% Credible Interval Estimates[a]				Influenza-associated Respiratory Annual Death 95% Credible Interval Estimates[a]		
	AD	Estimates using All EMR-contributing Countries	Estimates Removing EMR-contributing Country	Fold Difference[b]	WHO Region[c]	Estimates using All EMR-contributing Countries	Estimates Removing EMR-contributing Country	Fold Difference[b]
Argentina	3	13,732 – 205,491	14,209 – 140,859	0·93	AMRO	10,580 – 59,379	12,654 – 54,724	0·98
Australia	1	9,680 – 169,547	13,374 – 176,975	1·09	WPRO	14,016 – 97,992	12,049 – 126,999	0·98
Austria	1	9,680 – 169,547	9,938 – 107,323	0·94	EURO	10,640 – 65,831	10,435 – 47,703	0·87
Brazil	3	13,732 – 205,491	14,357 – 207,434	0·93	AMRO	10,580 – 59,379	12,891 – 60,045	0·97
Canada	1	9,680 – 169,547	10,992 – 173,742	0·95	AMRO	10,580 – 59,379	8,893 – 60,158	1·02
Chile	2	4,027 – 74,729	4,152 – 59,516	0·92	AMRO	10,580 – 59,379	11,467 – 60,127	0·99
China	1	9,680 – 169,547	9,786 – 171,618	0·94	WPRO	14,016 – 97,992	12,158 – 98,608	0·96
Czech Republic	2	4,027 – 74,729	3,794 – 75,469	1·07	EURO	10,640 – 65,831	12,346 – 71,742	1·00
Denmark	2	4,027 – 74,729	3,708 – 74,138	1·04	EURO	10,640 – 65,831	11,624 – 68,700	1·00
Germany	1	9,680 – 169,547	11,235 – 177,781	1·09	EURO	10,640 – 65,831	15,900 – 66,448	0·99
Hong Kong	3	13,732 – 205,491	12,365 – 205,433	1·08	WPRO	14,016 – 97,992	15,329 – 97,453	1·00
India	3	13,732 – 205,491	12,705 – 200,928	1·03	SEARO	9,309 – 119,557	8,911 – 110,722	1·01
Israel	2	4,027 – 74,729	4,192 – 75,845	1·08	EURO	10,640 – 65,831	11,443 – 75,457	1·00
Japan	3	13,732 – 205,491	19,433 – 206,914	1·06	WPRO	14,016 – 97,992	17,028 – 100,000	1·02
Kenya[d]	3	--	--	--	AFRO	--	--	--
Mexico	2	4,027 – 74,729	3,963 – 75,605	0·92	AMRO	10,580 – 59,379	11,648 – 59,601	0·98
Netherlands	2	4,027 – 74,729	3,856 – 73,992	0·88	EURO	10,640 – 65,831	11,048 – 66,416	0·89
New Zealand	1	9,680 – 169,547	9,023 – 171,817	1·06	WPRO	14,016 – 97,992	16,087 – 98,379	1·00
Norway	2	4,027 – 74,729	3,437 – 76,232	0·99	EURO	10,640 – 65,831	11,042 – 72,425	0·94
Paraguay	2	4,027 – 74,729	3,651 – 74,774	0·91	AMRO	10,580 – 59,379	11,120 – 57,672	0·99
Portugal	3	13,732 – 205,491	13,578 – 205,135	0·94	EURO	10,640 – 65,831	10,270 – 65,399	0·99
Romania	1	9,680 – 169,547	9,285 – 171,596	1·07	EURO	10,640 – 65,831	12,249 – 65,940	1·00
Serbia	1	9,680 – 169,547	9,919 – 171,805	1·04	EURO	10,640 – 65,831	13,015 – 65,754	0·99
Singapore	3	13,732 – 205,491	12,986 – 204,683	0·96	WPRO	14,016 – 97,992	11,995 – 103,326	1·00
South Africa	3	13,732 – 205,491	12,190 – 205,628	0·95	AFRO	2,401 – 28,834	2,225 – 29,151	0·93
South Korea	2	4,027 – 74,729	4,933 – 74,834	1·09	WPRO	14,016 – 97,992	13,865 – 96,912	1·01
Spain	1	9,680 – 169,547	11,109 – 172,612	0·94	EURO	10,640 – 65,831	12,433 – 65,582	0·94
Switzerland	1	9,680 – 169,547	9,132 – 178,517	1·04	EURO	10,640 – 65,831	10,112 – 66,959	0·99
Taiwan	3	13,732 – 205,491	13,396 – 205,403	1·08	WPRO	14,016 – 97,992	12,555 – 102,129	1·05
Thailand	3	13,732 – 205,491	16,101 – 197,175	1·02	SEARO	9,309 – 119,557	8,972 – 112,366	1·01
United Kingdom (England and Wales)	2	4,027 – 74,729	3,768 – 75,250	1·01	EURO	10,640 – 65,831	11,306 – 68,006	0·99
Uruguay	2	4,027 – 74,729	4,328 – 74,686	0·90	AMRO	10,580 – 59,379	10,482 – 60,853	0·97
USA	1	9,680 – 169,547	9,319 – 172,501	0·99	AMRO	10,580 – 59,379	12,935 – 58,035	0·98

[a]For validation comparisons, the analytic division and WHO region interval estimates presented include the EMR-contributing country estimates calculated by applying the extrapolation approach rather than estimates with replacement for EMR-contributing countries with mean annual influenza-associated respiratory death estimates

[b]The fold difference was calculated as the 50th percentile (median) of the interval with the EMR-contributing country removed divided by the 50th percentile of the interval with all EMR-contributing countries included

[c]WHO Region=World Health Organization Region; AFRO=Sub-Saharan Africa; AMRO=Americas; EMRO=Eastern Mediterranean; EURO=Europe; SEARO=Southeast Asia; WPRO=Western Pacific

[d]For Kenya, estimates were only available for the <65 year age group

Appendix Table 14. Comparison of excess mortality rate (EMR)-contributing country mean annual influenza-associated excess respiratory death interval, estimated annual influenza-associated respiratory death interval using all EMR-contributing countries, and estimated annual influenza-associated respiratory death interval removing the EMR-contributing country by age group.

	Annual Influenza-associated Respiratory Death Estimate <65 Years			Annual Influenza-associated Respiratory Death Estimate 65-74 Years			Annual Influenza-associated Respiratory Death Estimate ≥75 Years		
EMR-contributing Country	**Mean Death 95% Credible Interval[a]**	**Estimated Death 95% Credible Interval Using all EMR-contributing Countries[b]**	**Estimated Death 95% Credible Interval Removing EMR-contributing Country[c]**	**Mean Death 95% Credible Interval[a]**	**Estimated Death 95% Credible Interval Using all EMR-contributing Countries[b]**	**Estimated Death 95% Credible Interval Removing EMR-contributing Country[c]**	**Mean Death 95% Credible Interval[a]**	**Estimated Death 95% Credible Interval Using all EMR-contributing Countries[b]**	**Estimated Death 95% Credible Interval Removing EMR-contributing Country[c]**
Argentina	715 – 1,592	85 – 1,266	83 – 939	759 – 1,602	174 – 1,299	153 – 1,183	2,759 – 6,435	359 – 4,791	378 – 3,184
Australia	37 – 167	13 – 402	13 – 392	13– 145	16 – 358	16 – 368	61 – 671	158 – 2,607	209 – 2,641
Austria	26 – 126	2 – 70	2 – 41	40 – 170	5 – 109	5 – 75	335 – 615	32 – 527	34 – 335
Canada	45 – 172	24 – 740	23 – 775	55 – 347	36 – 787	37 – 835	474 – 1,754	230 – 3,782	263 – 3,798
Chile	170 – 272	19 – 586	19 – 602	206 – 497	25 – 541	25 – 574	912 – 2,256	90 – 1,657	92 – 1,308
China	2,079 – 15,229	918 – 39,140	868 – 42,806	4,983 – 28,640	1,365 – 31,027	1,291 – 27,216	20,954 – 84,822	1,192 – 68,299	1,051 – 66,221
Czech Republic	30 – 58	16 – 499	16 – 513	46 – 85	15 – 284	14 – 279	105 – 207	52 – 961	49 – 973
Denmark	14 – 41	4 – 130	4 – 136	9 – 49	12 – 264	13 – 277	98 – 339	41 – 760	37 – 754
Germany	93 – 371	78 – 2,422	79 – 2,503	53 – 466	151 – 3,294	210 – 3,495	557 – 3,245	838 – 13,789	947 – 13,909
Hong Kong	18 – 29	11 – 112	10 – 112	55 – 84	22 – 164	18 – 168	345 – 536	129 – 1,724	118 – 1,748
India	7,281 – 52,259	5,545 – 278,440	4,542 – 289,084	6,567 – 30,247	3,644 – 66,898	3,529 – 67,231	8,213 – 36,565	4,532 – 100,255	4,091 – 94,095
Israel	10 – 22	8 – 242	7 – 248	9 – 25	7 – 144	8 – 147	81 – 158	43 – 795	46 – 803
Japan	162 – 258	167 – 5,227	213 – 5,078	469 – 740	303 – 5,854	336 – 5,844	3,529 – 5,370	2,360 – 31,528	3,358 – 31,706
Mexico	1,019 – 2,378	229 – 2,372	224 – 2,359	491 – 1,369	71 – 1,369	72 – 1,359	859 – 3,892	231 – 4,252	224 – 4,281
Netherlands	28 – 79	11 – 352	11 – 364	133 – 317	26 – 560	25 – 583	678 – 1,708	104 – 1,917	98 – 1,893
New Zealand	8 – 18	2 – 73	2 – 70	10 – 29	2 – 38	2 – 40	59 – 145	35 – 573	33 – 574
Norway	25 – 55	3 – 101	3 – 112	29 – 70	7 – 152	6 – 162	215 – 328	40 – 738	35 – 750
Paraguay	50 – 236	13 – 168	12 – 171	31 – 99	4 – 89	4 – 92	60 – 308	13 – 281	12 – 274
Portugal	27 – 67	11 – 117	11 – 115	42 – 184	17 – 324	21 – 313	505 – 1,448	129 – 1,723	132 – 1,739
Romania	67 – 135	43 – 650	41 – 679	84 – 161	35 – 686	32 – 666	207 – 432	145 – 2,385	140 – 2,387
Serbia	23 – 81	10 – 298	10 – 301	23 – 101	13 – 274	13 – 284	48 – 188	35 – 578	35 – 576
Singapore	57 – 87	13 – 136	13 – 137	127 – 193	26 – 193	24 – 191	387 – 539	74 – 994	73 – 1,007
South Africa	2,258 – 3,110	320 – 4,797	256 – 4,851	511 – 773	180 – 1,346	178 – 1,343	1,118 – 1,426	199 – 2,658	179 – 2,682
South Korea	28 – 86	33 – 1,028	36 – 1,038	75 – 220	50 – 964	49 – 963	329 – 1,099	314 – 5,774	372 – 5,778

EMR-contributing Country	Annual Influenza-associated Respiratory Death Estimate <65 Years			Annual Influenza-associated Respiratory Death Estimate 65-74 Years			Annual Influenza-associated Respiratory Death Estimate ≥75 Years		
	Mean Death 95% Credible Interval[a]	Estimated Death 95% Credible Interval Using all EMR-contributing Countries[b]	Estimated Death 95% Credible Interval Removing EMR-contributing Country[c]	Mean Death 95% Credible Interval[a]	Estimated Death 95% Credible Interval Using all EMR-contributing Countries[b]	Estimated Death 95% Credible Interval Removing EMR-contributing Country[c]	Mean Death 95% Credible Interval[a]	Estimated Death 95% Credible Interval Using all EMR-contributing Countries[b]	Estimated Death 95% Credible Interval Removing EMR-contributing Country[c]
Spain	77 – 166	27 – 828	26 – 871	159 – 431	42 – 921	41 – 947	1,121 – 3,702	442 – 7,267	505 – 7,174
Switzerland	19 – 28	5 – 172	6 – 176	28 – 49	9 – 189	8 – 199	148 – 317	71 – 1,162	66 – 1,184
Taiwan	17 – 55	29 – 303	48 – 306	28 – 90	32 – 623	34 – 620	277 – 612	163 – 2,180	164 – 2,196
Thailand	49 – 2,176	274 – 14,066	347 – 14,365	72 – 2,607	315 – 5,974	533 –6,065	224 – 8,097	526 – 10,739	586 – 10,857
United Kingdom (England and Wales)	56 – 3,670	64 – 2,014	63 – 1,911	58 – 3,100	119 – 2,600	128 – 2,723	361 – 7,933	639 – 11,764	588 – 11,773
Uruguay	11 – 266	5 – 54	5 – 41	13 – 365	5 – 90	5 – 84	51 – 1,403	28 – 512	30 – 507
USA	1,187 – 1,880	414 – 4,282	403 – 4,393	1,802 – 2,923	359 – 6,944	329 – 6,942	7,457 – 12,460	2,330 – 38,345	2,189 – 38,476
Bangladesh[d]	4,714 – 6,498	671 – 34,930	--	--	--	--	--	--	--

[a]The country-specific mean annual influenza-associated respiratory death intervals are the interval ranges (2.5% to 97.5% quantiles) estimated from a Bayesian hierarchical model for the individual EMR-contributing country using their own annual influenza-associated respiratory excess mortality estimates

[b]The estimated annual influenza-associated respiratory death interval estimate for each EMR-contributing country was calculated from the Bayesian Hierarchical extrapolation model using influenza-associated excess mortality information from all EMR-contributing countries

[c]The estimated annual influenza-associated respiratory death interval estimate for each EMR-contributing country was calculated from the Bayesian Hierarchical extrapolation model excluding excess mortality information that specific EMR-contributing country

[d]The country-specific estimated mean annual influenza-associated respiratory death intervals for Bangladesh are estimated influenza-associated acute respiratory infection mortality calculated using a multiplier approach using influenza sentinel site surveillance data from 11 hospitals and counts of acute respiratory infection deaths from a death survey conducted in the same 11 regions for 2010/11-2011/12. Estimates were only available for the <65 year age group.
Ahmed M et al. (2017) Seasonal Influenza-associated Mortality in Bangladesh, 2010-12. in press: Influenza Other Respir Viruses

Appendix Table 15: Annual proportion of excess mortality rate (EMR)-contributing country-specific influenza-associated respiratory death estimates of total respiratory deaths (International Classification of Disease coded deaths) by age group.

		Proportion of Influenza-associated Respiratory Deaths out of Total Respiratory Deaths, Range		
Country	**Years of Available Data**	**<65 Years**	**65–74 Years**	**≥75 Years**
Argentina	2003 – 2009	10·9 – 30·5	11·4 – 22·8	10·5 – 24·3
Australia	2003 – 2009	0·1 – 12·3	0·03 – 1·0	0·1 – 5·2
Austria[a]	2002/03 – 2008/09	1·3 – 9·9	0·5 – 5·9	1·4 – 3·7
Brazil, Southern[b]	2003 – 2009	1·6 – 17·2	2·2 – 10·2	3·0 – 14·5
Canada	1999/2000 – 2007/08	0·2 – 12·9	0·0 – 10·2	2·1 – 13·2
Chile	2002 – 2009	13·6 – 23·7	10·0 – 27·6	9·0 – 28·0
China[b]	--	--	--	--
Czech Republic	1999/2000 – 2010/11	1·1 – 5·8	1·3 – 6·8	1·3 – 6·5
Denmark	2002/03 – 2013/14	0·3 – 3·4	0·1 – 2·3	0·1 – 4·3
Germany[a]	2001/02 – 2012/13	0·2 – 14·0	0·0 – 8·4	0·0 – 11·0
Hong Kong	1999/2000 – 2015/16	0·0 – 7·7	2·4 – 8·0	1·0 – 7·9
Israel	2004/05 – 2013/14	1·7 – 14·5	0·6 – 5·3	0·6 – 6·9
India	2010 – 2013	5·2 – 6·9	4·5 – 7·3	4·5 – 7·3
Japan	1999/2000 – 2010/11	1·3 – 4·6	1·3 – 4·0	0·7 – 3·7
Kenya[b]	2007 – 2013	4·6 – 8·0	--	--
Mexico	2002/03 – 2009/2010	7·1 – 26·6	5·6 – 18·0	3·0 – 15·6
Netherlands[a]	1999/2000 – 2010/11	1·1 – 13·0	0·0 – 11·3	0·0 – 16·7
New Zealand	2002 – 2013	2·2 – 16·6	0·6 – 8·2	1·8 – 10·4
Norway[a]	1999/2000 – 2013/14	4·4 – 27·8	2·6 – 17·1	3·9 – 12·7
Paraguay	2002 – 2009	7·7 – 50·3	7·7 – 43·2	4·0 – 44·2
Portugal	1999/2000 – 2013/14	1·9 – 32·3	1·9 – 49·7	10·2 – 41·8
Romania	2000/01 – 2014/15	0·6 – 8·8	0·9 – 12·2	1·2 – 11·2
Serbia	2000/01 – 2010/11	0·6 – 11·1	0·1 – 12·2	0·3 – 13·3
Singapore	2004 – 2011	10·4 – 17·1	13·5 – 18·7	9·0 – 13·2
South Africa	1999 – 2013	2·3 – 5·1	0·6 – 7·2	2·9 – 10·1
South Korea[a]	2003/04 – 2012/13	1·1 – 7·7	0·0 – 11·5	1·2 – 11·7
Spain	2000/01 – 2012/13	0·4 – 8·5	0·5 – 11·4	0·5 – 14·3
Switzerland	1999/2000 – 2013/14	3·4 – 11·4	0·9 – 9·2	0·5 – 11·5
Taiwan	2000/01 – 2013/14	0·9 – 7·8	0·5 – 4·4	1·9 – 11·1
Thailand	2006 – 2010	3·0 – 17·5	5·4 – 15·9	8·4 – 24·3
United Kingdom (England and Wales)	2006/07 – 2011/12	2·1 – 18·4	0·5 – 10·0	0·5 – 10·0
Uruguay	2004, 2007 – 2009	6·3 – 25·7	7·8 – 19·0	4·3 – 23·1
USA	1999/2000 – 2014/15	1·6 – 9·7	0·9 – 6·9	1·1 – 10·0

[a]The annual number of coded respiratory deaths were obtained through the World Health Organization mortality database for ICD-10 coded deaths (http://www.who.int/healthinfo/statistics/mortality_rawdata/en/). Annual numbers of coded respiratory deaths from all other countries obtained through in-country collaborators

[b]The annual number of coded respiratory deaths was unavailable at the national level for this country

Appendix Table 16. Comparison of death estimate applying the proportion of influenza-associated respiratory deaths to estimated annual influenza-associated respiratory death interval for 13 validation countries.

Country	<65 Years		65-74 Years		≥75 Years	
	Estimated Deaths Applying Influenza-associated Proportion, Range[a]	Estimated Annual Death 95% Credible Interval[b]	Estimated Deaths Applying Influenza-associated Proportion, Range[a]	Estimated Annual Death 95% Credible Interval[b]	Estimated Deaths Applying Influenza-associated Proportion, Range[a]	Estimated Annual Death 95% Credible Interval[b]
Colombia	0 – 2,406	98 – 1,013	0 – 1,803	38 – 734	0 – 4,467	86 – 1,589
Costa Rica	0 – 75	8 – 252	0 – 59	5 – 105	0 – 126	18 – 290
Cuba	0 – 726	19 – 192	9 – 350	31 – 235	44 – 2,510	81 – 1,078
Ecuador	12 – 574	33 – 490	0 – 284	16 – 315	19 – 1,096	55 – 734
El Salvador	6 – 282	25 – 1,231	3 – 95	19 – 400	9 – 532	38 – 799
Guatemala	37 – 1,745	65 – 972	7 – 258	30 – 227	22 – 1,282	61 – 811
Indonesia	133 – 6,244	1,087 – 54,421	--	--	--	--
Kuwait	0 – 32	7 – 222	0 – 12	4 – 32	1 – 48	5 – 69
Mongolia	4 – 173	6 – 93	--	--	--	--
Morocco	9 – 418	134 – 7,202	--	--	--	--
Panama	0 – 208	9 – 96	0 – 92	3 – 56	0 – 332	11 – 203
Peru	27 – 1,281	125 – 6,657	14 – 510	104 – 1,813	63 – 3,598	158 – 3,340
Venezuela	0 – 1,235	64 – 663	0 – 594	20 – 392	0 – 1,585	69 – 1,261

[a]The proportion of influenza-associated respiratory deaths out of total respiratory deaths was calculated for each year of data available for 32 of the excess mortality rate (EMR)-contributing countries that provided the total number of respiratory deaths by age group and year or season. The range of these proportions, across all country-years of data, was calculated for each age-specific analytic division. This proportion range was then applied to the annual age-specific respiratory deaths provided by the 13 validation countries. The range represents the lowest and highest possible number of influenza-associated annual deaths using this estimation method

[b]The estimated annual death interval for each EMR-contributing country was calculated from the Bayesian Hierarchical extrapolation model using influenza-associated excess mortality information from all EMR-contributing countries

Appendix Table 17. Comparison of three global seasonal influenza-associated death estimates.

	Global Seasonal Influenza-associated Mortality Project	**The GLaMOR Project**	**Global Burden of Disease Project**
Organization	Centers for Disease Control and Prevention, Atlanta, GA	Netherlands Institute for Health Services Research, Utrecht, Netherlands	Institute for Health Metrics and Evaluation, Seattle, WA
Year Published	2017	2013	2016
Type of Estimate Presented	95% credible interval	Point estimate; 95% credible interval	Point estimate; 95% uncertainty interval
Estimates Provided in Publication	Worldwide, regional, and country-specific	Worldwide, regional	Worldwide
Age Groups Estimated	<65 years, 65-74 years, ≥75 years, all ages	<65 years, ≥65 years, all ages	<5 years, all ages
Global Influenza-associated Death Estimate	All ages: 291,000-646,000	All ages: 148,000-249,000	All ages: 83,100 (55,700-122,100)
Death Category Estimated	Influenza-associated respiratory deaths	Influenza-associated respiratory deaths	Influenza-attributed lower respiratory tract infection deaths
Years Used in Estimation	1999-2015	2005-2009	1990-2015
Objective	Primary objective was to estimate seasonal influenza-associated respiratory deaths	Primary objective was to estimate worldwide pandemic deaths; worldwide seasonal influenza-associated deaths was a secondary objective	Primary objective was to estimate worldwide cause-specific mortality for 249 causes of death including lower respiratory tract infection death; pathogen specific attribution (including influenza) of lower respiratory tract infection deaths was a secondary objective
Data Sources	- Estimates of influenza-associated excess mortality from 33 countries by age group allowing variability in the models by country - Annual number of ICD-coded respiratory deaths from 13 countries by age group - WHO, Global Health Estimates (GHE) for respiratory infection deaths, 2015 - United Nations and United States Census Population Estimates 2015	- Estimates of influenza-associated excess mortality from 20 countries by age group using same model for each country - Country-specific indicators for WHO region, age-specific all cause mortality rates, physician density, obesity, population density, major infectious diseases (HIV, TB prevalence), GNI per capita, rural population, population age structure (percent <15 years, >60 years), latitude	- Estimates of country-specific lower respiratory tract infection deaths calculated using Cause of Death Ensemble Models - Proportion influenza virus positive among patients with lower respiratory tract infections from published literature (1990-2015) - Adjustment factors (odds ratio of lower respiratory tract infection given presence of influenza virus, ratio of viral: bacterial pneumonia case-fatality)
Description of Model	Bayesian Hierarchical Model with Multiplier: - Annual country-specific death estimates pooled to calculate mean country-specific mortality rates for contributing countries - Countries grouped by age group into analytic divisions generated from GHE respiratory infection deaths - Country-specific mortality rate ratios generated from GHE respiratory infection deaths - Within the Bayesian hierarchical model with 5,000 iterations, random mean country-specific mortality rate from a contributing country was multiplied by country-specific mortality rate ratio to calculate country-specific mortality rate distributions	Multiple Imputation Method for extrapolation: - Two step approach with a data creation step followed by a hierarchical regression modeling step to project burden for all countries - For data creation, used statistical correlations between country-specific indicators and contributing country mortality estimates to create distribution of possible mortality values - Selected random sample of 20 possible values from each country for additional analyses - In analysis step, applied hierarchical linear random effects regression model to final dataset to generate point estimate and standard error for each country	Counter-Factual Approach to Attribute Influenza: - Lower respiratory tract infection deaths first estimated and then attribution of specific pathogens (including influenza) was done by: - Systematic review conducted to estimate prevalence of influenza virus in patients with lower respiratory tract infections - Population attributable fraction was calculated using proportion influenza positive and odds ratio of a lower respiratory tract infection given the presence of influenza virus - Attributable fraction adjusted by the ratio of viral: bacterial pneumonia case-fatality

	Global Seasonal Influenza-associated Mortality Project	The GLaMOR Project	Global Burden of Disease Project
Limitations Reported	- Limited data availability (sub-Saharan Africa, Middle East, Southeast Asia, low-income countries, tropical climate countries) - Estimates for countries in AD3 may be less precise because fewer contributing countries and quality of available data - Vital records data may be limited by lack of reliability of cause-of-death coding - Ecological models to estimate excess mortality have inherent uncertain and error - Bayesian modeling framework relies on assumptions that might impact accuracy and precision of estimates - Hierarchical model assumes EMRs to be independent between countries, seasons and may have resulted in narrower interval estimates - GHE respiratory infection estimates used were limited by variable source information and quality and availability between countries - Assumed constant influenza attack rate between countries and could not account for differences in virus circulation between countries - Countries provided data from a variable number of seasons	- Noted some misalignment between influenza virology and seasonal pneumonia mortality peaks in some countries that could not be resolved - Lacked good representation of low-income countries and countries in Southeast Asia, Eastern Mediterranean, and Africa - Countries provided data from a variable number of seasons	- Adjustment ratio of viral: bacterial pneumonia case-fatality limited to data from four countries - Odds ratio of lower respiratory tract infection given presence of influenza virus from literature was only for children <5 but applied to all ages - Limited cause of death data from sub-Saharan Africa, Southeast Asia, and the Middle East - Results depend critically on the validity of approach to garbage code redistribution
Critical Evaluation	- Critical evaluation presented in manuscript as limitations and those limitations described in row above	- Statistical correlations between set of 10 indicators used to create distribution of possible mortality values for each unknown country with limited information on how these variables are associated with risk of influenza-associated death - Multiple imputation method generated a 60 estimate distribution for each country - Assumed a country-specific rates as a Normal distribution, potential imposing shrinkage towards global and regional means - Fitted the 60 imputed datasets for all countries in a hierarchical model that may under-estimate uncertainty due to imputation	- Categorical attribution of death assumes there is only one cause of death for each death, which may underestimate true underlying causes of death - Only primary cause of death used in estimation, which may underestimate certain causes of deaths
Reference		Simonsen L, et al., PLOS Med 2013	GBD 2015 Mortality and Causes of Death Collaborators, Lancet 2016

Appendix Table 18. Estimated between season/year heterogeneity standard deviation.[a]

	<65 Years (Mean (95% CI))	**65-74 Years (Mean (95% CI))**	**≥75 Years (Mean (95% CI))**
Analytic Division 1	0·20 (0·16 – 0·24)	4·00 (3·27 – 4·83)	22·87 (19·44 – 26·97)
Analytic Division 2	0·32 (0·26 – 0·40)	5·00 (4·26 – 5·91)	40·21 (33·46 – 48·10)
Analytic Division 3	0·76 (0·55 – 1·02)	9·83 (7·70 – 12·53)	43·83 (36·66 – 52·27)

[a]The Bayesian hierarchical model assumes each season/year's true mortality rate is normally distributed around the country-specific mean annual estimate. Larger heterogeneity standard deviation indicates higher between-season/year variability in mortality rates

Appendix Table 19. Comparison of estimated annual influenza-associated respiratory death median and 95% credible interval to World Health Organization (WHO) Global Health Estimates (GHE) of respiratory infection (RI) death.

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			<65 Years				
			<65 Years	65-74 Years	≥75 Years	Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
							Median	95% Credible Interval		
Worldwide			--	--	--		175,303	67,255 – 342,576	1,584,258	11·1%
Afghanistan	EMRO	Low	4	3	2		1,190	139 – 7,348	22,067	5·4%
Albania	EURO	Low	1	1	1		11	2 – 81	114	2·3%
Algeria	AFRO	Low	3	2	2		1,428	170 – 8,730	5,242	9·7%
Angola	AFRO	Low	4	4	4		938	106 – 5,498	40,397	20·8%
Antigua and Barbuda	AMRO	High	2	2	3		1	0 – 2	8	11·8%
Argentina	AMRO	High	3	3	3	1,155	598	85 – 1,266	5,077	8·8%
Armenia	EURO	Low	1	1	1		12	2 – 87	136	13·2%
Australia	WPRO	High	1	1	1	103	60	13 – 402	363	16·5%
Austria	EURO	High	1	1	1	71	10	2 – 70	63	15·8%
Azerbaijan	EURO	Low	3	1	1		334	40 – 2,105	1,266	26·4%
Bahamas	AMRO	High	2	2	2		5	1 – 12	43	4·4%
Bahrain	EMRO	Low	1	2	2		6	1 – 42	38	16·4%
Bangladesh	SEARO	Low	3	2	1		5,679	671 – 34,930	22,167	4·4%
Barbados	AMRO	High	3	3	3		6	1 – 12	47	4·8%
Belarus	EURO	High	2	1	1		60	14 – 145	540	25·6%
Belgium	EURO	High	1	2	2		73	16 – 492	444	11·0%
Belize	AMRO	High	2	3	4		4	1 – 10	37	15·8%
Benin	AFRO	Low	4	4	4		392	44 – 2,335	8,989	11·6%
Bhutan	SEARO	Low	3	3	2		27	3 – 170	188	17·3%
Bolivia (Plurinational State of)	AMRO	Low	3	3	3		376	44 – 2,231	3,356	11·1%
Bosnia and Herzegovina	EURO	Low	1	1	1		14	2 – 100	81	10·9%
Botswana	AFRO	Low	3	4	4		80	9 – 493	649	11·2%
Brazil	AMRO	High	2	3	3		2,698	634 – 6,564	24,450	11·0%
Brunei Darussalam	WPRO	High	1	2	3		3	1 – 23	21	12·8%
Bulgaria	EURO	High	2	1	1		56	13 – 136	507	14·2%
Burkina Faso	AFRO	Low	4	4	4		648	80 – 3,856	13,448	14·3%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			<65 Years				
						Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
			<65 Years	65-74 Years	≥75 Years		Median	95% Credible Interval		
Burundi	AFRO	Low	4	4	4		417	50 – 2,516	9,473	12·3%
Cambodia	WPRO	Low	3	3	3		562	64 – 3,349	3,409	3·3%
Cameroon	AFRO	Low	4	4	4		835	96 – 5,226	18,534	16·4%
Canada	AMRO	High	1	1	1	108	110	24 – 740	669	16·8%
Cape Verde	AFRO	Low	3	4	4		18	2 – 107	81	16·4%
Central African Republic	AFRO	Low	4	4	4		174	21 – 1,003	5,255	10·9%
Chad	AFRO	Low	4	4	4		513	60 – 3,101	24,869	3·2%
Chile	AMRO	High	1	1	2	219	87	19 – 586	530	4·5%
China	WPRO	Low	1	2	1	8,328	5,319	918 – 39,140	48,652	4·2%
China, Hong Kong SAR[g]	WPRO	High	2	3	4	24	46	11 – 112	417	9·1%
Colombia	AMRO	High	2	2	2		417	98 – 1,013	3,775	11·0%
Comoros	AFRO	Low	4	4	4		29	3 – 166	548	5·3%
Congo	AFRO	Low	4	3	4		166	20 – 1,008	1,815	22·4%
Costa Rica	AMRO	High	1	1	1		38	8 – 252	228	16·7%
Côte d'Ivoire	AFRO	Low	4	4	4		807	98 – 4,918	25,100	11·1%
Croatia	EURO	High	1	1	1		16	3 – 109	99	21·4%
Cuba	AMRO	High	2	3	3		79	19 – 192	715	16·4%
Cyprus	EURO	Low	1	1	1		4	1 – 33	19	16·5%
Czech Republic	EURO	High	1	2	2	42	74	16 – 499	451	7·1%
Democratic People's Republic of Korea	SEARO	Low	2	2	2		218	47 – 605	2,202	16·2%
Democratic Republic of the Congo	AFRO	Low	4	4	4		2,801	322 – 16,819	67,120	8·0%
Denmark	EURO	High	1	1	2	26	19	4 – 130	117	27·2%
Djibouti	EMRO	Low	4	4	4		31	4 – 191	435	11·8%
Dominican Republic	AMRO	Low	2	2	2		93	21 – 261	1,166	26·2%
Ecuador	AMRO	High	3	2	3		231	33 – 490	1,965	7·3%
Egypt	EMRO	Low	3	3	2		3,365	389 – 19,887	12,853	16·6%
El Salvador	AMRO	Low	3	3	3		211	25 – 1,231	848	11·2%
Equatorial Guinea	AFRO	Low	4	4	4		31	4 – 184	725	6·8%
Eritrea	AFRO	Low	4	4	4		185	21 – 1,090	2,542	16·2%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			<65 Years				
			<65 Years	65-74 Years	≥75 Years	Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
							Median	95% Credible Interval		
Estonia	EURO	High	2	1	1		9	2 – 22	80	11·9%
Ethiopia	AFRO	Low	4	3	3		3,529	419 – 22,225	51,761	16·5%
Fiji	WPRO	High	3	3	3		18	3 – 38	151	17·5%
Finland	EURO	High	1	1	1		8	2 – 55	50	9·6%
France	EURO	High	1	1	2		231	50 – 1,549	1,400	16·5%
Gabon	AFRO	Low	3	3	4		61	7 – 353	633	17·2%
Gambia	AFRO	Low	4	4	4		74	9 – 418	1,346	6·5%
Georgia	EURO	Low	2	1	1		33	7 – 92	192	4·1%
Germany	EURO	High	1	1	1	229	361	78 – 2,422	2,188	5·5%
Ghana	AFRO	Low	4	4	4		978	121 – 5,902	14,982	4·5%
Greece	EURO	High	1	1	1		35	8 – 237	214	4·3%
Grenada	AMRO	High	3	3	4		2	0 – 5	19	16·3%
Guatemala	AMRO	High	3	3	3		459	65 – 972	3,898	10·3%
Guinea	AFRO	Low	4	4	4		461	58 – 2,726	11,325	11·8%
Guinea-Bissau	AFRO	Low	4	4	4		67	8 – 386	1,478	12·1%
Guyana	AMRO	High	3	3	3		19	3 – 39	157	11·0%
Haiti	AMRO	Low	4	3	3		385	46 – 2,368	5,784	12·7%
Honduras	AMRO	Low	2	1	1		73	16 – 205	576	16·2%
Hungary	EURO	High	1	1	1		41	9 – 277	250	6·7%
Iceland	EURO	High	1	1	2		0	0 – 3	2	16·4%
India	SEARO	Low	3	3	3	25,741	46,877	5,545 – 278,440	267,348	26·1%
Indonesia	SEARO	Low	3	2	2		9,279	1,087 – 54,421	35,489	17·5%
Iran (Islamic Republic of)	EMRO	High	2	2	2		496	117 – 1,208	4,498	15·9%
Iraq	EMRO	Low	3	2	1		1,359	155 – 7,789	6,881	11·0%
Ireland	EURO	High	1	1	2		10	2 – 70	63	19·7%
Israel	EURO	High	1	2	2	15	36	8 – 242	219	0·0%
Italy	EURO	High	1	1	1		114	25 – 766	692	16·4%
Jamaica	AMRO	High	1	2	2		22	5 – 148	134	16·5%
Japan	WPRO	High	1	2	3	207	780	167 – 5,227	4,723	16·4%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			<65 Years				
			<65 Years	65-74 Years	≥75 Years	Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
							Median	95% Credible Interval		
Jordan	EMRO	Low	2	2	2		70	15 – 202	565	12·3%
Kazakhstan	EURO	High	3	2	1		401	57 – 849	3,406	16·5%
Kenya[e]	AFRO	Low	4	4	4		1,696	199 – 10,783	19,176	11·8%
Kiribati	WPRO	Low	3	3	3		4	0 – 25	42	8·8%
Kuwait	EMRO	High	1	3	4		33	7 – 222	201	11·0%
Kyrgyzstan	EURO	High	2	1	1		76	18 – 185	691	16·5%
Lao People's Democratic Republic	WPRO	Low	4	3	3		239	29 – 1,441	2,678	9·4%
Latvia	EURO	High	2	1	1		21	5 – 52	194	16·5%
Lebanon	EMRO	Low	1	1	1		23	4 – 176	116	16·4%
Lesotho	AFRO	Low	4	4	3		77	9 – 473	1,346	8·9%
Liberia	AFRO	Low	4	4	4		168	20 – 959	2,712	19·8%
Libya	EMRO	Low	2	3	3		57	12 – 159	473	6·2%
Lithuania	EURO	High	2	1	1		22	5 – 54	203	12·0%
Luxembourg	EURO	High	1	1	1		2	0 – 11	10	12·5%
Madagascar	AFRO	Low	4	4	3		886	96 – 5,484	10,918	9·3%
Malawi	AFRO	Low	4	4	4		627	71 – 3,729	7,642	5·7%
Malaysia	WPRO	Low	3	4	4		1,072	123 – 6,278	4,008	10·9%
Maldives	SEARO	Low	1	2	2		2	0 – 11	11	20·4%
Mali	AFRO	Low	4	3	3		634	72 – 3,770	13,178	10·9%
Malta	EURO	High	1	1	2		2	0 – 12	10	27·8%
Mauritania	AFRO	Low	4	4	4		148	17 – 904	2,481	11·7%
Mauritius	AFRO	High	2	2	2		11	3 – 28	103	8·1%
Mexico	AMRO	High	2	2	2	1,685	975	229 – 2,372	8,835	19·0%
Micronesia (Federated States of)	WPRO	Low	3	3	3		4	0 – 23	23	11·0%
Mongolia	WPRO	High	3	1	1		44	6 – 93	371	15·7%
Montenegro	EURO	High	1	1	1		2	0 – 14	12	4·8%
Morocco	EMRO	Low	3	3	2		1,195	134 – 7,202	4,302	19·1%
Mozambique	AFRO	Low	4	4	3		1,033	123 – 6,110	17,831	13·8%
Myanmar	SEARO	Low	3	3	2		1,906	229 – 11,743	13,852	16·1%

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			<65 Years	65-74 Years	≥75 Years		Median	95% Credible Interval		
Namibia	AFRO	Low	4	4	4		88	10 – 548	1,013	11·8%
Nepal	SEARO	Low	3	3	3		1,040	126 – 6,380	5,473	5·8%
Netherlands	EURO	High	1	1	2	53	52	11 – 352	318	6·0%
New Zealand	WPRO	High	1	1	1	12	11	2 – 73	66	10·6%
Nicaragua	AMRO	Low	2	2	2		54	12 – 154	734	8·2%
Niger	AFRO	Low	4	4	4		710	93 – 4,319	22,602	26·7%
Nigeria	AFRO	Low	4	4	4		6,653	746 – 38,790	240,499	8·7%
Norway	EURO	High	1	1	2	38	15	3 – 101	91	3·1%
Oman	EMRO	Low	2	3	3		42	9 – 120	332	2·8%
Pakistan	EMRO	Low	3	2	1		6,609	783 – 40,547	72,702	7·4%
Panama	AMRO	High	2	2	2		40	9 – 96	358	16·4%
Papua New Guinea	WPRO	Low	4	4	3		277	34 – 1,663	3,642	16·4%
Paraguay	AMRO	Low	2	2	2	135	59	13 – 168	793	19·0%
Peru	AMRO	Low	3	4	4		1,080	125 – 6,657	7,050	16·7%
Philippines	WPRO	High	3	4	4		3,878	549 – 8,211	32,927	12·6%
Poland	EURO	High	2	2	2		266	63 – 647	2,411	9·1%
Portugal	EURO	High	2	2	3	47	48	11 – 117	434	11·2%
Qatar	EMRO	Low	1	2	1		10	2 – 73	38	15·3%
Republic of Korea	WPRO	High	1	2	2	57	153	33 – 1,028	929	11·8%
Republic of Moldova	EURO	High	3	2	1		95	13 – 202	809	7·6%
Romania	EURO	High	3	2	1	97	307	43 – 650	2,608	11·0%
Russian Federation	EURO	High	3	2	1		3,658	517 – 7,745	31,060	9·9%
Rwanda	AFRO	Low	4	4	4		430	49 – 2,508	4,693	11·1%
Saint Lucia	AMRO	High	2	2	3		2	0 – 4	16	7·4%
Saint Vincent and the Grenadines	AMRO	High	3	3	3		2	0 – 5	21	26·0%
Samoa	WPRO	Low	2	3	3		2	0 – 5	21	11·8%
Sao Tome and Principe	AFRO	Low	3	4	4		7	1 – 43	71	11·8%
Saudi Arabia	EMRO	Low	2	3	3		288	63 – 828	2,447	9·2%
Senegal	AFRO	Low	4	4	4		544	67 – 3,278	6,035	11·8%

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			<65 Years	65-74 Years	≥75 Years		Median	95% Credible Interval		
Serbia	EURO	High	1	1	1	49	44	10 – 298	269	6·9%
Seychelles	AFRO	High	3	4	3		2	0 – 5	20	9·0%
Sierra Leone	AFRO	Low	4	4	4		229	29 – 1,403	8,133	11·1%
Singapore	WPRO	High	2	3	4	73	56	13 – 136	506	16·2%
Slovakia	EURO	High	2	2	2		42	10 – 102	380	2·8%
Slovenia	EURO	High	1	1	2		5	1 – 34	31	24·8%
Solomon Islands	WPRO	Low	3	3	3		21	2 – 122	129	2·2%
Somalia	EMRO	Low	4	4	4		400	45 – 2,430	17,796	16·3%
South Africa	AFRO	High	3	4	3	2,661	2,265	320 – 4,797	19,235	3·9%
South Sudan	AFRO	Low	4	4	4		446	51 – 2,687	11,573	9·8%
Spain	EURO	High	1	1	1	121	124	27 – 828	749	11·4%
Sri Lanka	SEARO	Low	2	2	2		177	40 – 512	1,898	11·1%
Sudan	EMRO	Low	4	3	3		1,411	172 – 8,857	20,375	16·2%
Suriname	AMRO	High	2	3	3		7	2 – 17	62	16·6%
Swaziland	AFRO	Low	4	4	3		47	6 – 275	656	7·2%
Sweden	EURO	High	1	1	2		33	7 – 220	199	10·2%
Switzerland	EURO	High	1	1	1	23	26	5 – 172	155	12·3%
Syrian Arab Republic	EMRO	Low	2	2	2		169	35 – 471	1,378	2·1%
Taiwan[f,g]	WPRO	High	2	2	3	33	125	29 – 303	1,135	5·2%
Tajikistan	EURO	Low	3	3	2		309	35 – 1,783	3,237	17·0%
Thailand	SEARO	Low	3	3	4	783	2,224	274 – 14,066	13,071	9·5%
The former Yugoslav Republic of Macedonia	EURO	High	1	1	1		7	2 – 49	45	12·9%
Timor-Leste	SEARO	Low	4	3	3		42	5 – 251	633	6·6%
Togo	AFRO	Low	4	4	4		269	31 – 1,527	5,156	8·4%
Tonga	WPRO	Low	2	3	3		1	0 – 3	12	10·8%
Trinidad and Tobago	AMRO	High	2	2	2		15	4 – 37	139	9·5%
Tunisia	EMRO	Low	2	3	2		99	21 – 281	1,043	11·0%
Turkey	EURO	High	2	1	1		425	100 – 1,033	3,848	11·0%
Turkmenistan	EURO	Low	3	2	1		194	23 – 1,111	1,502	7·0%

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							Median	95% Credible Interval		
Uganda	AFRO	Low	4	4	4		1,403	172 – 8,495	22,505	6·2%
Ukraine	EURO	High	2	1	1		411	97 – 1,000	3,725	11·0%
United Arab Emirates	EMRO	Low	1	3	3		40	6 – 303	192	11·0%
United Kingdom[h]	EURO	High	1	1	2	1,097	301	64 – 2,014	1,820	11·0%
United Republic of Tanzania	AFRO	Low	4	4	4		1,950	229 – 11,645	27,777	11·8%
United States of America	AMRO	High	2	2	1	1,523	1,760	414 – 4,282	15,949	9·6%
Uruguay	AMRO	High	2	2	2	52	22	5 – 54	200	11·1%
Uzbekistan	EURO	High	3	1	1		760	107 – 1,609	6,452	10·5%
Vanuatu	WPRO	Low	3	3	3		10	1 – 57	44	23·0%
Venezuela (Bolivarian Republic of)	AMRO	High	2	2	2		273	64 – 663	2,470	9·6%
Viet Nam	WPRO	Low	2	2	2		829	177 – 2,306	7,920	12·0%
Yemen	EMRO	Low	3	3	3		976	114 – 5,786	8,112	11·8%
Zambia	AFRO	Low	4	4	3		591	70 – 3,515	8,831	6·7%
Zimbabwe	AFRO	Low	4	4	4		555	66 – 3,345	8,432	6·6%

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							Median	95% Credible Interval		
Worldwide			--	--	--		72,720	48,810 – 102,187	413,934	17·6%
Afghanistan	EMRO	Low	4	3	2		224	47 – 822	703	31·9%
Albania	EURO	Low	1	1	1		16	2 – 69	51	9·8%
Algeria	AFRO	Low	3	2	2		131	23 – 496	1,104	31·6%
Angola	AFRO	Low	4	4	4		154	30 – 568	1,564	33·7%
Antigua and Barbuda	AMRO	High	2	2	3		0	0 – 1	3	13·8%
Argentina	AMRO	High	3	3	3	1,179	687	174 – 1,299	4,968	35·8%
Armenia	EURO	Low	1	1	1		11	1 – 48	31	0·0%
Australia	WPRO	High	1	1	1	68	100	16 – 358	314	31·9%
Austria	EURO	High	1	1	1	100	30	5 – 109	96	31·3%
Azerbaijan	EURO	Low	3	1	1		20	2 – 91	116	17·2%
Bahamas	AMRO	High	2	2	2		2	0 – 7	14	10·7%
Bahrain	EMRO	Low	1	2	2		2	0 – 8	19	15·0%
Bangladesh	SEARO	Low	3	2	1		475	84 – 1,801	2,714	6·1%
Barbados	AMRO	High	3	3	3		6	1 – 11	40	6·5%
Belarus	EURO	High	2	1	1		17	3 – 60	53	17·5%
Belgium	EURO	High	1	2	2		97	17 – 334	646	31·9%
Belize	AMRO	High	2	3	4		2	1 – 4	15	10·4%
Benin	AFRO	Low	4	4	4		87	17 – 319	1,424	14·2%
Bhutan	SEARO	Low	3	3	2		9	2 – 34	31	30·1%
Bolivia (Plurinational State of)	AMRO	Low	3	3	3		152	31 – 559	959	32·3%
Bosnia and Herzegovina	EURO	Low	1	1	1		25	3 – 107	83	13·7%
Botswana	AFRO	Low	3	4	4		21	4 – 77	168	15·9%
Brazil	AMRO	High	2	3	3		1,911	483 – 3,615	13,830	13·8%
Brunei Darussalam	WPRO	High	1	2	3		1	0 – 5	9	14·8%
Bulgaria	EURO	High	2	1	1		107	17 – 382	335	11·1%
Burkina Faso	AFRO	Low	4	4	4		120	24 – 438	1,841	29·0%
Burundi	AFRO	Low	4	4	4		72	14 – 267	672	12·5%
Cambodia	WPRO	Low	3	3	3		168	35 – 635	912	9·8%

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Cameroon	AFRO	Low	4	4	4		191	41 – 712	2,592	31·9%
Canada	AMRO	High	1	1	1	201	220	36 – 787	690	32·0%
Cape Verde	AFRO	Low	3	4	4		4	1 – 15	39	31·8%
Central African Republic	AFRO	Low	4	4	4		49	10 – 178	499	20·2%
Chad	AFRO	Low	4	4	4		89	17 – 337	1,447	5·0%
Chile	AMRO	High	1	1	2	344	151	25 – 541	475	7·4%
China	WPRO	Low	1	2	1	16,156	7,939	1,365 – 31,027	39,296	10·2%
China, Hong Kong SAR[g]	WPRO	High	2	3	4	69	87	22 – 164	627	14·1%
Colombia	AMRO	High	2	2	2		214	38 – 734	1,417	15·1%
Comoros	AFRO	Low	4	4	4		6	1 – 21	71	8·5%
Congo	AFRO	Low	4	3	4		43	8 – 159	304	10·3%
Costa Rica	AMRO	High	1	1	1		29	5 – 105	92	31·5%
Côte d'Ivoire	AFRO	Low	4	4	4		191	41 – 726	3,793	13·8%
Croatia	EURO	High	1	1	1		31	5 – 110	97	41·8%
Cuba	AMRO	High	2	3	3		124	31 – 235	897	15·1%
Cyprus	EURO	Low	1	1	1		7	1 – 28	17	31·8%
Czech Republic	EURO	High	1	2	2	64	83	15 – 284	549	11·9%
Democratic People's Republic of Korea	SEARO	Low	2	2	2		153	26 – 586	942	31·9%
Democratic Republic of the Congo	AFRO	Low	4	4	4		605	123 – 2,210	5,958	14·1%
Denmark	EURO	High	1	1	2	26	74	12 – 264	232	11·9%
Djibouti	EMRO	Low	4	4	4		10	2 – 36	84	15·1%
Dominican Republic	AMRO	Low	2	2	2		37	7 – 146	263	38·4%
Ecuador	AMRO	High	3	2	3		92	16 – 315	608	8·0%
Egypt	EMRO	Low	3	3	2		1,200	239 – 4,393	3,124	31·8%
El Salvador	AMRO	Low	3	3	3		108	19 – 400	365	32·1%
Equatorial Guinea	AFRO	Low	4	4	4		6	1 – 22	63	14·4%
Eritrea	AFRO	Low	4	4	4		38	8 – 148	476	31·4%
Estonia	EURO	High	2	1	1		15	2 – 53	47	14·6%
Ethiopia	AFRO	Low	4	3	3		898	169 – 3,354	6,219	31·9%

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Fiji	WPRO	High	3	3	3		8	2 – 14	55	20·9%
Finland	EURO	High	1	1	1		11	2 – 40	35	13·8%
France	EURO	High	1	1	2		455	75 – 1,627	1,428	31·8%
Gabon	AFRO	Low	3	3	4		20	4 – 75	145	25·4%
Gambia	AFRO	Low	4	4	4		12	3 – 46	240	6·5%
Georgia	EURO	Low	2	1	1		21	3 – 89	83	7·1%
Germany	EURO	High	1	1	1	245	921	151 – 3,294	2,891	5·0%
Ghana	AFRO	Low	4	4	4		243	53 – 886	3,706	6·6%
Greece	EURO	High	1	1	1		93	15 – 333	293	9·5%
Grenada	AMRO	High	3	3	4		1	0 – 2	10	31·8%
Guatemala	AMRO	High	3	3	3		120	30 – 227	869	10·5%
Guinea	AFRO	Low	4	4	4		104	20 – 399	1,464	13·8%
Guinea-Bissau	AFRO	Low	4	4	4		16	3 – 62	241	13·3%
Guyana	AMRO	High	3	3	3		6	2 – 12	45	13·9%
Haiti	AMRO	Low	4	3	3		119	23 – 438	572	19·9%
Honduras	AMRO	Low	2	1	1		18	2 – 76	91	32·1%
Hungary	EURO	High	1	1	1		57	9 – 204	179	20·8%
Iceland	EURO	High	1	1	2		1	0 – 3	3	31·9%
India	SEARO	Low	3	3	3	17262.1	18,280	3,644 – 66,898	124,105	12·4%
Indonesia	SEARO	Low	3	2	2		858	142 – 3,248	6,936	14·7%
Iran (Islamic Republic of)	EMRO	High	2	2	2		188	33 – 647	1,249	31·6%
Iraq	EMRO	Low	3	2	1		70	12 – 265	480	15·0%
Ireland	EURO	High	1	1	2		29	5 – 104	92	14·6%
Israel	EURO	High	1	2	2	16	42	7 – 144	277	39·7%
Italy	EURO	High	1	1	1		326	54 – 1,167	1,024	15·2%
Jamaica	AMRO	High	1	2	2		9	2 – 32	61	31·8%
Japan	WPRO	High	1	2	3	596	1,706	303 – 5,854	11,305	14·7%
Jordan	EMRO	Low	2	2	2		18	3 – 67	151	11·9%
Kazakhstan	EURO	High	3	2	1		68	12 – 235	453	15·1%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			65-74 Years				
			<65 Years	65-74 Years	≥75 Years	Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
							Median	95% Credible Interval		
Kenya[e]	AFRO	Low	4	4	4		321	66 – 1,207	2,464	15·0%
Kiribati	WPRO	Low	3	3	3		1	0 – 4	5	13·0%
Kuwait	EMRO	High	1	3	4		17	4 – 32	121	30·7%
Kyrgyzstan	EURO	High	2	1	1		7	1 – 26	23	18·4%
Lao People's Democratic Republic	WPRO	Low	4	3	3		66	13 – 238	353	19·2%
Latvia	EURO	High	2	1	1		24	4 – 86	75	15·1%
Lebanon	EMRO	Low	1	1	1		22	3 – 94	79	14·1%
Lesotho	AFRO	Low	4	4	3		21	4 – 79	160	18·7%
Liberia	AFRO	Low	4	4	4		37	8 – 134	477	27·8%
Libya	EMRO	Low	2	3	3		69	14 – 259	238	7·8%
Lithuania	EURO	High	2	1	1		30	5 – 107	94	29·0%
Luxembourg	EURO	High	1	1	1		4	1 – 15	13	13·9%
Madagascar	AFRO	Low	4	4	3		169	37 – 650	1,359	10·5%
Malawi	AFRO	Low	4	4	4		156	31 – 583	1,472	13·2%
Malaysia	WPRO	Low	3	4	4		462	95 – 1,659	3,764	31·9%
Maldives	SEARO	Low	1	2	2		1	0 – 4	8	29·7%
Mali	AFRO	Low	4	3	3		122	25 – 453	765	31·8%
Malta	EURO	High	1	1	2		5	1 – 18	15	27·0%
Mauritania	AFRO	Low	4	4	4		34	7 – 129	517	15·1%
Mauritius	AFRO	High	2	2	2		6	1 – 20	38	12·4%
Mexico	AMRO	High	2	2	2	935	399	71 – 1,369	2,643	12·4%
Micronesia (Federated States of)	WPRO	Low	3	3	3		1	0 – 4	5	15·1%
Mongolia	WPRO	High	3	1	1		8	1 – 27	24	31·7%
Montenegro	EURO	High	1	1	1		3	0 – 10	9	15·9%
Morocco	EMRO	Low	3	3	2		487	93 – 1,808	1,807	32·5%
Mozambique	AFRO	Low	4	4	3		244	47 – 873	1,748	27·5%
Myanmar	SEARO	Low	3	3	2		724	143 – 2,701	2,630	32·7%
Namibia	AFRO	Low	4	4	4		22	5 – 82	203	33·3%
Nepal	SEARO	Low	3	3	3		410	82 – 1,495	1,885	13·9%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			65-74 Years				
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							Median	95% Credible Interval		
Netherlands	EURO	High	1	1	2	226	156	26 – 560	491	6·6%
New Zealand	WPRO	High	1	1	1	19	11	2 – 38	33	15·7%
Nicaragua	AMRO	Low	2	2	2		17	3 – 64	119	10·6%
Niger	AFRO	Low	4	4	4		147	28 – 544	2,421	12·3%
Nigeria	AFRO	Low	4	4	4		1,433	301 – 5,502	31,761	10·8%
Norway	EURO	High	1	1	2	44	42	7 – 152	133	6·1%
Oman	EMRO	Low	2	3	3		31	6 – 110	162	4·5%
Pakistan	EMRO	Low	3	2	1		533	96 – 2,028	3,740	14·3%
Panama	AMRO	High	2	2	2		16	3 – 56	107	31·7%
Papua New Guinea	WPRO	Low	4	4	3		64	13 – 229	522	31·6%
Paraguay	AMRO	Low	2	2	2	62	23	4 – 89	218	21·7%
Peru	AMRO	Low	3	4	4		482	104 – 1,813	4,120	32·9%
Philippines	WPRO	High	3	4	4		1,612	408 – 3,048	11,660	19·2%
Poland	EURO	High	2	2	2		287	51 – 984	1,901	14·3%
Portugal	EURO	High	2	2	3	114	94	17 – 324	626	14·9%
Qatar	EMRO	Low	1	2	1		2	0 – 6	10	11·7%
Republic of Korea	WPRO	High	1	2	2	141	281	50 – 964	1,861	13·8%
Republic of Moldova	EURO	High	3	2	1		18	3 – 62	119	12·3%
Romania	EURO	High	3	2	1	122	200	35 – 686	1,326	15·1%
Russian Federation	EURO	High	3	2	1		946	168 – 3,248	6,272	16·2%
Rwanda	AFRO	Low	4	4	4		84	18 – 308	656	15·0%
Saint Lucia	AMRO	High	2	2	3		1	0 – 4	7	10·5%
Saint Vincent and the Grenadines	AMRO	High	3	3	3		1	0 – 2	8	19·8%
Samoa	WPRO	Low	2	3	3		2	0 – 8	9	15·1%
Sao Tome and Principe	AFRO	Low	3	4	4		1	0 – 4	9	15·1%
Saudi Arabia	EMRO	Low	2	3	3		222	43 – 798	1,282	12·8%
Senegal	AFRO	Low	4	4	4		113	23 – 419	1,190	17·3%
Serbia	EURO	High	1	1	1	58	77	13 – 274	241	27·8%
Seychelles	AFRO	High	3	4	3		1	0 – 3	10	9·5%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			65-74 Years				
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							Median	95% Credible Interval		
Sierra Leone	AFRO	Low	4	4	4		50	10 – 188	1,225	13·8%
Singapore	WPRO	High	2	3	4	160	102	26 – 193	738	20·6%
Slovakia	EURO	High	2	2	2		46	8 – 159	306	4·1%
Slovenia	EURO	High	1	1	2		11	2 – 40	35	29·6%
Solomon Islands	WPRO	Low	3	3	3		5	1 – 19	24	10·8%
Somalia	EMRO	Low	4	4	4		80	16 – 301	739	32·0%
South Africa	AFRO	High	3	4	3	638	712	180 – 1,346	5,149	10·7%
South Sudan	AFRO	Low	4	4	4		112	22 – 412	1,050	11·0%
Spain	EURO	High	1	1	1	293	258	42 – 921	809	15·1%
Sri Lanka	SEARO	Low	2	2	2		125	21 – 480	1,187	15·0%
Sudan	EMRO	Low	4	3	3		338	73 – 1,291	1,214	31·0%
Suriname	AMRO	High	2	3	3		4	1 – 7	27	31·7%
Swaziland	AFRO	Low	4	4	3		12	2 – 45	113	10·6%
Sweden	EURO	High	1	1	2		125	21 – 449	394	9·7%
Switzerland	EURO	High	1	1	1	38	53	9 – 189	166	11·3%
Syrian Arab Republic	EMRO	Low	2	2	2		45	8 – 174	397	6·2%
Taiwan[f,g]	WPRO	High	2	2	3	54	182	32 – 623	1,199	6·0%
Tajikistan	EURO	Low	3	3	2		55	11 – 202	192	14·5%
Thailand	SEARO	Low	3	3	4	976	1,613	315 – 5,974	11,111	28·6%
The former Yugoslav Republic of Macedonia	EURO	High	1	1	1		9	1 – 32	28	22·2%
Timor-Leste	SEARO	Low	4	3	3		19	4 – 72	104	18·2%
Togo	AFRO	Low	4	4	4		57	11 – 210	943	15·9%
Tonga	WPRO	Low	2	3	3		1	0 – 5	6	15·2%
Trinidad and Tobago	AMRO	High	2	2	2		11	2 – 37	72	31·1%
Tunisia	EMRO	Low	2	3	2		186	40 – 702	598	31·9%
Turkey	EURO	High	2	1	1		444	73 – 1,588	1,394	15·2%
Turkmenistan	EURO	Low	3	2	1		13	2 – 49	59	11·5%
Uganda	AFRO	Low	4	4	4		248	53 – 918	2,041	12·1%
Ukraine	EURO	High	2	1	1		198	33 – 709	622	31·8%

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							Median	95% Credible Interval		
United Arab Emirates	EMRO	Low	1	3	3		31	6 – 114	92	15·0%
United Kingdom[h]	EURO	High	1	1	2	958	727	119 – 2,600	2,282	15·1%
United Republic of Tanzania	AFRO	Low	4	4	4		427	84 – 1,592	3,705	31·8%
United States of America	AMRO	High	2	2	1	2,354	2,023	359 – 6,944	13,411	12·5%
Uruguay	AMRO	High	2	2	2	82	26	5 – 90	174	15·0%
Uzbekistan	EURO	High	3	1	1		103	17 – 369	324	15·5%
Vanuatu	WPRO	Low	3	3	3		3	1 – 10	13	23·6%
Venezuela (Bolivarian Republic of)	AMRO	High	2	2	2		114	20 – 392	758	21·6%
Viet Nam	WPRO	Low	2	2	2		304	53 – 1,169	1,961	22·2%
Yemen	EMRO	Low	3	3	3		211	43 – 732	950	13·8%
Zambia	AFRO	Low	4	4	3		119	23 – 440	936	12·7%
Zimbabwe	AFRO	Low	4	4	4		105	20 – 404	899	11·7%

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							Median	95% Credible Interval		
Worldwide			--	--	--		172,420	122,876 – 237,933	1,202,683	14·3%
Afghanistan	EMRO	Low	4	3	2		129	18 – 363	1,039	12·4%
Albania	EURO	Low	1	1	1		36	4 – 214	246	6·0%
Algeria	AFRO	Low	3	2	2		606	84 – 1,727	3,611	14·6%
Angola	AFRO	Low	4	4	4		187	30 – 659	3,139	18·6%
Antigua and Barbuda	AMRO	High	2	2	3		2	0 – 4	18	10·3%
Argentina	AMRO	High	3	3	3	4,598	2,038	359 – 4,791	19,760	23·7%
Armenia	EURO	Low	1	1	1		45	6 – 268	190	10·9%
Australia	WPRO	High	1	1	1	315	581	158 – 2,607	3,486	16·7%
Austria	EURO	High	1	1	1	474	117	32 – 527	705	16·6%
Azerbaijan	EURO	Low	3	1	1		70	8 – 412	416	16·8%
Bahamas	AMRO	High	2	2	2		8	1 – 20	48	7·4%
Bahrain	EMRO	Low	1	2	2		7	1 – 20	48	16·4%
Bangladesh	SEARO	Low	3	2	1		737	72 – 4,428	5,526	5·1%
Barbados	AMRO	High	3	3	3		22	4 – 51	209	5·4%
Belarus	EURO	High	2	1	1		10	3 – 46	62	13·3%
Belgium	EURO	High	1	2	2		830	115 – 2,124	5,065	16·6%
Belize	AMRO	High	2	3	4		6	1 – 14	58	14·5%
Benin	AFRO	Low	4	4	4		92	16 – 314	1,813	16·8%
Bhutan	SEARO	Low	3	3	2		9	1 – 26	57	21·4%
Bolivia (Plurinational State of)	AMRO	Low	3	3	3		314	52 – 1,135	2,995	16·1%
Bosnia and Herzegovina	EURO	Low	1	1	1		66	6 – 393	308	10·3%
Botswana	AFRO	Low	3	4	4		29	5 – 101	338	10·5%
Brazil	AMRO	High	2	3	3		4,933	868 – 11,599	47,835	10·3%
Brunei Darussalam	WPRO	High	1	2	3		4	1 – 9	36	10·5%
Bulgaria	EURO	High	2	1	1		160	44 – 719	961	11·0%
Burkina Faso	AFRO	Low	4	4	4		128	21 – 456	2,385	15·8%
Burundi	AFRO	Low	4	4	4		97	16 – 342	1,316	8·4%
Cambodia	WPRO	Low	3	3	3		212	35 – 763	1,817	5·5%

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							Median	95% Credible Interval		
Cameroon	AFRO	Low	4	4	4		266	44 – 944	4,249	16·7%
Canada	AMRO	High	1	1	1	1,110	843	230 – 3,782	5,057	16·7%
Cape Verde	AFRO	Low	3	4	4		14	2 – 52	191	16·4%
Central African Republic	AFRO	Low	4	4	4		67	12 – 232	1,217	8·9%
Chad	AFRO	Low	4	4	4		115	19 – 390	2,089	5·0%
Chile	AMRO	High	1	1	2	1,568	648	90 – 1,657	3,951	6·3%
China	WPRO	Low	1	2	1	53,038	11,507	1,192 – 68,299	129,484	6·6%
China, Hong Kong SAR[g]	WPRO	High	2	3	4	439	733	129 – 1,724	7,108	8·1%
Colombia	AMRO	High	2	2	2		621	86 – 1,589	3,788	16·4%
Comoros	AFRO	Low	4	4	4		8	1 – 27	106	7·6%
Congo	AFRO	Low	4	3	4		61	10 – 219	756	7·3%
Costa Rica	AMRO	High	1	1	1		65	18 – 290	388	16·8%
Côte d'Ivoire	AFRO	Low	4	4	4		190	32 – 652	3,836	10·3%
Croatia	EURO	High	1	1	1		73	20 – 326	436	13·7%
Cuba	AMRO	High	2	3	3		458	81 – 1,078	4,444	16·4%
Cyprus	EURO	Low	1	1	1		16	1 – 92	113	16·7%
Czech Republic	EURO	High	1	2	2	148	376	52 – 961	2,293	8·5%
Democratic People's Republic of Korea	SEARO	Low	2	2	2		500	67 – 1,444	2,614	16·4%
Democratic Republic of the Congo	AFRO	Low	4	4	4		751	126 – 2,741	11,426	21·5%
Denmark	EURO	High	1	1	2	216	297	41 – 760	1,813	16·8%
Djibouti	EMRO	Low	4	4	4		12	2 – 44	141	10·3%
Dominican Republic	AMRO	Low	2	2	2		192	26 – 547	890	16·2%
Ecuador	AMRO	High	3	2	3		312	55 – 734	3,028	8·7%
Egypt	EMRO	Low	3	3	2		996	137 – 2,821	6,146	16·7%
El Salvador	AMRO	Low	3	3	3		237	38 – 799	1,369	16·3%
Equatorial Guinea	AFRO	Low	4	4	4		9	2 – 33	148	10·9%
Eritrea	AFRO	Low	4	4	4		37	6 – 138	424	16·5%
Estonia	EURO	High	2	1	1		20	6 – 92	123	10·8%
Ethiopia	AFRO	Low	4	3	3		1,202	198 – 4,150	10,995	16·4%

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Fiji	WPRO	High	3	3	3		9	2 – 20	83	15·7%
Finland	EURO	High	1	1	1		43	12 – 195	261	6·5%
France	EURO	High	1	1	2		3,002	417 – 7,680	18,313	16·4%
Gabon	AFRO	Low	3	3	4		37	6 – 137	568	22·0%
Gambia	AFRO	Low	4	4	4		14	2 – 53	285	5·2%
Georgia	EURO	Low	2	1	1		72	7 – 436	327	6·6%
Germany	EURO	High	1	1	1	1,820	3,072	838 – 13,789	18,436	4·9%
Ghana	AFRO	Low	4	4	4		312	53 – 1,080	6,008	5·2%
Greece	EURO	High	1	1	1		442	121 – 1,984	2,653	6·1%
Grenada	AMRO	High	3	3	4		5	1 – 13	53	16·7%
Guatemala	AMRO	High	3	3	3		345	61 – 811	3,343	9·4%
Guinea	AFRO	Low	4	4	4		115	20 – 422	1,730	10·3%
Guinea-Bissau	AFRO	Low	4	4	4		16	3 – 57	309	10·5%
Guyana	AMRO	High	3	3	3		11	2 – 25	104	10·3%
Haiti	AMRO	Low	4	3	3		190	33 – 653	1,698	10·6%
Honduras	AMRO	Low	2	1	1		40	4 – 230	378	16·8%
Hungary	EURO	High	1	1	1		117	32 – 525	702	11·2%
Iceland	EURO	High	1	1	2		10	1 – 26	62	16·7%
India	SEARO	Low	3	3	3	21,319	27,147	4,532 – 100,255	257,540	18·8%
Indonesia	SEARO	Low	3	2	2		2,678	367 – 7,804	14,281	10·5%
Iran (Islamic Republic of)	EMRO	High	2	2	2		891	124 – 2,279	5,435	16·4%
Iraq	EMRO	Low	3	2	1		96	10 – 570	863	16·4%
Ireland	EURO	High	1	1	2		169	24 – 433	1,031	11·1%
Israel	EURO	High	1	2	2	117	311	43 – 795	1,897	16·1%
Italy	EURO	High	1	1	1		2,021	551 – 9,072	12,130	16·4%
Jamaica	AMRO	High	1	2	2		61	9 – 157	375	16·7%
Japan	WPRO	High	1	2	3	4,427	13,410	2,360 – 31,528	130,023	16·3%
Jordan	EMRO	Low	2	2	2		63	9 – 187	390	16·2%
Kazakhstan	EURO	High	3	2	1		141	38 – 632	846	10·3%

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							Median	95% Credible Interval		
Kenya[e]	AFRO	Low	4	4	4		470	76 – 1,714	5,337	16·7%
Kiribati	WPRO	Low	3	3	3		1	0 – 5	10	8·8%
Kuwait	EMRO	High	1	3	4		29	5 – 69	285	16·2%
Kyrgyzstan	EURO	High	2	1	1		11	3 – 51	68	11·7%
Lao People's Democratic Republic	WPRO	Low	4	3	3		93	16 – 316	903	10·0%
Latvia	EURO	High	2	1	1		28	8 – 127	169	16·4%
Lebanon	EMRO	Low	1	1	1		48	5 – 291	305	10·2%
Lesotho	AFRO	Low	4	4	3		36	6 – 129	391	10·3%
Liberia	AFRO	Low	4	4	4		41	7 – 152	710	15·8%
Libya	EMRO	Low	2	3	3		110	19 – 374	633	5·8%
Lithuania	EURO	High	2	1	1		53	15 – 240	320	17·4%
Luxembourg	EURO	High	1	1	1		17	5 – 77	104	9·5%
Madagascar	AFRO	Low	4	4	3		247	43 – 857	2,325	17·4%
Malawi	AFRO	Low	4	4	4		193	32 – 675	2,740	9·2%
Malaysia	WPRO	Low	3	4	4		623	103 – 2,359	8,446	16·5%
Maldives	SEARO	Low	1	2	2		5	1 – 13	27	16·4%
Mali	AFRO	Low	4	3	3		131	23 – 474	955	16·5%
Malta	EURO	High	1	1	2		26	4 – 66	159	12·2%
Mauritania	AFRO	Low	4	4	4		43	7 – 144	774	17·0%
Mauritius	AFRO	High	2	2	2		27	4 – 69	165	10·6%
Mexico	AMRO	High	2	2	2	2,283	1,662	231 – 4,252	10,139	18·8%
Micronesia (Federated States of)	WPRO	Low	3	3	3		2	0 – 6	13	16·4%
Mongolia	WPRO	High	3	1	1		7	2 – 33	45	15·9%
Montenegro	EURO	High	1	1	1		7	2 – 31	42	13·7%
Morocco	EMRO	Low	3	3	2		525	70 – 1,515	4,299	16·4%
Mozambique	AFRO	Low	4	4	3		321	53 – 1,091	2,714	13·4%
Myanmar	SEARO	Low	3	3	2		606	82 – 1,759	4,525	16·6%
Namibia	AFRO	Low	4	4	4		31	5 – 107	356	15·6%
Nepal	SEARO	Low	3	3	3		543	94 – 1,833	3,193	11·8%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			≥75 Years				
			<65 Years	65-74 Years	≥75 Years	Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
							Median	95% Credible Interval		
Netherlands	EURO	High	1	1	2	1,179	749	104 – 1,917	4,571	5·5%
New Zealand	WPRO	High	1	1	1	102	128	35 – 573	767	16·4%
Nicaragua	AMRO	Low	2	2	2		85	11 – 248	399	7·0%
Niger	AFRO	Low	4	4	4		139	20 – 471	2,913	7·4%
Nigeria	AFRO	Low	4	4	4		1,271	207 – 4,572	33,449	8·7%
Norway	EURO	High	1	1	2	265	289	40 – 738	1,761	4·8%
Oman	EMRO	Low	2	3	3		37	6 – 131	251	3·8%
Pakistan	EMRO	Low	3	2	1		701	60 – 4,068	7,512	21·3%
Panama	AMRO	High	2	2	2		79	11 – 203	483	16·4%
Papua New Guinea	WPRO	Low	4	4	3		68	12 – 245	686	16·4%
Paraguay	AMRO	Low	2	2	2	174	96	13 – 281	781	17·0%
Peru	AMRO	Low	3	4	4		954	158 – 3,340	13,460	16·7%
Philippines	WPRO	High	3	4	4		3,243	571 – 7,624	31,444	14·8%
Poland	EURO	High	2	2	2		1,241	173 – 3,174	7,569	9·3%
Portugal	EURO	High	2	2	3	966	733	129 – 1,723	7,106	16·4%
Qatar	EMRO	Low	1	2	1		2	0 – 13	19	7·1%
Republic of Korea	WPRO	High	1	2	2	688	2,257	314 – 5,774	13,769	10·3%
Republic of Moldova	EURO	High	3	2	1		23	6 – 101	136	9·9%
Romania	EURO	High	3	2	1	316	531	145 – 2,385	3,188	16·4%
Russian Federation	EURO	High	3	2	1		2,480	676 – 11,130	14,880	19·1%
Rwanda	AFRO	Low	4	4	4		109	18 – 398	1,358	10·3%
Saint Lucia	AMRO	High	2	2	3		4	1 – 10	42	12·3%
Saint Vincent and the Grenadines	AMRO	High	3	3	3		3	0 – 6	26	10·6%
Samoa	WPRO	Low	2	3	3		4	1 – 16	26	16·7%
Sao Tome and Principe	AFRO	Low	3	4	4		3	1 – 11	41	16·7%
Saudi Arabia	EMRO	Low	2	3	3		343	59 – 1,221	3,042	8·0%
Senegal	AFRO	Low	4	4	4		151	24 – 524	2,066	11·3%
Serbia	EURO	High	1	1	1	110	129	35 – 578	772	19·0%
Seychelles	AFRO	High	3	4	3		4	1 – 9	37	7·3%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			≥75 Years				
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							Median	95% Credible Interval		
Sierra Leone	AFRO	Low	4	4	4		40	6 – 138	974	10·3%
Singapore	WPRO	High	2	3	4	469	423	74 – 994	4,101	11·8%
Slovakia	EURO	High	2	2	2		195	27 – 498	1,188	4·1%
Slovenia	EURO	High	1	1	2		112	16 – 287	683	17·3%
Solomon Islands	WPRO	Low	3	3	3		6	1 – 24	51	8·3%
Somalia	EMRO	Low	4	4	4		99	16 – 375	1,194	16·7%
South Africa	AFRO	High	3	4	3	1,274	1,131	199 – 2,658	10,963	8·4%
South Sudan	AFRO	Low	4	4	4		138	25 – 478	1,645	7·4%
Spain	EURO	High	1	1	1	2,360	1,619	442 – 7,267	9,717	10·1%
Sri Lanka	SEARO	Low	2	2	2		384	50 – 1,114	2,205	16·4%
Sudan	EMRO	Low	4	3	3		466	77 – 1,614	2,456	16·4%
Suriname	AMRO	High	2	3	3		9	2 – 22	89	16·4%
Swaziland	AFRO	Low	4	4	3		16	3 – 53	164	9·8%
Sweden	EURO	High	1	1	2		495	69 – 1,267	3,021	10·7%
Switzerland	EURO	High	1	1	1	229	259	71 – 1,162	1,554	16·8%
Syrian Arab Republic	EMRO	Low	2	2	2		171	22 – 491	1,018	5·5%
Taiwan[f,g]	WPRO	High	2	2	3	434	927	163 – 2,180	8,667	4·9%
Tajikistan	EURO	Low	3	3	2		69	10 – 202	402	8·9%
Thailand	SEARO	Low	3	3	4	3,136	3,205	526 – 10,739	36,158	17·2%
The former Yugoslav Republic of Macedonia	EURO	High	1	1	1		8	2 – 38	50	20·6%
Timor-Leste	SEARO	Low	4	3	3		16	2 – 54	149	10·8%
Togo	AFRO	Low	4	4	4		57	10 – 199	1,162	13·0%
Tonga	WPRO	Low	2	3	3		3	0 – 11	23	16·1%
Trinidad and Tobago	AMRO	High	2	2	2		28	4 – 73	173	11·7%
Tunisia	EMRO	Low	2	3	2		228	32 – 658	1,948	16·7%
Turkey	EURO	High	2	1	1		933	255 – 4,188	5,600	10·7%
Turkmenistan	EURO	Low	3	2	1		22	2 – 136	107	8·3%
Uganda	AFRO	Low	4	4	4		336	58 – 1,199	3,886	8·6%
Ukraine	EURO	High	2	1	1		161	44 – 721	964	16·7%

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							Median	95% Credible Interval		
United Arab Emirates	EMRO	Low	1	3	3		24	4 – 85	129	16·4%
United Kingdom[h]	EURO	High	1	1	2	3,214	4,599	639 – 11,764	28,052	16·7%
United Republic of Tanzania	AFRO	Low	4	4	4		632	108 – 2,228	7,590	16·6%
United States of America	AMRO	High	2	2	1	9,929	8,543	2,330 – 38,345	51,267	11·6%
Uruguay	AMRO	High	2	2	2	405	200	28 – 512	1,221	16·4%
Uzbekistan	EURO	High	3	1	1		96	26 – 433	578	19·0%
Vanuatu	WPRO	Low	3	3	3		4	1 – 13	26	15·4%
Venezuela (Bolivarian Republic of)	AMRO	High	2	2	2		493	69 – 1,261	3,007	15·5%
Viet Nam	WPRO	Low	2	2	2		1,932	269 – 5,618	10,157	14·6%
Yemen	EMRO	Low	3	3	3		212	37 – 725	1,456	10·3%
Zambia	AFRO	Low	4	4	3		172	29 – 594	1,698	10·1%
Zimbabwe	AFRO	Low	4	4	4		193	34 – 695	2,250	8·6%

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							Median	95% Credible Interval		
Worldwide			--	--	--		409,111	291,243 – 645,832	3,200,874	12·8%
Afghanistan	EMRO	Low	4	3	2		1,641	445 – 7,785	23,808	6·9%
Albania	EURO	Low	1	1	1		74	26 – 268	411	3·0%
Algeria	AFRO	Low	3	2	2		2,297	731 – 9,967	9,957	18·0%
Angola	AFRO	Low	4	4	4		1,366	406 – 5,961	45,100	25·2%
Antigua and Barbuda	AMRO	High	2	2	3		3	1 – 7	29	10·9%
Argentina	AMRO	High	3	3	3	6,916	3,257	1,385 – 7,156	29,806	21·6%
Armenia	EURO	Low	1	1	1		77	26 – 320	357	10·5%
Australia	WPRO	High	1	1	1	489	792	322 – 2,960	4,163	19·0%
Austria	EURO	High	1	1	1	648	171	69 – 624	864	19·8%
Azerbaijan	EURO	Low	3	1	1		468	109 – 2,307	1,798	26·0%
Bahamas	AMRO	High	2	2	2		16	6 – 30	105	5·5%
Bahrain	EMRO	Low	1	2	2		16	6 – 60	105	16·1%
Bangladesh	SEARO	Low	3	2	1		7,540	1,642 – 36,590	30,407	5·1%
Barbados	AMRO	High	3	3	3		32	13 – 71	297	5·5%
Belarus	EURO	High	2	1	1		94	42 – 179	654	24·8%
Belgium	EURO	High	1	2	2		991	286 – 2,662	6,155	19·7%
Belize	AMRO	High	2	3	4		13	6 – 21	110	15·2%
Benin	AFRO	Low	4	4	4		625	189 – 2,668	12,227	15·3%
Bhutan	SEARO	Low	3	3	2		51	17 – 197	276	25·4%
Bolivia (Plurinational State of)	AMRO	Low	3	3	3		962	346 – 3,159	7,310	14·4%
Bosnia and Herzegovina	EURO	Low	1	1	1		120	39 – 471	472	11·9%
Botswana	AFRO	Low	3	4	4		143	47 – 571	1,155	13·2%
Brazil	AMRO	High	2	3	3		9,930	4,646 – 16,910	86,114	11·5%
Brunei Darussalam	WPRO	High	1	2	3		9	4 – 33	66	10·8%
Bulgaria	EURO	High	2	1	1		356	154 – 1,047	1,803	13·5%
Burkina Faso	AFRO	Low	4	4	4		969	299 – 4,241	17,675	18·5%
Burundi	AFRO	Low	4	4	4		633	189 – 2,743	11,461	12·4%
Cambodia	WPRO	Low	3	3	3		1,052	348 – 3,926	6,138	4·6%

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							Median	95% Credible Interval		
Cameroon	AFRO	Low	4	4	4		1,428	452 – 5,942	25,375	19·9%
Canada	AMRO	High	1	1	1	1,419	1,276	536 – 4,569	6,417	19·3%
Cape Verde	AFRO	Low	3	4	4		41	14 – 142	310	19·5%
Central African Republic	AFRO	Low	4	4	4		322	109 – 1,196	6,970	14·3%
Chad	AFRO	Low	4	4	4		771	229 – 3,378	28,404	3·9%
Chile	AMRO	High	1	1	2	2,135	966	252 – 2,235	4,955	5·6%
China	WPRO	Low	1	2	1	77,126	31,060	10,067 – 91,814	217,432	5·4%
China, Hong Kong SAR[g]	WPRO	High	2	3	4	532	877	248 – 1,905	8,152	10·4%
Colombia	AMRO	High	2	2	2		1,344	559 – 2,527	8,980	15·0%
Comoros	AFRO	Low	4	4	4		46	14 – 190	724	6·4%
Congo	AFRO	Low	4	3	4		300	95 – 1,168	2,876	13·2%
Costa Rica	AMRO	High	1	1	1		146	72 – 438	707	20·6%
Côte d'Ivoire	AFRO	Low	4	4	4		1,286	402 – 5,480	32,729	11·0%
Croatia	EURO	High	1	1	1		133	59 – 439	631	20·9%
Cuba	AMRO	High	2	3	3		666	258 – 1,349	6,056	16·1%
Cyprus	EURO	Low	1	1	1		31	11 – 114	148	20·1%
Czech Republic	EURO	High	1	2	2	256	531	188 – 1,505	3,293	9·1%
Democratic People's Republic of Korea	SEARO	Low	2	2	2		930	355 – 2,018	5,758	19·6%
Democratic Republic of the Congo	AFRO	Low	4	4	4		4,523	1,403 – 18,932	84,504	15·0%
Denmark	EURO	High	1	1	2	270	424	98 – 922	2,161	23·1%
Djibouti	EMRO	Low	4	4	4		60	20 – 228	660	10·8%
Dominican Republic	AMRO	Low	2	2	2		347	130 – 731	2,319	27·8%
Ecuador	AMRO	High	3	2	3		605	257 – 1,444	5,600	8·2%
Egypt	EMRO	Low	3	3	2		6,142	2,009 – 22,843	22,124	18·8%
El Salvador	AMRO	Low	3	3	3		634	231 – 1,923	2,581	19·6%
Equatorial Guinea	AFRO	Low	4	4	4		51	16 – 208	936	9·0%
Eritrea	AFRO	Low	4	4	4		283	85 – 1,227	3,442	20·0%
Estonia	EURO	High	2	1	1		49	21 – 139	250	10·7%
Ethiopia	AFRO	Low	4	3	3		6,183	2,067 – 25,783	68,974	18·5%

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							Median	95% Credible Interval		
Fiji	WPRO	High	3	3	3		31	14 – 69	289	17·3%
Finland	EURO	High	1	1	1		69	30 – 239	345	10·0%
France	EURO	High	1	1	2		3,907	924 – 9,199	21,141	18·6%
Gabon	AFRO	Low	3	3	4		134	48 – 461	1,346	23·6%
Gambia	AFRO	Low	4	4	4		107	31 – 473	1,871	6·8%
Georgia	EURO	Low	2	1	1		142	51 – 507	602	5·2%
Germany	EURO	High	1	1	1	2,302	4,737	1,980 – 16,876	23,515	5·7%
Ghana	AFRO	Low	4	4	4		1,689	557 – 6,838	24,696	5·4%
Greece	EURO	High	1	1	1		611	243 – 2,277	3,160	5·4%
Grenada	AMRO	High	3	3	4		9	4 – 19	82	19·3%
Guatemala	AMRO	High	3	3	3		827	369 – 1,925	8,111	11·0%
Guinea	AFRO	Low	4	4	4		756	228 – 3,053	14,519	10·2%
Guinea-Bissau	AFRO	Low	4	4	4		109	34 – 441	2,028	10·4%
Guyana	AMRO	High	3	3	3		32	14 – 73	306	10·8%
Haiti	AMRO	Low	4	3	3		769	276 – 2,867	8,054	14·5%
Honduras	AMRO	Low	2	1	1		151	57 – 342	1,044	21·1%
Hungary	EURO	High	1	1	1		240	112 – 750	1,131	9·5%
Iceland	EURO	High	1	1	2		12	2 – 29	67	21·2%
India	SEARO	Low	3	3	3	64,537	105,668	36,454 – 362,108	648,994	24·2%
Indonesia	SEARO	Low	3	2	2		13,701	3,921 – 59,453	56,706	16·3%
Iran (Islamic Republic of)	EMRO	High	2	2	2		1,707	674 – 3,156	11,183	18·8%
Iraq	EMRO	Low	3	2	1		1,609	296 – 8,113	8,225	15·3%
Ireland	EURO	High	1	1	2		223	51 – 510	1,186	19·6%
Israel	EURO	High	1	2	2	148	385	119 – 1,052	2,393	17·9%
Italy	EURO	High	1	1	1		2,604	982 – 10,058	13,847	16·1%
Jamaica	AMRO	High	1	2	2		97	35 – 294	570	18·8%
Japan	WPRO	High	1	2	3	5,232	16,096	5,226 – 38,951	146,050	17·0%
Jordan	EMRO	Low	2	2	2		169	64 – 325	1,106	15·3%
Kazakhstan	EURO	High	3	2	1		648	203 – 1,448	4,705	11·0%

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Kenya[e]	AFRO	Low	4	4	4		2,702	857 – 11,842	26,977	13·8%
Kiribati	WPRO	Low	3	3	3		7	2 – 28	58	10·0%
Kuwait	EMRO	High	1	3	4		79	37 – 305	607	13·1%
Kyrgyzstan	EURO	High	2	1	1		102	36 – 205	782	17·1%
Lao People's Democratic Republic	WPRO	Low	4	3	3		441	145 – 1,697	3,933	12·1%
Latvia	EURO	High	2	1	1		84	39 – 209	438	16·0%
Lebanon	EMRO	Low	1	1	1		109	40 – 399	500	13·0%
Lesotho	AFRO	Low	4	4	3		149	50 – 566	1,897	11·2%
Liberia	AFRO	Low	4	4	4		265	84 – 1,096	3,898	21·8%
Libya	EMRO	Low	2	3	3		263	109 – 589	1,344	6·8%
Lithuania	EURO	High	2	1	1		118	52 – 335	617	19·6%
Luxembourg	EURO	High	1	1	1		25	10 – 91	127	10·7%
Madagascar	AFRO	Low	4	4	3		1,405	435 – 6,036	14,602	14·0%
Malawi	AFRO	Low	4	4	4		1,081	348 – 4,255	11,855	7·9%
Malaysia	WPRO	Low	3	4	4		2,434	859 – 8,412	16,218	19·1%
Maldives	SEARO	Low	1	2	2		7	2 – 23	45	19·7%
Mali	AFRO	Low	4	3	3		959	280 – 4,127	14,898	19·2%
Malta	EURO	High	1	1	2		35	8 – 79	184	23·7%
Mauritania	AFRO	Low	4	4	4		246	80 – 1,026	3,772	13·5%
Mauritius	AFRO	High	2	2	2		47	18 – 92	307	9·6%
Mexico	AMRO	High	2	2	2	4,903	3,278	1,319 – 6,075	21,617	15·5%
Micronesia (Federated States of)	WPRO	Low	3	3	3		7	2 – 28	40	15·2%
Mongolia	WPRO	High	3	1	1		61	19 – 141	440	21·9%
Montenegro	EURO	High	1	1	1		13	6 – 43	64	6·4%
Morocco	EMRO	Low	3	3	2		2,469	838 – 8,641	10,408	19·0%
Mozambique	AFRO	Low	4	4	3		1,740	564 – 6,977	22,292	17·0%
Myanmar	SEARO	Low	3	3	2		3,563	1,210 – 13,551	21,008	20·4%
Namibia	AFRO	Low	4	4	4		157	49 – 641	1,572	13·9%
Nepal	SEARO	Low	3	3	3		2,232	769 – 8,006	10,552	7·8%

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							Median	95% Credible Interval		
Netherlands	EURO	High	1	1	2	1,458	1,033	240 – 2,312	5,380	6·5%
New Zealand	WPRO	High	1	1	1	134	157	60 – 618	866	15·3%
Nicaragua	AMRO	Low	2	2	2		171	66 – 341	1,252	9·1%
Niger	AFRO	Low	4	4	4		1,082	325 – 4,824	27,936	15·0%
Nigeria	AFRO	Low	4	4	4		10,217	2,851 – 43,493	305,709	10·0%
Norway	EURO	High	1	1	2	350	366	81 – 852	1,985	3·9%
Oman	EMRO	Low	2	3	3		126	53 – 244	745	3·3%
Pakistan	EMRO	Low	3	2	1		8,476	1,717 – 42,650	83,955	13·7%
Panama	AMRO	High	2	2	2		146	57 – 275	949	19·2%
Papua New Guinea	WPRO	Low	4	4	3		448	144 – 1,862	4,850	18·4%
Paraguay	AMRO	Low	2	2	2	375	197	75 – 400	1,792	21·1%
Peru	AMRO	Low	3	4	4		2,903	1,020 – 9,212	24,629	18·1%
Philippines	WPRO	High	3	4	4		7,928	3,669 – 18,065	76,032	16·9%
Poland	EURO	High	2	2	2		1,817	656 – 4,119	11,881	10·1%
Portugal	EURO	High	2	2	3	1,122	896	303 – 2,020	8,167	15·4%
Qatar	EMRO	Low	1	2	1		16	4 – 79	67	11·8%
Republic of Korea	WPRO	High	1	2	2	890	2,645	749 – 7,146	16,559	10·4%
Republic of Moldova	EURO	High	3	2	1		144	42 – 300	1,064	9·2%
Romania	EURO	High	3	2	1	536	1,124	465 – 3,076	7,122	15·3%
Russian Federation	EURO	High	3	2	1		7,442	2,760 – 18,654	52,212	16·2%
Rwanda	AFRO	Low	4	4	4		676	199 – 2,806	6,707	11·0%
Saint Lucia	AMRO	High	2	2	3		7	3 – 14	65	11·0%
Saint Vincent and the Grenadines	AMRO	High	3	3	3		6	3 – 13	55	23·7%
Samoa	WPRO	Low	2	3	3		9	3 – 23	56	15·8%
Sao Tome and Principe	AFRO	Low	3	4	4		12	4 – 49	121	14·3%
Saudi Arabia	EMRO	Low	2	3	3		968	396 – 1,974	6,771	10·1%
Senegal	AFRO	Low	4	4	4		879	288 – 3,675	9,291	14·3%
Serbia	EURO	High	1	1	1	217	279	128 – 874	1,282	10·1%
Seychelles	AFRO	High	3	4	3		7	3 – 16	67	9·5%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			All Age				
			<65 Years	65-74 Years	≥75 Years	Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
							Median	95% Credible Interval		
Sierra Leone	AFRO	Low	4	4	4		351	103 – 1,533	10,331	11·0%
Singapore	WPRO	High	2	3	4	701	586	215 – 1,212	5,345	17·6%
Slovakia	EURO	High	2	2	2		286	104 – 650	1,875	3·4%
Slovenia	EURO	High	1	1	2		133	28 – 320	750	24·6%
Solomon Islands	WPRO	Low	3	3	3		36	12 – 141	205	3·2%
Somalia	EMRO	Low	4	4	4		628	192 – 2,686	19,729	21·8%
South Africa	AFRO	High	3	4	3	4,580	3,734	1,639 – 8,409	35,346	5·4%
South Sudan	AFRO	Low	4	4	4		764	251 – 3,047	14,268	9·9%
Spain	EURO	High	1	1	1	2,775	2,124	821 – 8,091	11,274	11·9%
Sri Lanka	SEARO	Low	2	2	2		743	286 – 1,593	5,290	15·3%
Sudan	EMRO	Low	4	3	3		2,434	814 – 10,257	24,045	17·7%
Suriname	AMRO	High	2	3	3		21	10 – 33	177	19·7%
Swaziland	AFRO	Low	4	4	3		82	26 – 320	933	8·8%
Sweden	EURO	High	1	1	2		712	164 – 1,541	3,614	10·4%
Switzerland	EURO	High	1	1	1	291	362	147 – 1,342	1,875	15·4%
Syrian Arab Republic	EMRO	Low	2	2	2		431	165 – 821	2,793	2·7%
Taiwan[f,g]	WPRO	High	2	2	3	523	1,271	492 – 2,789	11,001	5·7%
Tajikistan	EURO	Low	3	3	2		460	138 – 1,947	3,831	13·4%
Thailand	SEARO	Low	3	3	4	5,062	8,088	2,894 – 24,419	60,340	12·0%
The former Yugoslav Republic of Macedonia	EURO	High	1	1	1		27	13 – 83	123	14·7%
Timor-Leste	SEARO	Low	4	3	3		86	30 – 305	886	9·7%
Togo	AFRO	Low	4	4	4		416	128 – 1,714	7,262	14·5%
Tonga	WPRO	Low	2	3	3		6	2 – 14	41	15·1%
Trinidad and Tobago	AMRO	High	2	2	2		58	24 – 115	385	15·8%
Tunisia	EMRO	Low	2	3	2		567	238 – 1,216	3,589	18·6%
Turkey	EURO	High	2	1	1		2,019	897 – 5,613	10,841	11·6%
Turkmenistan	EURO	Low	3	2	1		245	51 – 1,197	1,667	8·4%
Uganda	AFRO	Low	4	4	4		2,146	632 – 9,371	28,432	7·5%
Ukraine	EURO	High	2	1	1		882	420 – 1,622	5,312	16·6%

Country	WHO Region[a]	2015 WHO GHE Data Quality[b]	Analytic Division			All Age				
			<65 Years	65-74 Years	≥75 Years	Annual Influenza-associated Respiratory Death, Median[c]	Estimated Annual Influenza-associated Respiratory Death[d]		GHE RI Death Estimate	Proportion Influenza-associated Deaths of all GHE RI Deaths
							Median	95% Credible Interval		
United Arab Emirates	EMRO	Low	1	3	3		104	39 – 412	413	15·5%
United Kingdom[h]	EURO	High	1	1	2	5,579	5,980	1,359 – 13,879	32,154	16·5%
United Republic of Tanzania	AFRO	Low	4	4	4		3,280	1,073 – 13,389	39,072	13·4%
United States of America	AMRO	High	2	2	1	13,808	13,281	5,958 – 40,905	80,627	11·0%
Uruguay	AMRO	High	2	2	2	566	248	75 – 593	1,595	15·2%
Uzbekistan	EURO	High	3	1	1		989	281 – 2,225	7,354	16·6%
Vanuatu	WPRO	Low	3	3	3		18	6 – 68	82	21·9%
Venezuela (Bolivarian Republic of)	AMRO	High	2	2	2		949	380 – 1,773	6,234	16·1%
Viet Nam	WPRO	Low	2	2	2		3,330	1,183 – 7,110	20,038	14·4%
Yemen	EMRO	Low	3	3	3		1,510	447 – 6,413	10,518	10·6%
Zambia	AFRO	Low	4	4	3		961	297 – 3,980	11,465	8·4%
Zimbabwe	AFRO	Low	4	4	4		930	300 – 3,877	11,581	8·0%

[a]WHO Region=World Health Organization Region; AFRO=Sub-Saharan Africa; AMRO=Americas; EMRO=Eastern Mediterranean; EURO=Europe; SEARO=Southeast Asia; WPRO=Western Pacific

[b]High Data Quality was defined as countries with at least 5 years of death registration data available beginning in 2005 with mean usability of all available years (from 2000 forward) of ≥ 60% if ICD-coded registration data for specific causes of death were reported or with a mean usability of ≥ 80% if only summarized causes of death data were reported. Low Data Quality was defined as countries with no annual death registration data available or countries with less than 5 years of death registration available beginning in 2005 with a mean usability of all available years (from 2000 forward) of < 60% if ICD-coded registration data for specific causes of death were reported or a mean usability of < 80% if only summarized causes of death data were reported
http://www.who.int/healthinfo/global_burden_disease/GlobalCOD_method_2000_2015.pdf?ua=1

[c]Median of influenza-associated respiratory death estimates from a random-effects meta-analysis for each excess mortality rate (EMR)-contributing country using their annual influenza-associated respiratory excess mortality estimates

[d]The estimated annual influenza-associated respiratory death interval for each country was calculated from the Bayesian Hierarchical extrapolation model using excess mortality information from all EMR-contributing countries

[e]For Kenya, country-specific estimates were only available for <65 year age group

[f]Population estimates were derived from the US Census Bureau Estimates for 2015. Population estimates for all other countries were derived from the United Nations Census Estimates for 2015

[g]Global Health Estimates were not generated for Hong Kong and Taiwan in 2015. The analytic divisions and respiratory infection deaths for Hong Kong and Taiwan were based on vital records data from the Census and Statistics Department of the Hong Kong Government and the Ministry of Health and Welfare in Taiwan

[h]The annual influenza-associated respiratory death median estimate only reflects deaths for England and Wales

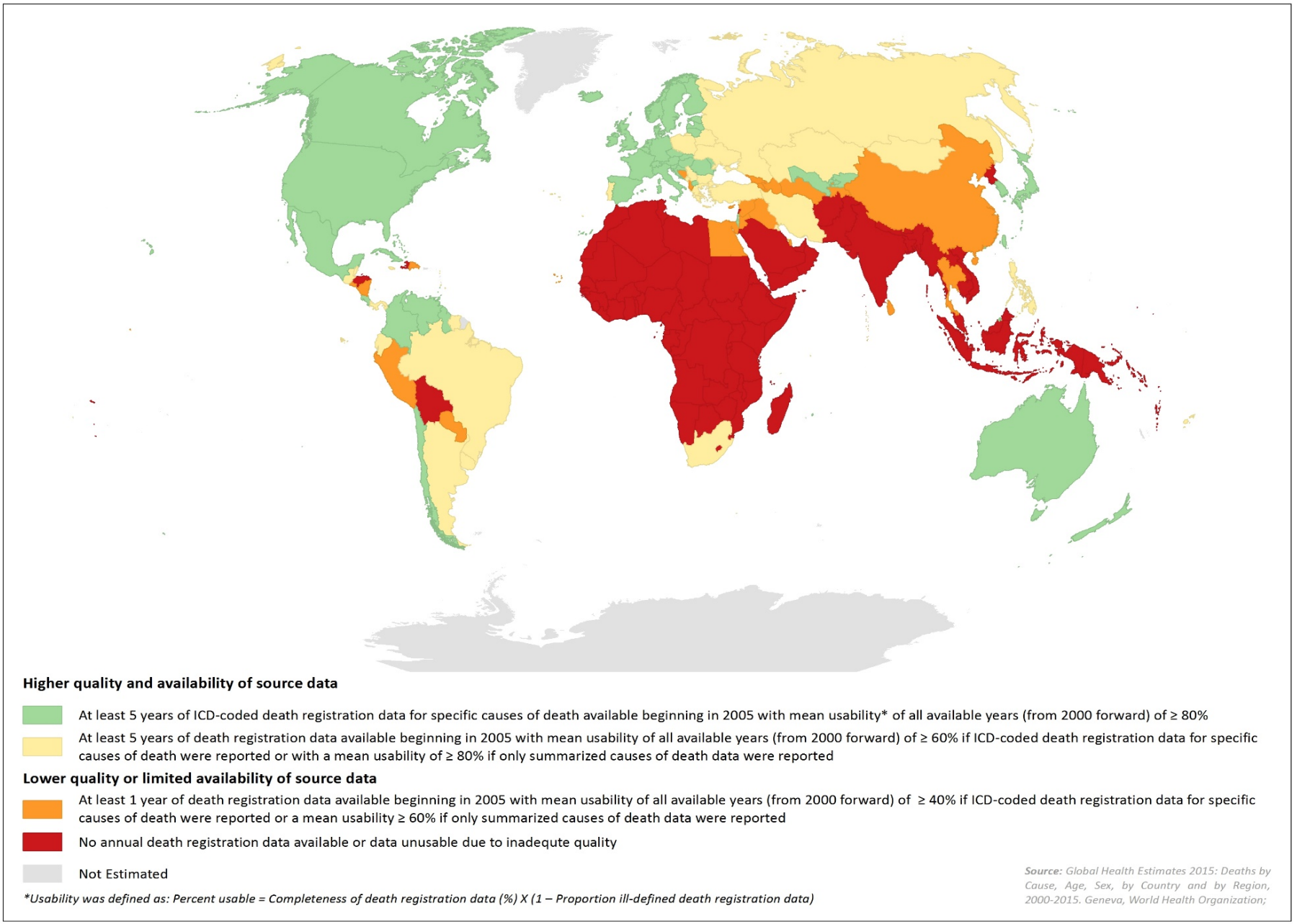
Appendix Table 20. Estimated annual influenza-associated respiratory death interval and rate per 100,000 population by age group, analytic division, World Health Organization regions, and World Bank income classification extrapolating with modified analytic divisions[a].

	<65 Years				65-74 Years			
	Influenza-associated Respiratory Annual Deaths[b]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[b]		Influenza-associated Respiratory Annual Deaths[b]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[b]	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Worldwide	159,542	71,547 – 270,746	2·4	1·1 – 4·0	71,459	48,658 – 101,807	19·4	13·2 – 27·7
Analytic Divisions								
Analytic Division 1	12,808	5,796 – 22,198	0·7	0·3 – 1·1	5,121	2,612 – 11,352	8·3	4·2 – 18·3
Analytic Division 2	15,105	7,095 – 25,282	1·3	0·6 – 2·1	26,828	13,468 – 45,369	13·4	6·7 – 22·7
Analytic Division 3	130,004	42,924 – 244,212	3·6	1·2 – 6·8	38,552	22,010 – 58,418	36·6	20·9 – 55·5
World Health Organization Regions								
Sub-Saharan Africa	44,660	10,613 – 96,748	4·7	1·1 – 10·1	8,913	2,881 – 17,788	40·4	13·1 – 80·6
Americas	12,842	8,996 – 19,856	1·4	1·0 – 2·2	9,138	6,357 – 12,848	15·4	10·7 – 21·6
Europe	9,981	4,718 – 17,495	1·3	0·6 – 2·3	6,521	3,547 – 12,908	8·8	4·8 – 17·4
Eastern Mediterranean	19,563	5,355 – 54,366	3·2	0·9 – 8·8	3,753	1,219 – 7,783	20·5	6·7 – 42·5
South-East Asia	47,905	20,511 – 102,312	2·6	1·1 – 5·6	21,785	10,803 – 34,954	29·5	14·6 – 47·4
Western Pacific	15,997	7,248 – 26,240	1·0	0·4 – 1·6	20,390	8,911 – 33,069	17·0	7·5 – 27·6
World Bank Income Classifications								
High Income	9,085	5,714 – 13,473	0·8	0·5 – 1·2	9,634	7,059 – 14,218	8·2	6·0 – 12·1
Upper Middle Income	30,504	19,854 – 45,641	1·4	0·9 – 2·0	26,284	14,162 – 40,051	19·6	10·5 – 29·8
Lower Middle Income	75,159	31,481 – 149,986	3·0	1·2 – 5·9	27,466	14,659 – 42,403	29·7	15·8 – 45·8
Low Income	39,408	7,750 – 87,879	4·6	0·9 – 10·2	7,825	2,413 – 15,668	34·1	10·5 – 68·3

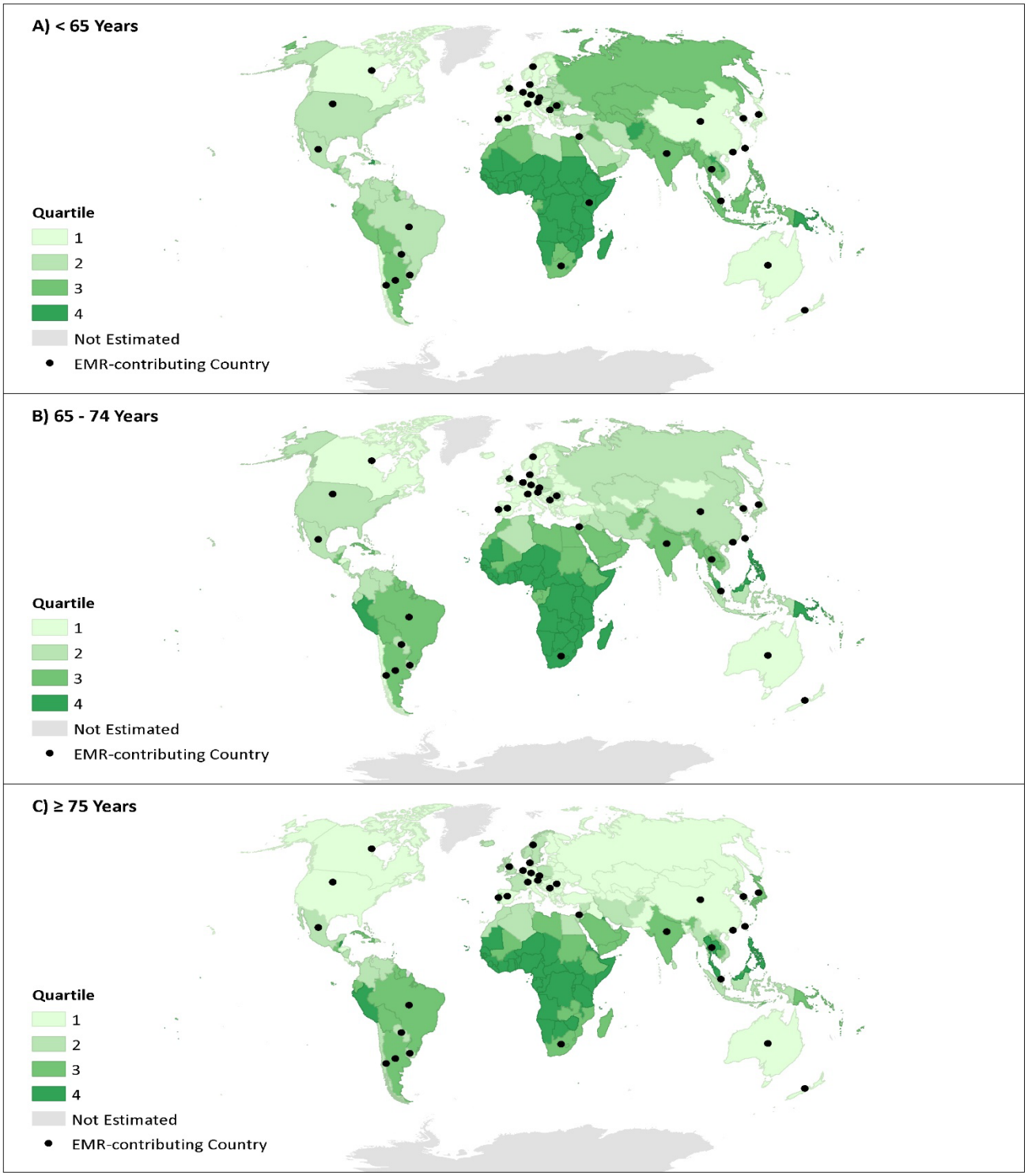
	≥75 Years				All Age			
	Influenza-associated Respiratory Annual Deaths[b]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[b]		Influenza-associated Respiratory Annual Deaths[b]		Influenza-associated Respiratory Annual Mortality Rates (per 100,000)[b]	
	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval	Median	95% Credible Interval
Worldwide	172,857	123,078 – 235,034	72·2	51·4 – 98·2	409,355	292,037 – 528,573	5·6	4·0 – 7·2
Analytic Divisions								
Analytic Division 1	82,304	48,284 – 124,250	65·0	38·2 – 98·2	100,507	65,456 – 145,095	4·7	3·1 – 6·8
Analytic Division 2	27,087	12,049 – 53,360	63·7	28·3 – 125·5	70,005	43,667 – 114,258	4·9	3·0 – 8·0
Analytic Division 3	61,268	37,133 – 100,235	87·0	52·7 – 142·4	237,182	134,496 – 344,551	6·3	3·6 – 9·2
World Health Organization Regions								
Sub-Saharan Africa	11,952	3,562 – 27,669	124·7	37·2 – 288·6	69,144	27,698 – 118,186	7·0	2·8 – 11·9
Americas	29,870	21,574 – 43,579	72·1	52·1 – 105·3	51,998	42,120 – 72,447	5·3	4·3 – 7·3
Europe	27,074	16,008 – 51,231	40·4	23·9 – 76·4	44,103	29,715 – 71,629	4·8	3·3 – 7·9
Eastern Mediterranean	5,724	2,026 – 12,154	61·4	21·7 – 130·3	30,263	13,700 – 64,325	4·7	2·1 – 10·0
South-East Asia	30,861	16,592 – 48,468	82·8	44·5 – 130·1	101,714	66,882 – 161,135	5·3	3·5 – 8·4
Western Pacific	66,232	33,923 – 99,183	88·6	45·4 – 132·6	102,411	67,643 – 138,949	5·5	3·6 – 7·4
World Bank Income Classifications								
High Income	44,975	34,566 – 62,927	44·4	34·1 – 62·1	64,104	51,889 – 83,537	4·9	4·0 – 6·4
Upper Middle Income	78,902	44,623 – 113,578	99·9	56·5 – 143·9	135,932	97,284 – 177,466	5·5	3·9 – 7·2
Lower Middle Income	38,382	21,464 – 64,534	79·3	44·4 – 133·4	143,498	89,220 – 220,483	5·4	3·3 – 8·3
Low Income	10,128	3,136 – 22,715	93·5	28·9 – 209·7	60,524	22,727 – 104,042	6·8	2·5 – 11·6

[a]Methods for extrapolation with modified analytic divisions found in Appendix Methods F in the section on sensitivity analysis to explore impact of analytic divisions on extrapolation model

[b]After applying extrapolation approach to all countries, excess mortality rate (EMR)-contributing country extrapolated estimates were replaced with mean annual influenza-associated respiratory EMRs and death estimates, except for Brazil and Kenya



Appendix Figure 1: Quality and Availability of Source Information to Calculate 2015 World Health Organization Global Health Estimates.



Appendix Figure 2a-c: World Health Organization Global Health Estimate Respiratory Infection Mortality Rate Quartiles and Influenza-associated Excess Mortality Rate (EMR)-Contributing Countries, (A) <65 years, (B) 65–74 years, and (C) ≥75 years.

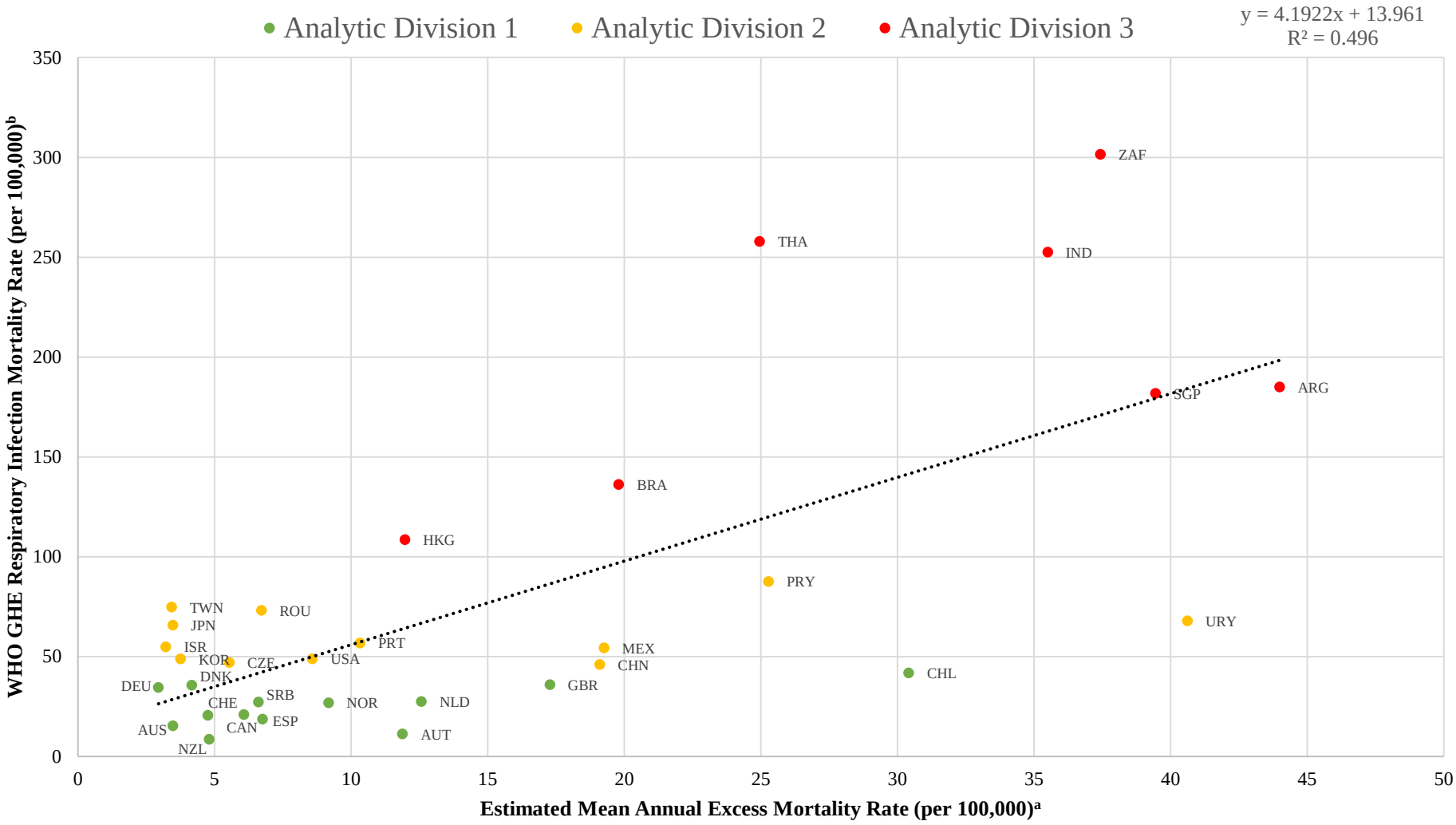
EMR-Contributing Countries:< 65 years (2a): Q1: Australia, Austria, Canada, Chile, China, Czech Republic, Denmark, Germany, Israel, Japan, Netherlands, New Zealand, Norway, Serbia, South Korea, Spain, Switzerland, United Kingdom; Q2: Brazil, Hong Kong, Mexico, Paraguay, Portugal, Singapore, Taiwan, Uruguay, USA; Q3: Argentina, India, Romania, South Africa, Thailand; Q4: Kenya;
65–75 years (2b): Q1: Australia, Austria, Canada, Chile, Denmark, Germany, Netherlands, New Zealand, Norway, Serbia, Spain, Switzerland, United Kingdom; Q2: China, Czech Republic, Israel, Japan, Mexico, Paraguay, Portugal, Romania, South Korea, Taiwan, Uruguay, USA; Q3: Argentina, Brazil, Hong Kong, India, Singapore, Thailand; Q4: South Africa;
≥ 75 years (2c): Q1: Australia, Austria, Canada, China, Germany, New Zealand, Romania, Serbia, Spain, Switzerland, USA; Q2: Chile, Czech Republic, Denmark, Israel, Mexico, Netherlands, Norway, Paraguay, South Korea, United Kingdom, Uruguay; Q3: Argentina, Brazil, India, Japan, Portugal, South Africa, Taiwan; Q4: Hong Kong, Singapore, Thailand.

Appendix Figure 3a. World Health Organization Global Health Estimate respiratory infection mortality rates compared to estimated mean annual influenza-associated excess respiratory mortality rates for 33 EMR-contributing countries: <65 Years

[a] Estimated mean annual respiratory EMRs per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for season/year estimates and their standard errors

[b] The rates of respiratory infection deaths for Hong Kong and Taiwan were based on vital records data from the Census and Statistics Department of the Hong Kong Government and the Ministry of Health and Welfare in Taiwan, as WHO Global Health Estimates did not generate estimates for Hong Kong or Taiwan

ARG: Argentina, AUS: Australia, AUT: Austria, BRA: Brazil, CAN: Canada, CHE: Switzerland, CHL: Chile, CHN: China, CZE: Czech Republic, DEU: Germany, DNK: Denmark, ESP: Spain, GBR: United Kingdom, HKG: Hong Kong, IND: India, ISR: Israel, JPN: Japan, KEN: Kenya, KOR: South Korea, MEX: Mexico, NLD: Netherlands, NOR: Norway, NZL: New Zealand, PRT: Portugal, PRY: Paraguay, ROU: Romania, SGP: Singapore, SRB: Serbia, THA: Thailand, TWN: Taiwan, URY: Uruguay, USA: United States of America, ZAF: South Africa

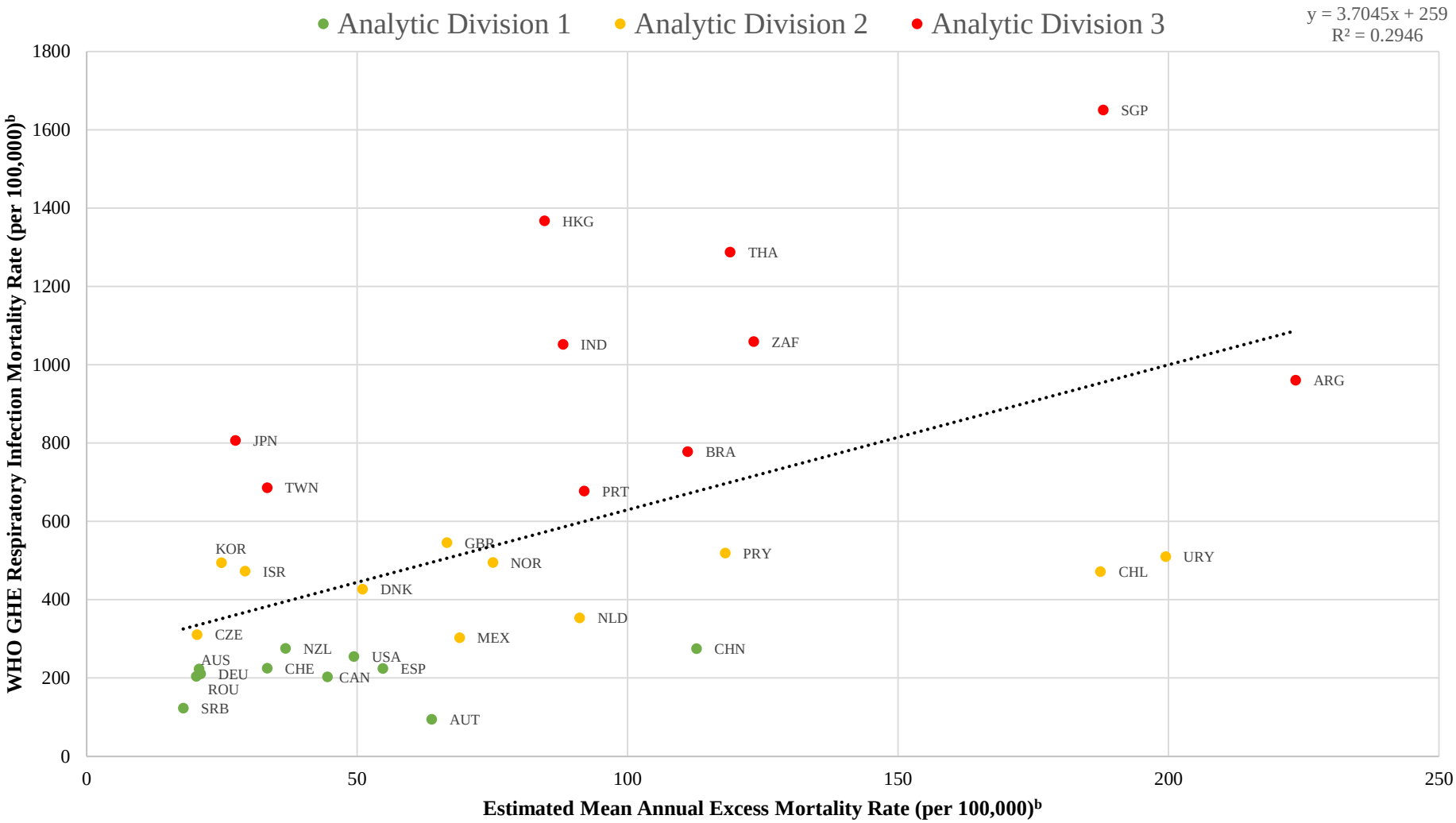


Appendix Figure 3b. World Health Organization Global Health Estimate respiratory infection mortality rates compared to estimated mean annual influenza-associated excess respiratory mortality rates for 33 EMR-contributing countries: 65–74 Years

[a] Estimated mean annual respiratory EMRs per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for season/year estimates and their standard errors

[b] The rates of respiratory infection deaths for Hong Kong and Taiwan were based on vital records data from the Census and Statistics Department of the Hong Kong Government and the Ministry of Health and Welfare in Taiwan, as WHO Global Health Estimates did not generate estimates for Hong Kong or Taiwan

ARG: Argentina, AUS: Australia, AUT: Austria, BRA: Brazil, CAN: Canada, CHE: Switzerland, CHL: Chile, CHN: China, CZE: Czech Republic, DEU: Germany, DNK: Denmark, ESP: Spain, GBR: United Kingdom, HKG: Hong Kong, IND: India, ISR: Israel, JPN: Japan, KOR: South Korea, MEX: Mexico, NLD: Netherlands, NOR: Norway, NZL: New Zealand, PRT: Portugal, PRY: Paraguay, ROU: Romania, SGP: Singapore, SRB: Serbia, THA: Thailand, TWN: Taiwan, URY: Uruguay, USA: United States of America, ZAF: South Africa

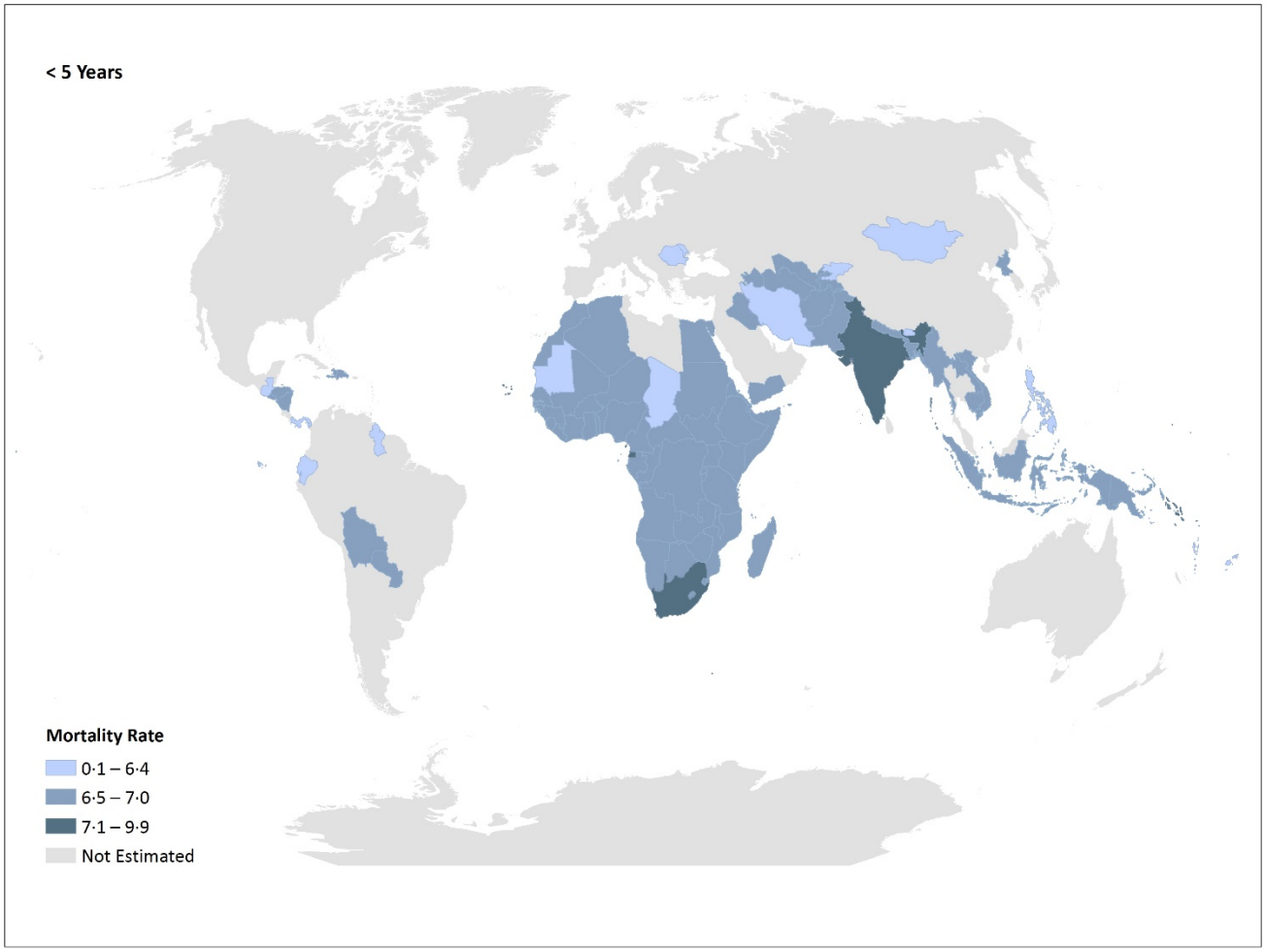


Appendix Figure 3c. World Health Organization Global Health Estimate respiratory infection mortality rates compared to estimated mean annual influenza-associated excess respiratory mortality rates for 33 EMR-contributing countries: ≥75 Years

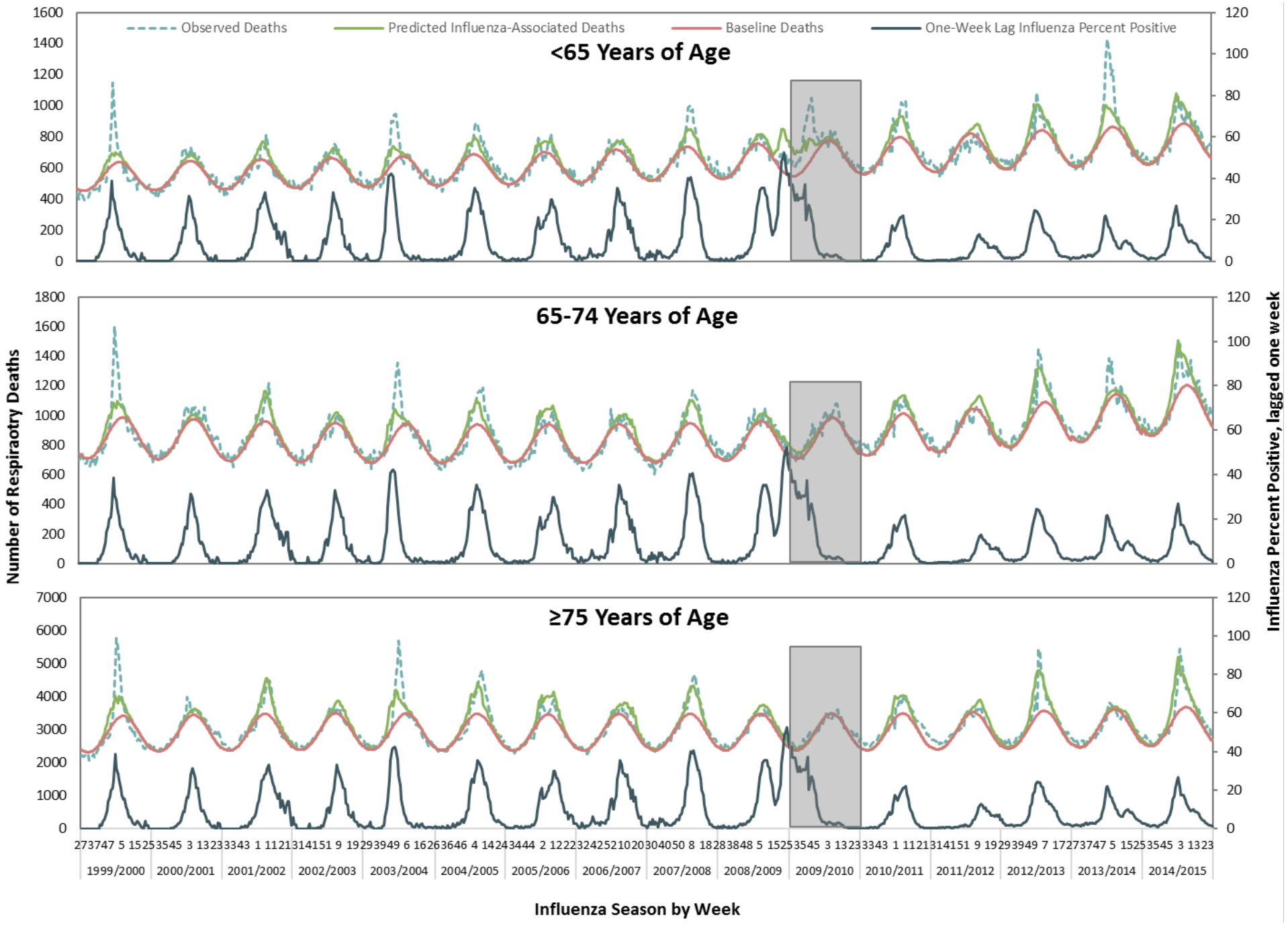
[a] Estimated mean annual respiratory EMRs per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for season/year estimates and their standard errors

[b] The rates of respiratory infection deaths for Hong Kong and Taiwan were based on vital records data from the Census and Statistics Department of the Hong Kong Government and the Ministry of Health and Welfare in Taiwan, as WHO Global Health Estimates did not generate estimates for Hong Kong or Taiwan

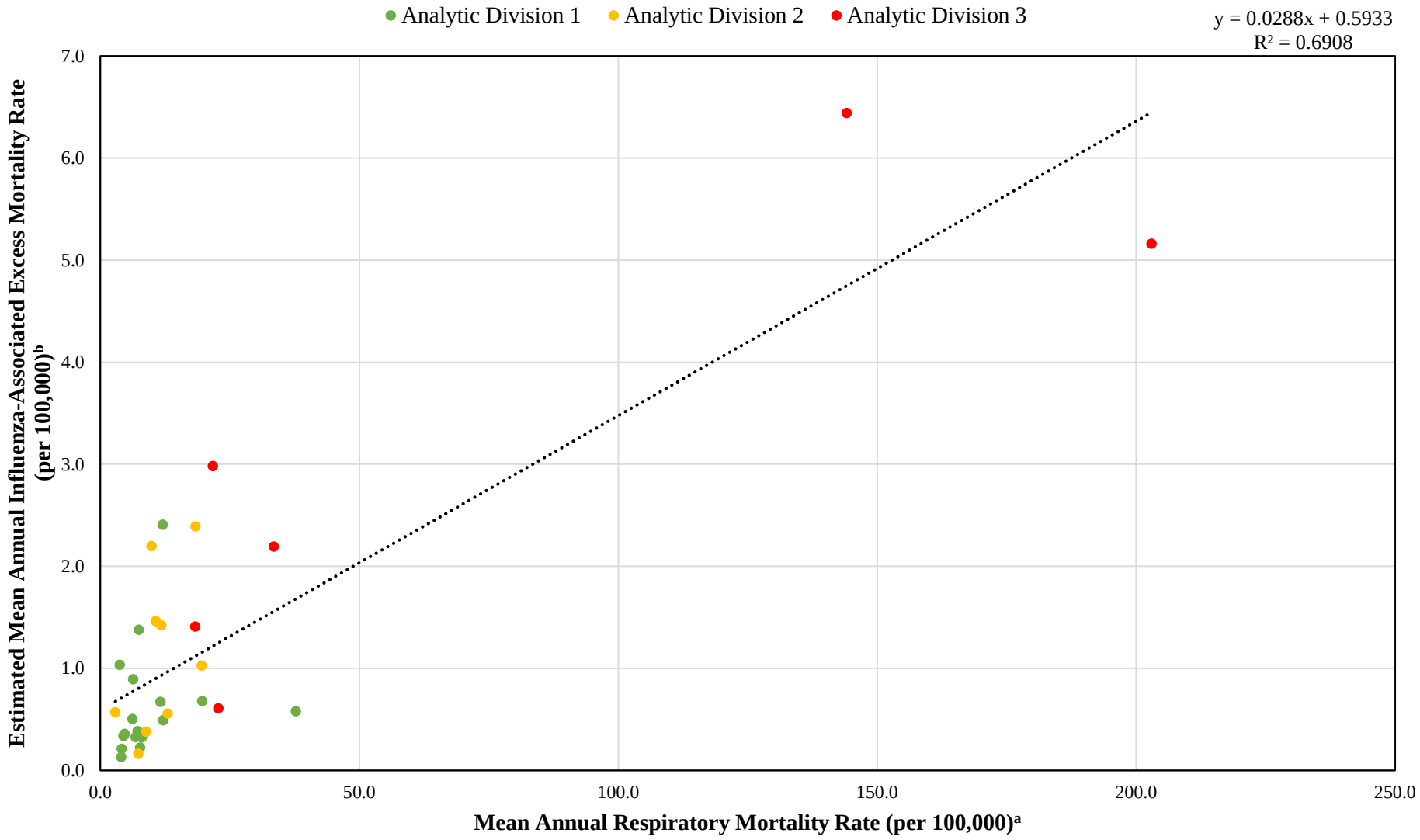
ARG: Argentina, AUS: Australia, AUT: Austria, BRA: Brazil, CAN: Canada, CHE: Switzerland, CHL: Chile, CHN: China, CZE: Czech Republic, DEU: Germany, DNK: Denmark, ESP: Spain, GBR: United Kingdom, HKG: Hong Kong, IND: India, ISR: Israel, JPN: Japan, KOR: South Korea, MEX: Mexico, NLD: Netherlands, NOR: Norway, NZL: New Zealand, PRT: Portugal, PRY: Paraguay, ROU: Romania, SGP: Singapore, SRB: Serbia, THA: Thailand, TWN: Taiwan, URY: Uruguay, USA: United States of America, ZAF: South Africa



Appendix Figure 4: Estimated Country-Specific Median Influenza-Associated Respiratory Mortality Rates (per 100,000) for Children <5 Years of Age



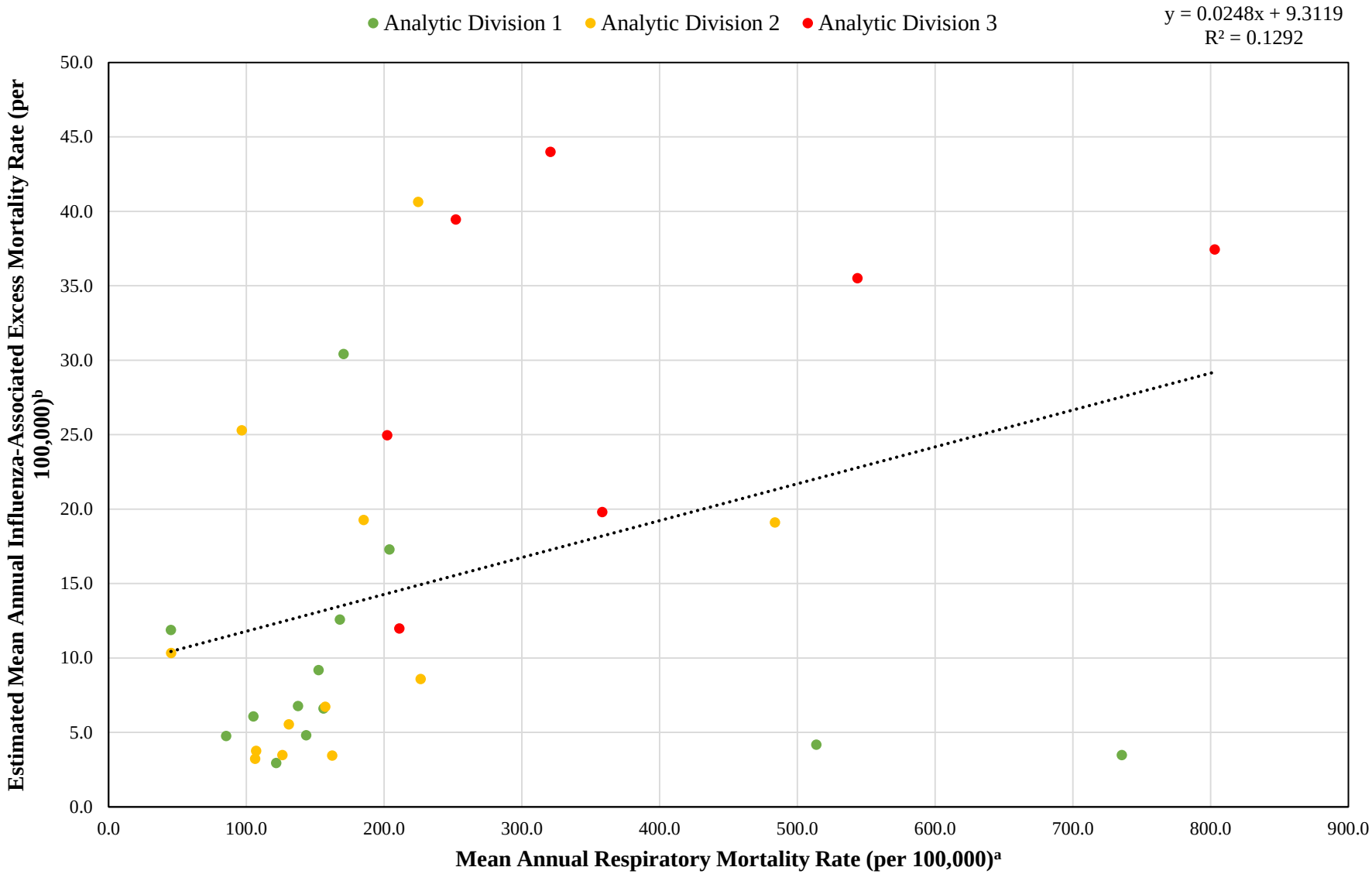
Appendix Figure 5: Observed respiratory coded deaths, estimated baseline deaths, predicted influenza-associated deaths, and influenza percent positive by week, United States, 1999/2000 – 2014/2015.



Appendix Figure 6a. Mean annual total respiratory mortality rates compared to estimated mean annual influenza-associated excess respiratory mortality rates: <65 Years for 33 EMR-contributing countries

[a] Estimated mean annual respiratory mortality rates per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for all ICD-coded respiratory deaths for the seasons or years provided

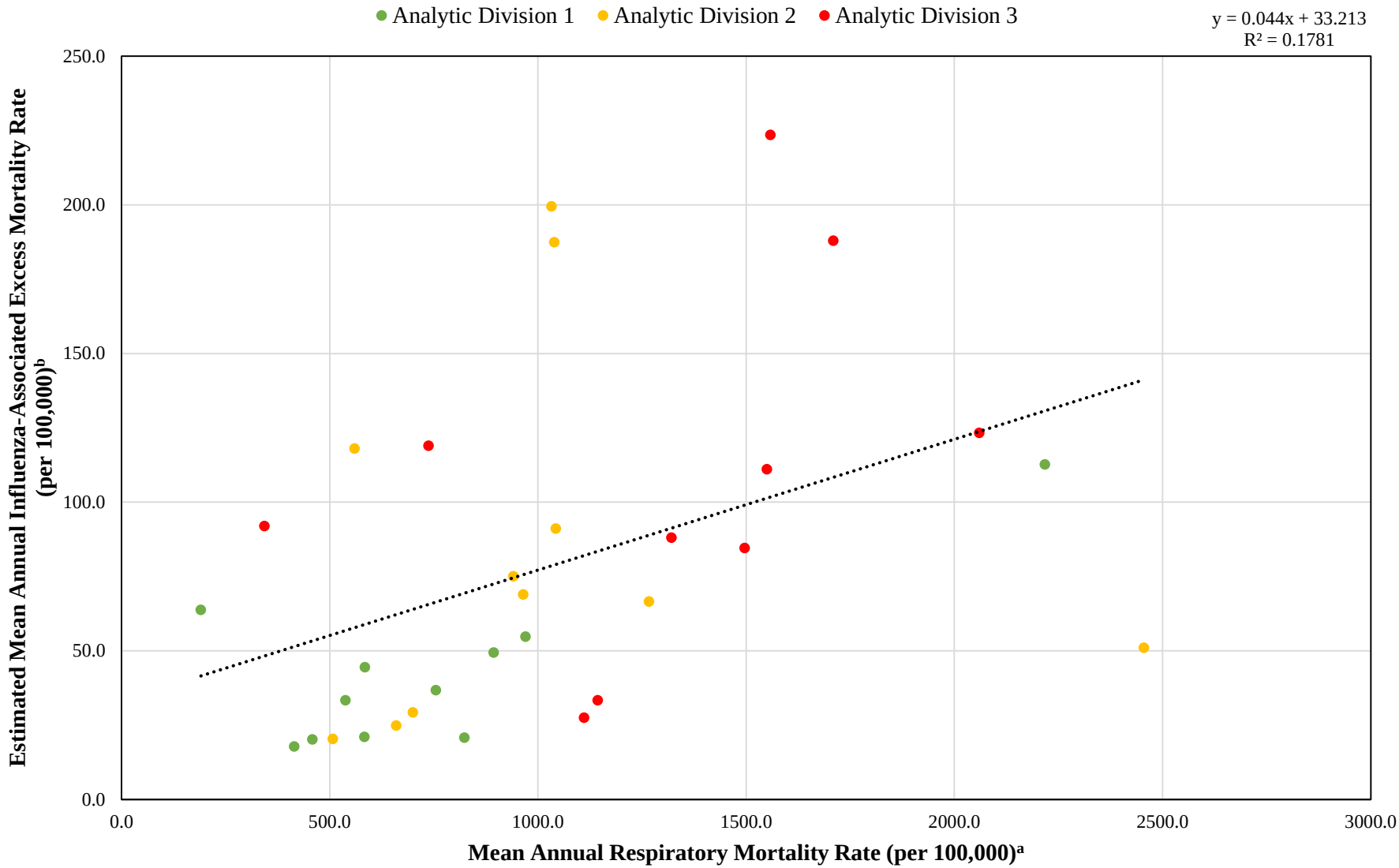
[b] Estimated mean annual respiratory EMRs per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for season/year estimates and their standard errors



Appendix Figure 6b. Mean annual total respiratory mortality rates compared to estimated mean annual influenza-associated excess respiratory mortality rates from extrapolation: 65–74 Years for 33 EMR-contributing countries

[a] Estimated mean annual respiratory mortality rates per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for all ICD-coded respiratory deaths for the seasons or years provided

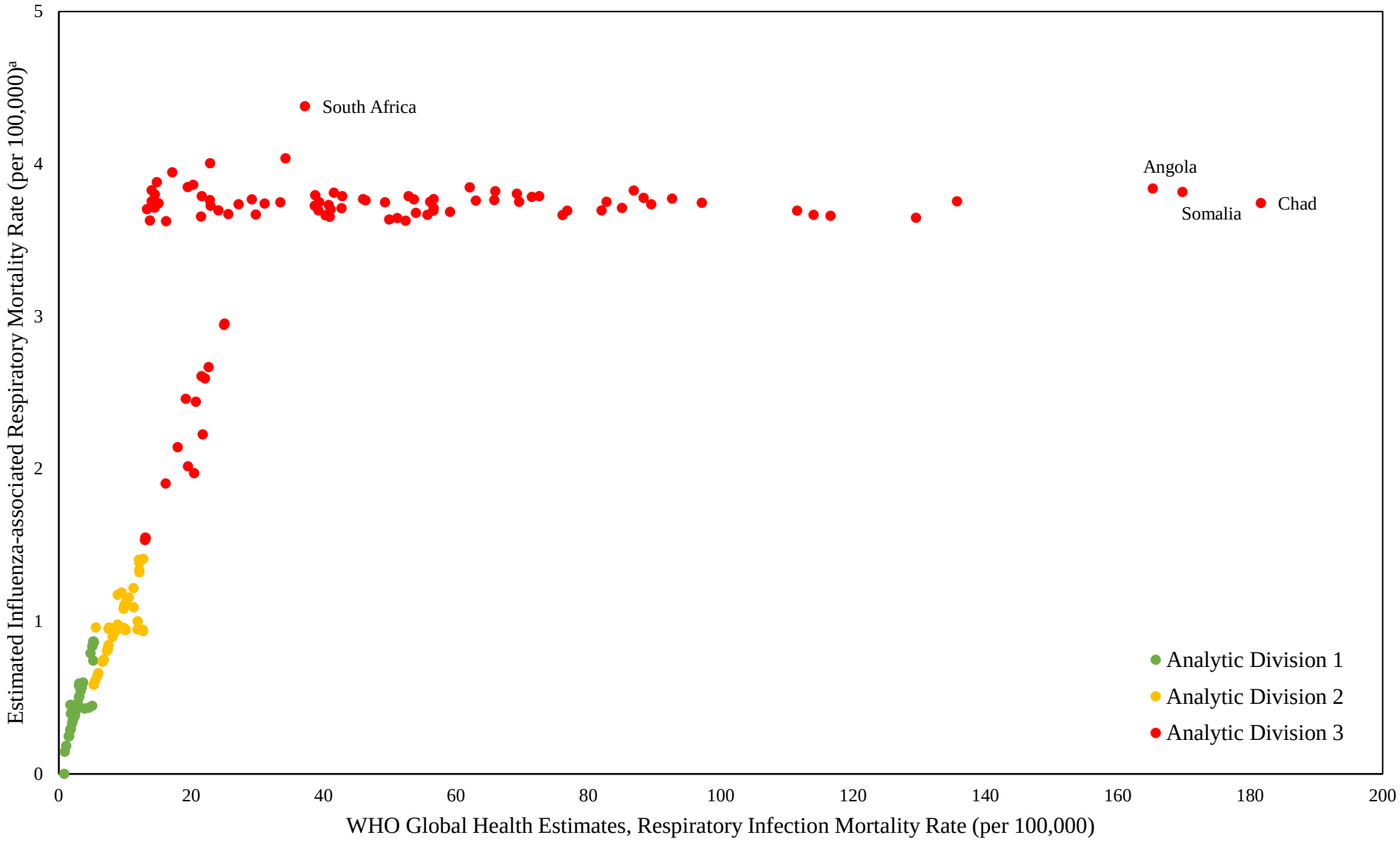
[b] Estimated mean annual respiratory EMRs per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for season/year estimates and their standard errors



Appendix Figure 6c. Mean annual total respiratory mortality rates compared to estimated mean annual influenza-associated excess respiratory mortality rates from extrapolation: ≥75 Years for 33 EMR-contributing countries

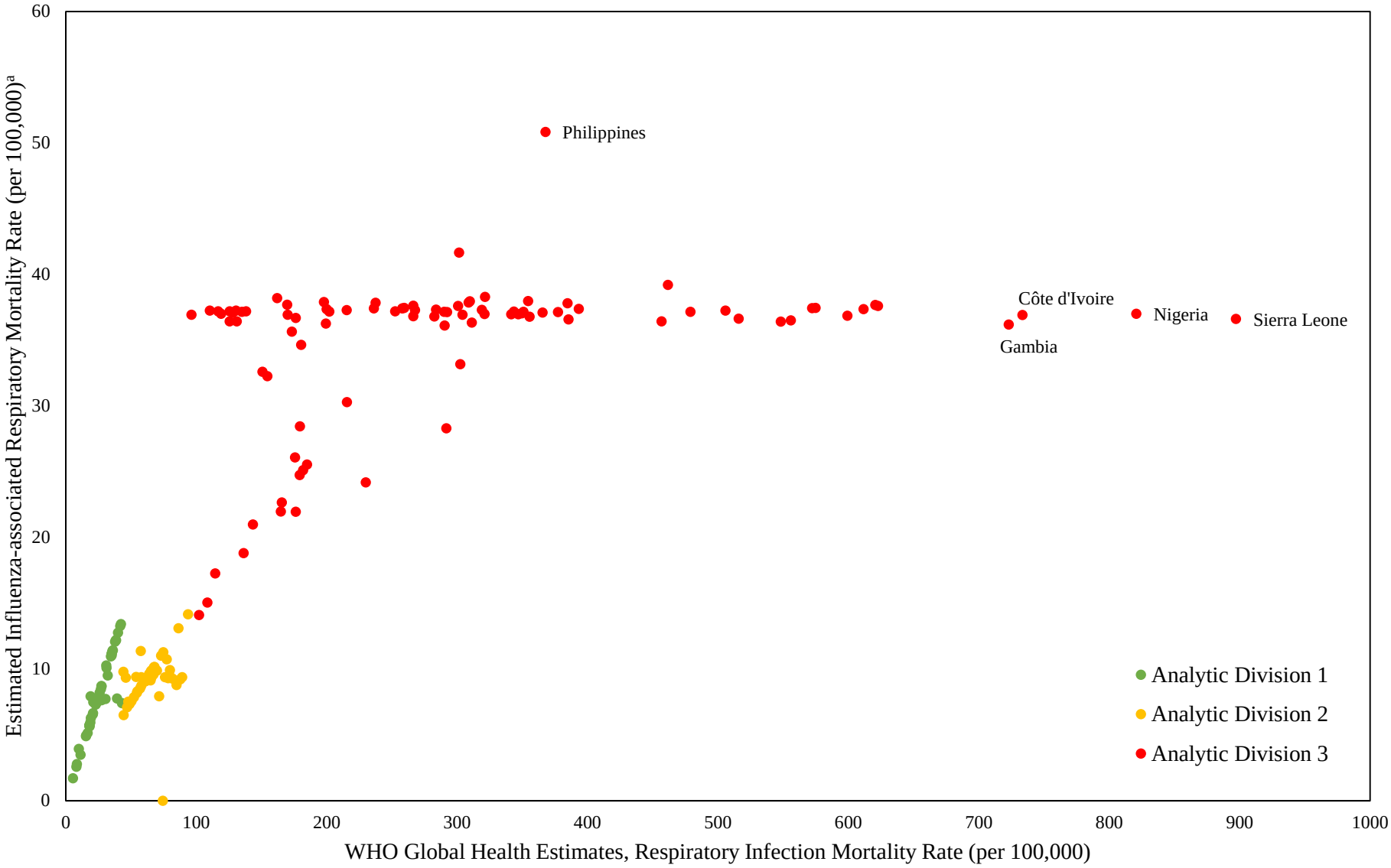
[a] Estimated mean annual respiratory mortality rates per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for all ICD-coded respiratory deaths for the seasons or years provided

[b] Estimated mean annual respiratory EMRs per 100,000 population for EMR-contributing countries were calculated using an age- and country-specific Bayesian hierarchical model for season/year estimates and their standard errors



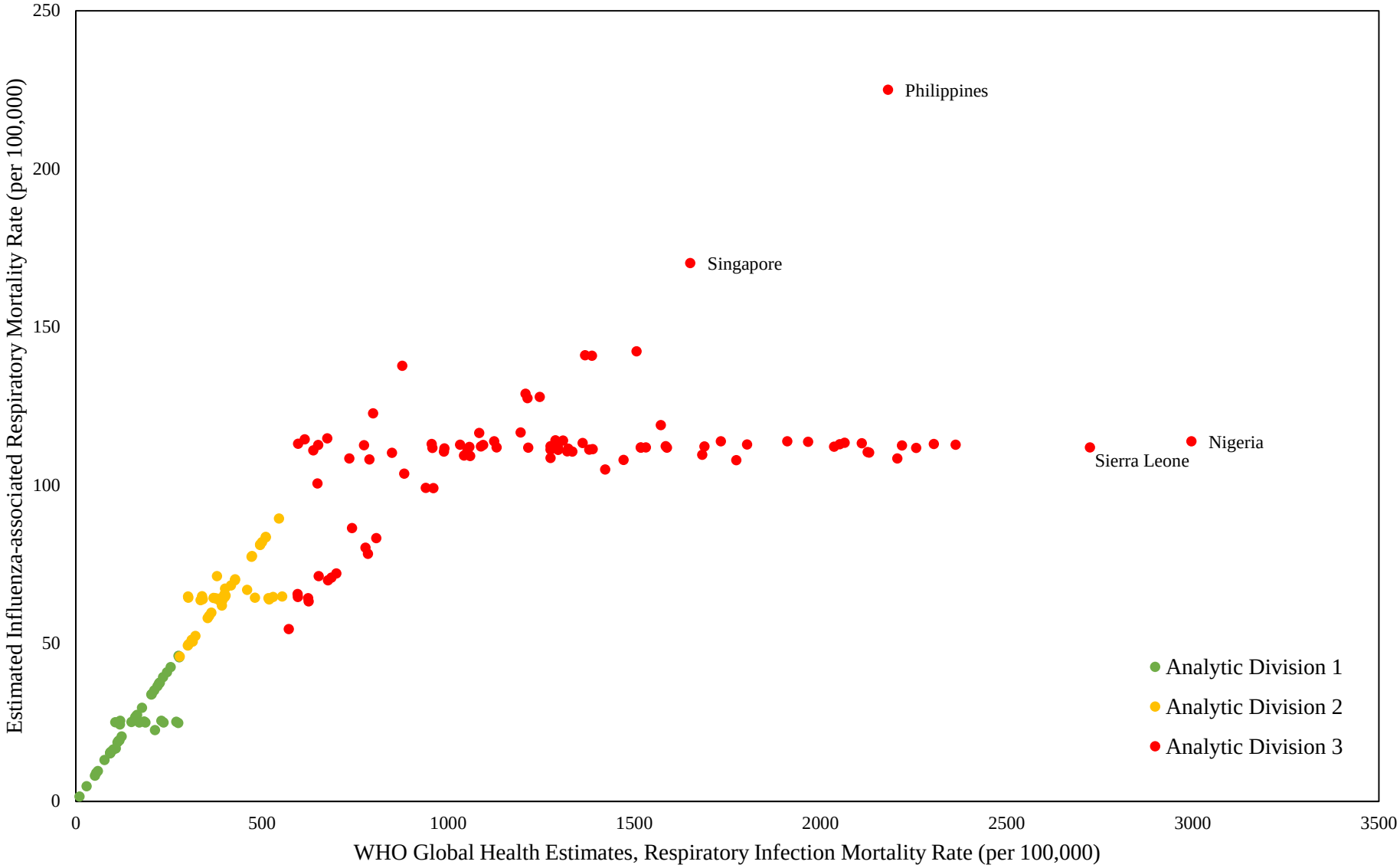
Appendix Figure 7a. Influenza-associated respiratory mortality rates compared to 2015 World Health Organization (WHO) Global Health Estimates, respiratory infection mortality rates for all countries by analytic division: <65 years

[a]Iceland had influenza-associated mortality rates equal to zero due to rounding and a small population

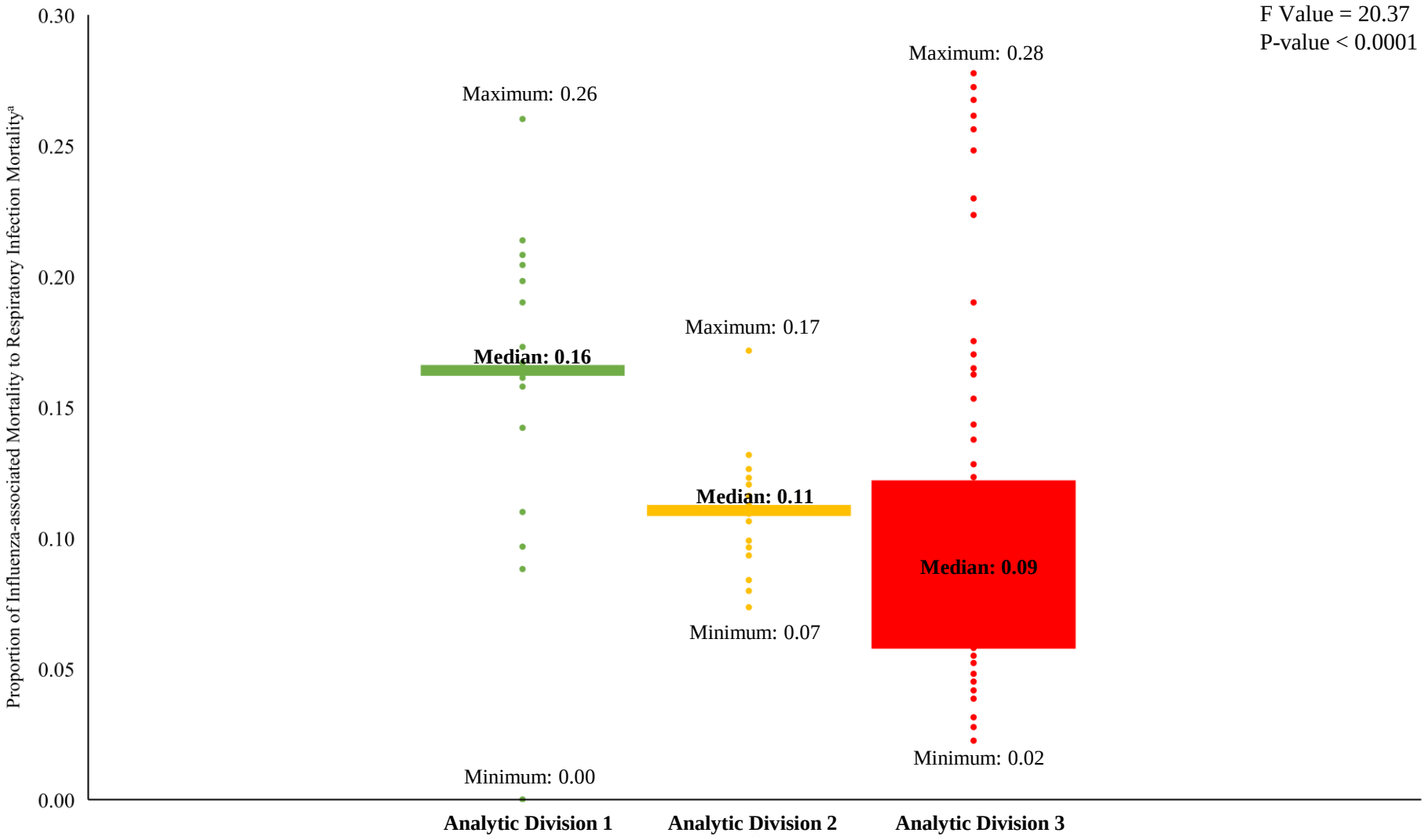


Appendix Figure 7b. Influenza-associated respiratory mortality rates compared to 2015 World Health Organization (WHO) Global Health Estimates, respiratory infection mortality rates for all countries by analytic division: 65-74 years

[a]Antigua and Barbuda had influenza-associated mortality rates equal to zero due to rounding and a small population

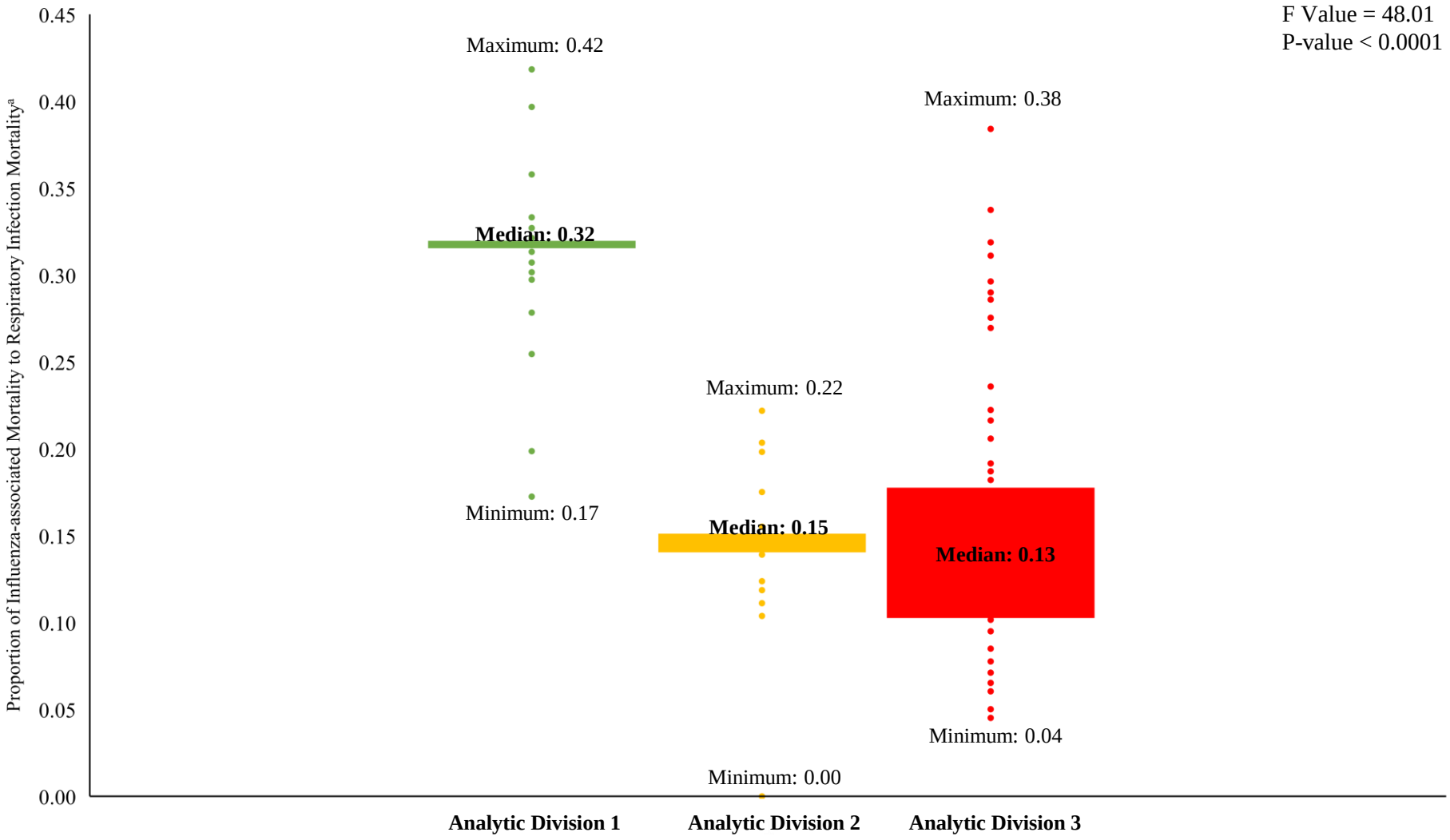


Appendix Figure 7c. Influenza-associated respiratory mortality rates compared to 2015 World Health Organization (WHO) Global Health Estimates, respiratory infection mortality rates for all countries by analytic division: ≥75 years



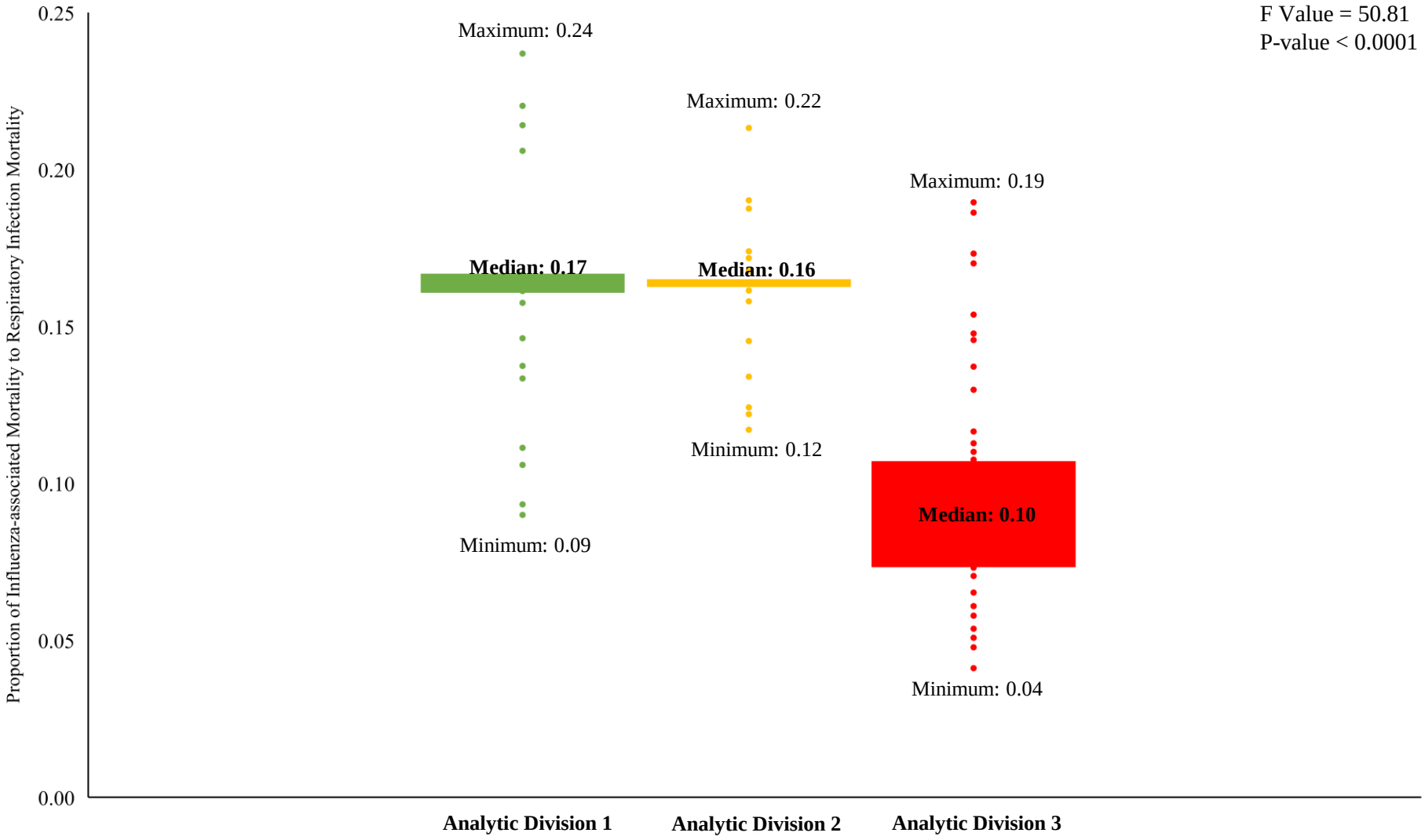
Appendix Figure 8a: Box and whisker plot of rate-ratio comparing influenza-associated respiratory mortality rates estimated from extrapolation model and 2015 World Health Organization, Global Health Estimates respiratory infection mortality rates within analytic division: <65 years

[a]Iceland had influenza-associated mortality rates equal to zero, thus the proportion was also zero due to rounding and a small population



Appendix Figure 8b: Box and whisker plot of rate-ratio comparing influenza-associated respiratory mortality rates estimated from extrapolation model and 2015 World Health Organization, Global Health Estimates respiratory infection mortality rates within analytic division: 65-74 years

[a]Antigua and Barbuda had influenza-associated mortality rates equal to zero, thus the proportion was also zero due to rounding and a small population



Appendix Figure 8c: Box and whisker plot of rate-ratio comparing influenza-associated respiratory mortality rates estimated from extrapolation model and 2015 World Health Organization, Global Health Estimates respiratory infection mortality rates within analytic division: ≥75 years

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