



Letter

US flu mortality estimates are based on solid science

Editor—Doshi implies that the use of statistical models to estimate flu related mortality is inappropriate.¹ Not so. Epidemiologists rely on statistical models because the International Classification of Diseases (ICD) code for influenza (ICD9 487) severely undercounts the true number of flu related deaths. Doshi also implies that the Centers for Disease Control and Prevention (CDC) deliberately exaggerates flu mortality for the benefit of the pharmaceutical industry, while other scientists stand by, meek and mute. The *BMJ's* decision to publish Doshi's commentary with no counterpoint from an expert in the field served only to sow unnecessary confusion.

We need statistical models partly because flu is rarely confirmed in the laboratory and partly because flu brings about many more deaths from secondary bacterial pneumonia or exacerbations of underlying chronic diseases than from primary flu pneumonia. The classic Serfling modelling approach measures the total seasonal number of flu related deaths as the excess mortality above an expected winter baseline of all winter deaths.^{2,3} Regression models guided by virus surveillance data have been developed more recently.^{4,5} These modelling approaches yield similar estimates

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when applied to the same mortality data for the same range of years ([table](#)). The deaths identified by the models only occur when flu causes epidemics² and are most numerous for flu seasons dominated by severe A(H3N2) viruses.³ The important point is that the deaths attributed to flu by these models are flu related in that they would not have occurred without flu.

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Why, Doshi asks, are the newer CDC estimates much higher than the older estimates of seasonal flu related deaths? The disparity between older and newer estimates is simply a consequence of various authors studying different time periods over decades when the elderly population simultaneously grew and aged ([table](#)); specifically, the proportion of elderly people over 85 had quadrupled by the end of the 1990s, which led to increasing mortality estimates because the risk of dying from flu increases exponentially in the last decades of life.³

And why, Doshi asks, is the estimate of 34 000 deaths for the 1968 pandemic lower than the current CDC estimate for an average season? One cannot compare crude mortality estimates across decades because of the ageing of the population; what makes the mild 1968 pandemic stand out is the shift in mortality to younger people—nearly half the 1968 flu related deaths occurred in people under 65, compared to around 10% of deaths in recent seasons.

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Average seasonal estimates of flu related deaths for specific time periods, based on applying various models to all US deaths

	1972-92	1976-99	1990-9
Crude estimates of all cause excess mortality			
Former CDC Serfling model ²	20 000	—	—
Current CDC virus-guided model ^{4*}	—	34 470	51 203
NIH Serfling model ³	24 400	33 400	48 700
Annual regression model ⁵	—	—	51 900
Age adjusted estimates of all cause excess mortality[†]			
NIH Serfling model ³	19 800	23 600	30 800

* Crude all cause excess deaths from tables 2 and 3 in Thompson et al.⁴

[†] Carefully adjusted for population ageing but not for increased circulation of virulent A(H3N2) viruses in 1990s—a factor explaining much of residual increase compared with previous time periods.³