



## Letter to the Editor

# Comparing mortalities of the first wave of coronavirus disease 2019 (COVID-19) and of the 1918–19 winter pandemic influenza wave in the USA

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It has been argued that coronavirus disease 2019 (COVID-19) mortality rates exceed those from the influenza pandemic in 1918–19,<sup>1</sup> but comparisons can be misleading unless marked differences in age-specific mortality<sup>2</sup> and changes in population age structure in the past century<sup>3</sup> are taken into account. The need for application of fundamental epidemiological approaches in understanding COVID-19 has also been recognized.<sup>4</sup>

We used indirect age standardization to calculate standardized mortality ratios (SMRs) for the 1918–19 winter influenza pandemic wave, with the reference mortality rate being COVID-19 death rates for New York City.<sup>5</sup> Population estimates were obtained from the United States (US) Census Bureau website and interpolated between censuses where necessary. Mortality in New York City for the 1918–19 winter pandemic influenza wave was obtained from Olson *et al.* (2005).<sup>6</sup> We also used published US influenza mortality data for the 1918–19 and 2009 pandemics and the severe 2017–18 season as comparators.<sup>2,7,8</sup>

This study used only aggregate statistics from public websites and published literature and was therefore exempt from ethics review by our institution.

Of 21,649 cumulative confirmed and probable COVID-19 deaths in New York City as at 2 June 2020,<sup>5</sup> 21,450 (99%) had a known age at death, of which 0.065%, 3.7%, 22%, 24% and 49% were in the ≤17, 18–44, 45–64, 65–

74 and ≥75 year age groups, respectively. The corresponding death rates per 100 000 population were 0.80, 24, 230, 740 and 2000, respectively, making crude, all-age mortality of 258 per 100 000 population almost uninterpretable for younger and older age groups.

In New York City, the age-adjusted, all-age mortality rate for the 1918–19 winter wave of the influenza pandemic was 6.7 times higher than COVID-19 cumulative mortality rates to 2 June 2020. In <45-year-olds, the SMR was 42; that is, 42 times higher for influenza in 1918–19 than for COVID in 2020. In ≥45-year-olds, the SMR was 0.56; that is, 44% lower in 1918–19 than for COVID in 2020 (Table 1).

Applying these methods to more contemporary influenza data, the SMR for children (aged ≤17 years) for the 2009 H1N1 influenza pandemic in the USA is 2.1; that is, double the mortality for COVID-19 in New York City in the first 2020 wave. For older age groups, the SMR is less than 0.05, or more than 20-fold lower (Table 2).

In New York City, all-age COVID-19 mortality rates remain substantially lower than those documented in the 1918–19 influenza pandemic, recognizing that 1918–19 mortality was inflated by lack of now routine treatments, such as antibiotics, supplemental oxygen and ventilatory support. In children, recent severe seasonal influenza mortality was similar to, and 2009 pandemic mortality double, that documented in the first 3 months of the COVID-19 epidemic. In older people, COVID-19 mortality is more

**Table 1** Standardized mortality ratios (SMR) of the 1918–19 winter wave of pandemic influenza<sup>6</sup> relative to the first 2020 wave of COVID-19 infection in New York City<sup>a</sup>

Age group (years)	Observed deaths	Expected deaths	Crude mortality ratio	SMR
All ages	29 200	4372	2.1	6.7
<45	26 200	629	38	42
≥45	2100	3743	0.33	0.56

<sup>a</sup>2020 COVID-19 confirmed and probable death rates by age (as at 2 June 2020).<sup>5</sup> Of 21 649 deaths, 1 (0.0046%) death with unknown age and 198 (0.91%) with incomplete age information were excluded.

**Table 2** Standardized mortality ratios (SMR) of comparator pandemics and epidemics in the USA relative to the first 2020 wave of COVID-19 infection in New York City<sup>a</sup>

Period	Outcome	Age group (years)	Observed deaths	Expected deaths	Crude mortality ratio	SMR
1918–19 <sup>2</sup>	Estimated influenza pandemic excess pneumonia and influenza deaths	All ages	546 000	102 194	2.1	5.3
		<65	538 000	48 914	7.0	11
		≥65	8000	53 280	0.13	0.15
April 2009–April 2010 <sup>7</sup>	Estimated pandemic influenza A(H1N1)pdm09 deaths	All ages	12 469	730 956	0.016	0.017
		≤17	1282	597	2.1	2.1
		18–64	9565	212 473	0.048	0.045
		≥65	1621	517 886	0.0032	0.0031
2017–18 influenza season <sup>8</sup>	Estimated (preliminary) seasonal influenza deaths	All ages	61 099	857 505	0.073	0.071
		≤17	643	592	1.1	1.1
		18–64	9554	222 400	0.046	0.043
		≥65	50 903	634 513	0.079	0.080

<sup>a</sup>2020 COVID-19 confirmed and probable death rates by age (as at 2 June 2020).<sup>5</sup> Of 21 649 deaths, 1 (0.0046%) death with unknown age and 198 (0.91%) with incomplete age information were excluded.

than 10-fold higher than a severe influenza season, and more than 300-fold higher than the 2009–10 influenza pandemic.

Limitations of this study include that deaths from COVID-19 in New York City continue to be reported, so SMRs may change, and ascertainment of COVID-19 deaths may have been reduced by insensitivity of earlier COVID-19 diagnostics,<sup>9</sup> with evidence of underascertainment of COVID-19-attributable deaths by routine surveillance.<sup>10</sup> It is also unknown whether changes in exposure and consequent immunity over time and by place will have an impact on the age-specific risk of severe illness, if infection by this new human coronavirus is sustained in human populations. Observed differences in clinical severity and mortality risk by age among emerging pandemic strains or coronaviruses or influenza viruses may reflect herd immunity conferred on different age cohorts by exposure to previously circulating strains of the same virus.<sup>11</sup>

In New York City in 1918–19, measures invoked included isolation of infected individuals, enhanced disease surveillance, and education campaigns but, unlike in 2020, not school closures.<sup>12,13</sup> Comparisons with 1918–19 must also take into account the prominent role of secondary

bacterial infection in influenza mortality and the lack of now routine treatments. However, it seems unlikely that these factors could fully explain a 40-fold lower mortality below 45 years of age for COVID-19 in New York City. Notwithstanding the substantial burden of less severe infections due to both influenza and COVID-19 in different age groups, and the possibility that risk of death may vary over time, the higher age-specific mortality in the young in both the 1918–19 and 2009 influenza pandemics compared with COVID-19 is an important factor for decisions about whole-of-population versus age-targeted vaccination strategies.

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## Author contributions

P.B.M. conceived of the study. D.J.M. conceived of and conducted the analysis and drafted the manuscript. Both authors contributed to the drafting of the manuscript.

## Conflict of Interest

None declared.

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