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Nonpharmaceutical Interventions Implemented by US Cities During the 1918-1919 Influenza Pandemic

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Context A critical question in pandemic influenza planning is the role nonpharmaceutical interventions might play in delaying the temporal effects of a pandemic, reducing the overall and peak attack rate, and reducing the number of cumulative deaths. Such measures could potentially provide valuable time for pandemic-strain vaccine and antiviral medication production and distribution. Optimally, appropriate implementation of nonpharmaceutical interventions would decrease the burden on health care services and critical infrastructure.

Objectives To examine the implementation of nonpharmaceutical interventions for epidemic mitigation in 43 cities in the continental United States from September 8, 1918, through February 22, 1919, and to determine whether city-to-city variation in mortality was associated with the timing, duration, and combination of nonpharmaceutical interventions; altered population susceptibility associated with prior pandemic waves; age and sex distribution; and population size and density.

Design and Setting Historical archival research, and statistical and epidemiological analyses. Nonpharmaceutical interventions were grouped into 3 major categories: school closure; cancellation of public gatherings; and isolation and quarantine.

Main Outcome Measures Weekly excess death rate (EDR); time from the activation of nonpharmaceutical interventions to the first peak EDR; the first peak weekly EDR; and cumulative EDR during the entire 24-week study period.

Results There were 115 340 excess pneumonia and influenza deaths (EDR, 500/100 000 population) in the 43 cities during the 24 weeks analyzed. Every city adopted at least 1 of the 3 major categories of nonpharmaceutical interventions. School closure and public gathering bans activated concurrently represented the most common combination implemented in 34 cities (79%); this combination had a median duration of 4 weeks (range, 1-10 weeks) and was significantly associated with reductions in weekly EDR. The cities that implemented nonpharmaceutical interventions earlier had greater delays in reaching peak mortality (Spearman $r=-0.74$, $P<.001$), lower peak mortality rates (Spearman $r=0.31$, $P=.02$), and lower total mortality (Spearman $r=0.37$, $P=.008$). There was a statistically significant association between increased duration of nonpharmaceutical interventions and a reduced total mortality burden (Spearman $r=-0.39$, $P=.005$).

Conclusions These findings demonstrate a strong association between early, sustained, and layered application of nonpharmaceutical interventions and mitigating the consequences of the 1918-1919 influenza pandemic in the United States. In planning for future severe influenza pandemics, nonpharmaceutical interventions should be considered for inclusion as companion measures to developing effective vaccines and medications for prophylaxis and treatment.

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THE INFLUENZA PANDEMIC OF 1918-1919 was the most deadly contagious calamity in human history. Approximately 40 million individuals died worldwide, including 550 000 individuals in the United States.[1-4] The historical record demonstrates that when faced with a devastating pandemic, many nations, communities, and individuals adopt what they perceive to be effective social distancing measures or nonpharmaceutical interventions including isolation of those who are ill, quarantine of those suspected of having contact with those who are ill, school and selected business closure, and public gathering cancellations.[5,6] One compelling question emerges: can lessons from the 1918-1919 pandemic be applied to contemporary pandemic planning efforts to maximize public health benefit while minimizing the disruptive social consequences of the pandemic as well as those accompanying public health response measures?[7-10]

Most pandemic influenza policy