

Emergency Preparedness and Response: School Dismissals to Reduce Transmission of Pandemic Influenza

Summary Evidence Table for Historical (Retrospective) Examinations of Community Mitigation Interventions in Previous Influenza Pandemics

Studies of the 1918 Pandemic (United States)

Author & year (study period) Study Design Study Quality (NA) Quality Concerns	Location Intervention Comparison	Study population description Sample size	Effect measure	Reported baseline	Reported effect	Value used in summary [95%CI]	Follow-up time
<p>Markel 2007 (also Stern 2009) (1918-1919 pandemic; a category 4-5 pandemic)</p> <p>Historical archive research Statistical and epidemiologic research (Not quality scored)</p> <p>Quality Concerns -Historical records as basis of intervention specifics -Mortality records as basis for outcomes (10 day timing estimate)</p>	<p>Location: United States, 43 cities</p> <p>Study period September 8, 1918 through February 22, 1919</p> <p>Intervention: Non-pharmaceutical interventions implemented by each of the study cities (different combinations were implemented by different cities)</p> <p>3 major intervention categories (Determined by archival community and health department records) -School dismissals -Cancellation of public gatherings (some businesses)</p>	<p>This study retrospectively plots and examines the timing and duration of community interventions (as determined in historical records) with mortality rates in each of the 43 cities</p> <p>Study population: 43 of the 66 most populous cities were included based on presence of complete archival and mortality data sources (23 cities had incomplete data and were not included here)</p> <p>The 43 study cities represented about</p>	<p>Weekly excess death rates (EDR) overall an for pneumonia and influenza deaths</p> <p>First peak weekly EDR (time to peak)</p> <p>Cumulative EDR over the 24 week study period</p> <p>Note: Base mortality data ws taken from US CensusBureau's Weekly Health</p>	<p>City specific baseline weekly estimated pneumonia and influenza death rates in the period 1910-1916</p>	<p>City specific changes in weekly pneumonia and influenza death rates in the f/u period (Sept 1918-Feb 1919)</p> <p>ANOVA model with weekly EDR as the dependent variable and epidemiological week, city, and interventions on/off status as the independent variables</p>	<p>City by City weekly EDR stratified, plotted, and examined by city specific intervention characteristics</p> <p>Narrative review of study findings including city EDR by response time scatterplots (Figure 1)</p>	<p>24 week study period (2nd wave and first 2months of the 3rd wave of the 1918 pandemic)</p>

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for expected effects) -Applicability to current era (interventions, response times)	-Case and contact isolation and quarantine (mandatory) -Minor category: ancillary interventions Comparisons: City by City comparisons on estimated pneumonia and influenza death rates by interventions, timing and duration	22% US population in 1918-1919 Study events N=115,340 excess pneumonia and influenza deaths in the study period	Index (1918-1919) EDR estimated using epidemiologic calculations				
Stern 2009 (also Markel 2007) (1918-1919 pandemic) Historical archive research. Descriptive study providing details about school dismissals in 43 US cities Concerns -Historical records -Potential biases in categorization -Applicability	Location: United States; 43 cities Intervention: Characteristics of the school dismissals including author categorization of community/public health cooperation and compliance Comparison Categorization of school actions by presence/absence of dismissal and community/public health support (see results)	43 US Cities: Populations ranged from 104,000 to 5.6 million (23 million people or 22% US population) "Typically, the order to close schools came late in the epidemic curves of cities—weeks if not days after deaths from influenza and pneumonia mounted." (page w1067)	Narrative findings based on descriptive comparisons of cities organized into author defined classification scheme (based on archive research) 1: Cities that kept schools open and relied heavily on the daily medical inspections of students: N= 3 (New York; New Haven; and Chicago) Note: Chicago had a very high rate (30% with peak 45-50%) of student absenteeism 2: Cities that closed schools and experience interagency conflict and low compliance with nonpharmaceutical interventions: N=9 cities 3: Cities that closed schools and experienced inconsistent and sporadic interagency cooperation and mixed compliance with nonpharmaceutical interventions: N=11 cities 4: Cities that closed schools and experience interagency cooperation and high compliance with nonpharmaceutical interventions: N=20 cities				24 week study period (2 nd wave and first 2 months of the 3 rd wave of the 1918 pandemic)

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<p>Hatchett 2007 (Sept-Dec 1918) Historical research Concerns (note: Markel 2007 claims that this paper primarily utilized secondary sources of data, not primary archival sources) However, this paper suggests that intervention date (without estimated transmission delay) is more useful than the delay used by others</p>	<p>Location: United States; 17 cities with complete data (of 45 in source reference) Interventions: Non-pharmaceutical interventions categorized into 19 types Table 1 has intervention summary and frequency of use School closures: 14 of 17 cities implemented these Median CEPID at time of closure 30.8 (IQI 15.1, 96.3) Comparisons -Early vs late implementation -Number of interventions implemented</p>	<p>“We tested the hypothesis that early implementation of multiple interventions was associated with reduced disease transmission.” Results continued “..no city in our analysis experienced a second wave while its main battery of NPIs was in place. Second waves occurred only after the relaxation of interventions.” Most NPIs were relaxed within 2-8 weeks. Authors stress need to continue NPIs longer than the 2-8 wk 1918 norm (if vaccines not available)</p>	<p>Cumulative excess pneumonia and influenza death rate (CEPID) Peak weekly CEPID Normalized peak CEPID per 100k</p>		<p>In the discussion the authors estimate that effective NPI combinations were implemented before CEPID 20/100,000 or before deaths by infection of 1% of the population had occurred.</p>	<p>Figure 2 and Table 2 in paper Across cities Aggressive early intervention was significantly associated with lower peak of excess mortality -School -Church -Theater Relationships were weaker or NS for total death rates</p>	<p>4 months Sept-Dec 1918</p>
<p>Bootsma 2007 (Sept 1918-May 1919) Historical research and analysis Concerns</p>	<p>Location: United States; subset of 23 cities with intervention start dates; subset of 16 cities with complete intervention data Interventions</p>	<p>Authors model and analyze 1918 pandemic mortality to investigate potential influence of community mitigation interventions on transmission.</p>	<p>Excess pneumonia and influenza deaths per week from Sept 1918-May 1919</p>		<p>The impact of community mitigation interventions on the shape of the epidemics seen was much more major than the</p>	<p>Authors examine impact of relaxing community mitigation on pandemic transmission resumption</p>	<p>9 months Sept 1918 – May 1919</p>

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-Analyses are not specific to school dismissals -Infections estimate based on assumption of 12 day lag from infection to death in 1918 pandemic	Not described in detail or assigned or evaluated by city This paper is not specific to school dismissals	City specific demographic or geographic variables predictive of pandemic mortality in 1918-1919 Intervention start dates from historical records Weekly mortality data from ref 1930 public health reports used to estimate excess pneumonia and influenza deaths per week	12 day delay from mortality used as proxy for unmeasured infections		effect on overall mortality	No results specific to school dismissals	

Historical Studies of the 1918 Pandemic (Australia)

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Caley 2007 (Jan 1919-1920)	Location: Sydney Australia Interventions implemented in Sydney (duration NR)	Authors attempt to estimate the degree of social distancing that occurred in Sydney in 1919 and explore this explanation as a	Analyses focused on social distancing (school as a form of social distancing is not	Estimated by Ro 59%	Observed clinical attack rate 36.6%	Estimate 22% of the population were spared from clinical infection due to	January 1919 - 1920

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Modeling based on historical records	-Closing theaters and public entertainment places -Compulsory mask wearing in public places and transport -Closure of schools -Prohibition race meetings and church services -Isolation and quarantine Individual social distancing This study is not specific to school dismissals	contributing factor to the multiple waves of pandemic influenza Interventions implemented /lifted -Jan 27-March 1 (4 weeks) -March 24-mid May (6-7 weeks)	evaluated separately) No analyses specific to school dismissal are reported		Analyses restricted to estimates of the effective R_0 based on modeling of historical records	variety of social distancing actions Authors argue that changes in social distancing explain the multi-wave pandemic in Sydney and the overall lower attack rate in the city	

Abbreviations

- ANOVA, analysis of variance
- CEPID, Cumulative excess pneumonia and influenza death rate
- EDR, Excess death rates
- NPI, non-pharmaceutical interventions