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

Summary Evidence Tables – Economic Review

Actual Dismissal Studies: School Dismissals to Reduce the Transmission of Pandemic Influenza in Communities

Study	Dismissal Type and Pandemic	Dismissal Size and Duration	Population Affected	Productivity Effects	Impact on Childcare	Other Findings
Author (Year): Alburto et al. (2010) **Location:** Mexico **Setting:** Urban	**Type of Dismissal:** Pre-emptive **Year:** 2009 **Pandemic Type:** H1N1	**Size:** 3 districts in 3 cities **Days of Dismissal:** NR	**Number affected:** NR	**% Lost Pay:** 83.1 to 89.6% **% Missed Work (≥ 1 Day):** 9.8 to 12.8%	NR	
Author (Year): Basurto-Davila (2010) **Location:** Argentina **Setting:** Urban	**Type of Dismissal:** Pre-emptive **Year:** 2009 **Pandemic Type:** H1N1	**Size:** 2 schools in Ushuaia and 1 school in Jujuy **Days of Dismissal:** 14 days	**Number affected:** NR	**% Lost Pay:** Ushuaia 27% (mean $35); Jujuy 11% (mean $7)	**% With Childcare Costs:** Ushuaia. 6% (mean $36); Jujuy. 4% (mean $6) **% With Childcare (≥ 1 Day):** Hired sitter: Ushuaia 13%; Jujuy 7%	Note Jujuy is much poorer. Child care expenses directly related to income Other expenses inversely. Increased food and transportation expenses.
Author (Year): Borse et al. (2011) **Location:** New York city, USA **Setting:** Urban	**Type of Dismissal:** Reactive **Year:** 2009 **Pandemic Type:** H1N1	**Size:** 57 schools **Days of Dismissal:** 5-7 days	**Number affected:** NR	**% Missed Work (≥ 1 Day):** 17%	NR	

Study	Dismissal Type and Pandemic	Dismissal Size and Duration	Population Affected	Productivity Effects	Impact on Childcare	Other Findings
Author (Year): CDC (2010a) **Location:** Kentucky, USA **Setting:** 1 Rural, 1 Urban	**Type of Dismissal:** Reactive **Year:** 2008 **Pandemic Type:** Seasonal	**Size:** 2 districts **Days of Dismissal:** 3-4 days	**Number affected:** 7300 children	**% Lost Pay:** 15.7% **% Missed Work (≥ 1 Day):** 29.1%	**% With Childcare (≥ 1 Day):** 60.1%	10% students on meals had difficulty. No difference work absences or child care by SES.
Author (Year): CDC (2010b) **Location:** National, USA **Setting:** Mixed	**Type of Dismissal:** Mixed **Year:** 2009 **Pandemic Type:** H1N1	**Size:** National **Days of Dismissal:** Median 2-3 days	**Number affected:** 523 families with dismissal experience and 721 without	**% Lost Pay:** 10% **% Missed Work (≥ 1 Day):** 20%	NR	19% missed meals 1% missed school health appointment
Author (Year): Copeland (2010) **Location:** Texas, USA **Setting:** Urban	**Type of Dismissal:** Pre-emptive **Year:** 2009 **Pandemic Type:** H1N1	**Size:** 1 district **Days of Dismissal:** 7 days	**Number affected:** 80,000 children	**% Lost Pay:** 14.3% **% Missed Work (≥ 1 Day):** 28.4%	**% With Childcare Costs:** 21.1%	ED visits down 1.2 percentage points. 21% missed meals 3.9% missed school health appointment.
Author (Year): Effler et al. (2010) **Location:** Perth, Australia **Setting:** Urban	**Type of Dismissal:** Pre-emptive **Year:** 2009 **Pandemic Type:** H1N1	**Size:** 3 schools **Days of Dismissal:** 7 days	**Number affected:** 402 children	**% Missed Work (≥ 1 Day):** 45% (Median 3 days)	**% With Childcare (≥ 1 Day):** 35% (Median 2 days)	
Author (Year): Gift et al. (2010) **Location:** Pennsylvania, USA	**Type of Dismissal:** Reactive **Year:** 2009	**Size:** 1 school	**Number affected:** 456 children	**% Missed Work (≥ 1 Day):** 21%	NR	Parents at or above median income more likely to miss work

Study	Dismissal Type and Pandemic	Dismissal Size and Duration	Population Affected	Productivity Effects	Impact on Childcare	Other Findings
Setting: Semirural	**Pandemic Type:** H1N1	**Days of Dismissal:** 5 days				
Author (Year): Jarquin et al. (2011) **Location:** Chicago, IL **Setting:** Urban	**Type of Dismissal:** Pre-emptive **Year:** 2009 **Pandemic Type:** H1N1	**Size:** 1 school **Days of Dismissal:** 8 days	**Number affected:** 744 children and household members from 609 households	**% Missed Work (≥ 1 Day):** 16% concerned about income loss to absence	**% With Childcare Costs:** 8% with mean cost of $45 per day **% With Childcare (≥ 1 Day):** 12% concerned about cost of childcare	25% concerned about lost school meals
Author (Year): Johnson et al. (2008) **Location:** North Carolina, USA **Setting:** Rural	**Type of Dismissal:** Reactive **Year:** 2006 **Pandemic Type:** Infl. B	**Size:** 9 schools **Days of Dismissal:** 11 days	**Number affected:** 1,750 families	**% Missed Work (≥ 1 Day):** 18% (All school employees)	**% With Childcare Costs:** 2 persons (1%) spent $100 & $150 **% With Childcare (≥ 1 Day):** 10%	
Author (Year): Miller et al. (2010) **Location:** Boston, USA **Setting:** Urban	**Type of Dismissal:** Reactive **Year:** 2009 **Pandemic Type:** H1N1	**Size:** 1 school **Days of Dismissal:** 7 days	**Number affected:** 416 children	**% Missed Work (≥ 1 Day):** 9% upper 30% for lower grades	**% With Childcare (≥ 1 Day):** 20% for lower grades	

NR – Not reported

Modeled Dismissal Studies: School Dismissals to Reduce the Transmission of Pandemic Influenza in Communities

Study	Model Characteristics	Interventions	Cost of Intervention Economic Benefits	Summary Economic Measures
Author (Year): Andradottir et al. (2011) **Country:** Canada	**Objective:** This study is a simulation that seeks to determine the economic costs and benefits associated with various mitigation strategies. **Model:** Agent simulation **Pandemic Type:** H1N1 data with CAR=34%, R_0=1.4 **Population:** Based on urban population: Hamilton, Canada	**Components:** School and day care dismissals of 5 days per event, low coverage antivirals and low efficacy vaccines, and social distancing. Triggered at 0.01% attack rate. **Closure Duration:** 5 days per event	**Intervention Cost:** Includes the cost of antivirals and vaccines. Also considers teacher salaries in computing cost of school dismissal. **Expected Benefits:** Health care utilization and productivity effects due to work absences are included.	**Loss of RDP (% of RDP)** **Base** $81 M (0.26%) **SD** $125 M (0.40%) **RS** $29.2 M (0.09%) RDP, Regional domestic product (estimated to be $31.2B in 2006 for Hamilton, Canada); SD, School dismissal; RS, School dismissal, low efficacy vaccine, antivirals, and social distancing.
Author (Year): Barrett et al. (2011) **Country:** USA	**Objective:** Assess economic cost of private social distancing and school dismissal. **Model:** Agent Simulation **Pandemic Type:** H5N1 **Population:** Based on Census for New River Valley, VA. Considers household SES based on income, age, family size	**Components:** School dismissal (SD), Antivirals (A), Private distancing (PD). Highest income Household purchase antivirals, middle utilize private distancing, and poorest do nothing. Public stockpile of antivirals limited to 10K triggered by 1% infection. **Closure Duration:** Schools are closed 14 days when triggered by 1% population infection.	**Intervention Cost:** No costs provided for interventions except for antiviral stockpile. **Expected Benefits:** Reduced health care costs and productivity losses.	Study compares total societal costs under various intervention scenarios to the base case. Costs which include productivity losses due to work absences due to illness and due to childcare and health care utilization. In the base case there is no intervention. **Scenarios Total cost (Benefit) in millions$** Base $65.82 (-) PD $25.86 ($39.96, savings compared to base) PD+A $24.35 ($41.47, savings compared to base) PD+A+SD $34.21 ($31.61, savings compared to base) PD, private distancing; A, antiviral distribution; SD, school dismissal

Study	Model Characteristics	Interventions	Cost of Intervention Economic Benefits	Summary Economic Measures
Author (Year): Ewers et al. (2007) **Country:** USA	**Objective:** Focus of this study is to determine the impact of influenza pandemic on US critical infrastructure and industries, which includes public health. **Model:** Based on national product accounting. Model with attack rate 30-40% and CFR=2% **Pandemic Type:** 1918 Pandemic **Population:** US and typical metro area	**Components:** School dismissals, social distancing, antivirals, and low efficacy vaccines. **Closure Duration:** NR.	**Intervention Cost:** No cost of interventions are considered. **Expected Benefits:** Only considers the productivity effects of work absences.	**Scenario; # Illnesses (Millions); # Deaths (Millions); Loss of GDP (Billions 2002$) and (GDP %)** **Base** 74; 1.5; $100 (<1%) **Self-Isolation** 61; 1.2; $300 (2.3%) **TLC** 1.2; 25K; 75[1] **TLC Lite** 28; 550K; $40[a] **Antivirals** 69; 1.4; $100[1] (<1%) **Partial Vaccine** 39; 780K; $60 (<1%) **Anticipated Intervention** 2.6; 52K; $260 (2%) [a]These were extracted from the figure 3 by reviewers Base - Adult attack rate-30% Student attack rate-40%, Mortality rate-2% of symptomatic cases, Fraction of symptomatic staying home: 50% adults, 75% students; TLC - Baseline + 60% symptomatic stay home Antivirals to symptomatic and household contacts; Symptomatic households quarantined (30%) Schools closed; TLC-Lite – TLC minus school dismissal; Antivirals - Baseline + Antivirals to symptomatic and household contacts; Vaccine - Baseline + Partially effective vaccine (40% immune and 60% becoming infected with milder and less contagious form).
Author (Year): Lempel et al. (2009) **Country:** USA	**Objective:** This study seeks to determine the impact on GDP through work absences caused by school dismissals. **Model:** Modeled on work absences. Based on national product accounting **Pandemic type:** NA **Population:** US population	**Components:** Only school dismissals **Closure Duration:** 28 days	**Intervention Cost:** NA **Expected Benefits:** NA	**Economic Costs of Absenteeism Due to School Closure in the U.S.** **(Billions of 2008 US dollars and Percent of 2008 GDP)** **Scenario Lower Bound; Base Case** **2 weeks** $5.2 (<0.1%); $21.3 (0.1%) **4 weeks** $10.6 (0.1%); $42.6 (0.3%) **6 weeks** $15.6 (0.1%); $63.9 (0.4%) **12 weeks** $31.3 (0.2%); $127.8 (0.9%) Lower bound assumes availability of informal care, ability to telecommute, and elasticity of labor to output of less than unity (0.8).

Study	Model Characteristics	Interventions	Cost of Intervention Economic Benefits	Summary Economic Measures
Author (Year): Loose et al. (2010) **Country:** USA	**Objective:** Estimate short-term and long-term effects of pandemic influenza and mitigation strategies. **Model:** Based on national product accounting. Uses regional economic model REMI **Pandemic Type:** H5N1 & H1N1 **Population:** US Population	**Components:** School dismissal, antivirals, social distancing, quarantine, delayed vaccine **Closure Duration**: To end of epidemic	**Intervention Cost:** Cost not accounted except for consumption change in health care **Expected Benefits:** Account for health care utilization and work absences.	**Scenario; Loss of GDP (Billions); % GDP Loss** **Base** $120-$350; 1.1-3.1% **CMG** $95-$280; 0.9-2.6% **CMG-SE** $93-$270; 0.8-2.3% CMG, Community Mitigation Guidance: Unlimited antivirals, strong social distancing, complete school closure for duration of epidemic, no circulating symptomatic people ("liberal leave"), partial quarantine of the families of sick people from day 1, partial reduction in children's activities, and no voluntary isolation; CMG-SE, Unlimited antivirals and strong social distancing only
Author (Year): Perlroth et al. (2010) **Country:** USA	**Objective:** Assess cost-effectiveness of various community mitigation strategies. **Model:** Agent simulation **Pandemic Type:** 1957 Pandemic **Population:** 10,000 agents based on US 1957 population	**Components:** Triggered school dismissals with ability to rescind, antivirals, social distancing, quarantine. **Closure Duration**: 48-52 days	**Intervention Cost:** School - $19 per day per student. Also includes cost of antivirals. **Expected Benefits:** Reduced health care costs and productivity losses.	**Scenarios Total cost per person; Total quality adjusted life expectancy (QALE) per person; Incremental cost per QALE:** (With Rho of 2.1 and Case Fatality of 1% at 60% Compliance) **AD+CD+AT+AP+SC** $1250; 20.207; $31,300[a] **AD+CD+SC** $1400; 20.182; $40,800* **AD+CD+AT+AP** $420; 20.18; Dominated **AD+CD** $490; 20.159; Extended dominance **Q** $720; 20.158; Extended dominance **AT** $460; 20.159; Extended dominance **SC** $1330; 20.161; $98.750 Dominated[b] **N** $540; 20.153; Extended dominance AD, Adult distancing; CD, Child distancing; SC, School closure; AT/AP, Antiviral therapy/treatment; Q, quarantine; N, No intervention *Where antivirals are not available [a]Compared to AD+CD+AT+AP [b]Compared to No intervention.

Study	Model Characteristics	Interventions	Cost of Intervention Economic Benefits	Summary Economic Measures
				School closure with other interventions was cost-effective unless CFR <1.0 for $R_0 <= 1.6$ or where pandemic CFR <0.25 for $R_0 => 2.1$
Author (Year): Sadique et al. (2008) **Country:** UK	**Objective:** This study seeks to determine the impact on GDP through work absences caused by school dismissals. **Model:** Based on national product accounting **Pandemic type:** NA **Population:** UK population	**Components:** Only school dismissals **Closure Duration:** 28 days	**Intervention Cost:** NA **Expected Benefits:** NA	**Percent Loss of GDP due to 4 week school dismissal** Base; Lower Bound* 0.28% to 0.32%; 0.07% to 0.08% * Lower bound for GDP loss assumes availability of informal child care and ability to telecommute.
Author (Year): Sander et al. (2009) **Country:** USA	**Objective:** Determine cost-utility of mitigation strategies. **Model:** Agent simulation with decision model for treatment **Pandemic type:** NR Mean simulated $R_0 = 2.0$ **Population:** Based on US population	**Components:** School dismissal, Antivirals, Pre-Vaccine. **Closure Duration:** 182 days	**Intervention Cost:** Cost of antivirals and pre-vaccine included. **Expected Benefits:** Accounts for health care utilization and work absences.	**Scenarios; quality adjusted life year (QALY) per 1000; Cost per 1000; Cost per QALY:** **Base** 21141; $0.19 (-) **SD** 21210; $2.72; $36,667[a] **FTAP** 21351; $0.12; **FTAP+SD** 21403 $2.61; $48,472[b] **HTAP50** 21239; 0.17; **HTAP50+SD** 21316; $2.68; $32,597[c] SD, School dismissal for 182 days; FTAP, Full targeted antiviral prophylaxis (household contacts and 60% of work/school contacts), stockpile unlimited; HTAP50, Household targeted antiviral prophylaxis, stockpile for 50% of population [a] Comparison to Base [b] Comparison to HTAP50 alone without school dismissal

Study	Model Characteristics	Interventions	Cost of Intervention Economic Benefits	Summary Economic Measures
Author (Year): Smith et al. (2009) **Country:** UK	**Objective:** Study is a Computable General Equilibrium (CGE) model of the UK seeking to estimate the effect of pandemic influenza and mitigation strategies on GDP. **Model:** CGE based on national product accounting **Pandemic type:** NA Model with CAR=25% to 50% and CFR=0.4% to 10% UK population	**Components:** School dismissal, low efficacy vaccine, and social distancing. **Closure Duration:** 28 or 100 days	**Intervention Cost:** Does not account for cost of interventions. **Expected Benefits:** All benefits are based on productivity through work absences.	**% loss of GDP WITHOUT 4 week School Closure with CAR from 25% to 50%** **Scenario % GDP Loss** **CFR 0.4%** 0.7-1.5% **CFR 2.5%** 4.8-6.3% **CFR 10%** 8.7-14.0% **% loss of GDP WITH 4 week School Closure with CAR from 25% to 50%** **Scenario % GDP Loss** **CFR 0.4%** 5.1-5.8% **CFR 2.5%** 8.8-10.3% **CFR 10%** 12.7-17.9% CFR, case fatality rate; CAR, case attack rate

Abbreviations

CAR, case attack rate

CFR, case fatality rate

NA, not applicable

NR, not reported