Community Mitigation Strategies: A Review of the Evidence

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Mitigating the Impact of an Influenza Pandemic

- Vaccination is the primary recommended strategy to prevent and control influenza transmission.

- Community mitigation may also be an important strategy, especially when vaccines and antiviral medications are unavailable:
  - Mitigate transmission
  - Decrease surge in healthcare system
  - Delay peak of infection rate
  - Some of these measures can be costly and disruptive

1 CDC, 2007
Categories of Community Mitigation Strategies

- **Personal Protective Behaviors & Equipment**
  - Hand washing
  - Covering coughs and sneezes

- **Social Distancing**
  - Staying home when sick
  - School closures
  - Cancellation of events
  - Limiting public transportation

- **Environmental Provisions**
  - Surface cleaning
  - Availability of supplies (personal hygiene and cleaning)

- **Community Preparedness**
  - Continuity planning (e.g., schools, workplaces)
  - Policy changes (e.g., leave, absenteeism)
<table>
<thead>
<tr>
<th>When Should Nonpharmaceutical Interventions (NPIs) be Implemented?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seasonal Influenza</strong></td>
</tr>
<tr>
<td>Personal Protective Behaviors</td>
</tr>
<tr>
<td>Environmental Provisions</td>
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<tr>
<td>Community Preparedness</td>
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<tr>
<td><strong>Social Distancing</strong></td>
</tr>
<tr>
<td>(encourage staying home when ill)</td>
</tr>
</tbody>
</table>

Depending on:
- Severity and Transmissibility
Preparedness Considerations For Severe Outbreaks and Pandemics

- **Social distancing measures (e.g., school closures)**
  - Reduce medical care surge
  - Minimize secondary effects of overwhelmed healthcare system

- **Require local input and tailoring**
  - Timing and duration
  - Geographic extent
  - Feasibility
  - Avoiding untoward consequences
    - Loss of school meals
    - Additional household costs
    - Job losses
Outline: Community Mitigation Strategies

- Hand washing
- Covering coughs and sneezes
- Use of masks
- School closures
- Discussion
Personal Protective Behaviors and Equipment

HAND WASHING
Only One Hand-Washing Study Has Used Confirmed Influenza As An Outcome¹

- **Egypt: 12-week randomized controlled trial (RCT)**
  - 60 schools randomly assigned to intervention or control groups
  - Intensive hand hygiene intervention:
    - Children required to wash hands twice during school day
    - Health messages through entertainment activities
    - Soap provided by schools and parents

- **Absence and illness data collected by teachers/nurses**
  - Reduction in absences due to ILI: 40%
  - Reduction in lab-confirmed influenza: 47%
  - OR of multiple cases of influenza: 2.8

¹ Talaat, Afifi, et al, ICEID 2010
# Studies of Association Between Hand-Hygiene Interventions and Respiratory Illness

<table>
<thead>
<tr>
<th>Intervention</th>
<th># Studies</th>
<th>Reduction in RI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall effect</td>
<td>16</td>
<td>21%</td>
<td>5%–34%</td>
</tr>
<tr>
<td>Education vs. Control</td>
<td>4</td>
<td>14%</td>
<td>0%–27%</td>
</tr>
<tr>
<td>Nonantibacterial soap + education vs. control</td>
<td>1</td>
<td>51%</td>
<td>39%–60%</td>
</tr>
<tr>
<td>Antibacterial soap + education vs. control</td>
<td>1</td>
<td>50%</td>
<td>39%–60%</td>
</tr>
<tr>
<td>Antibacterial soap vs. nonantibacterial soap</td>
<td>2</td>
<td>0%</td>
<td>-19%–16%</td>
</tr>
<tr>
<td>Alcohol-based hand sanitizer vs. control</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Alcohol-based hand sanitizer + education vs. control</td>
<td>6</td>
<td>7%</td>
<td>-3%–16%</td>
</tr>
<tr>
<td>Benzalkonium chloride-based hand sanitizer vs. control</td>
<td>2</td>
<td>40%</td>
<td>19%–55%</td>
</tr>
</tbody>
</table>

**NOTES:** All studies took place in a community setting; of the 16 studies, 13 were RCTs; none of these studies had influenza as a specific outcome; **bold** typeface indicates statistically significant risk ratios (95% confidence)

Other Findings On Hand Hygiene And Respiratory Illness

- Likely larger benefit of hand-hygiene interventions in developing countries vs. developed countries
  - Developed countries: 15% (95pct CI: 0%–29%)
  - Developing countries: 37% (95pct CI: 13%–55%)

- No difference in benefit of interventions between different target age groups
  - Ages 5 or less: 20% (95pct CI: -1%–37%)
  - Ages older than 5: 22% (95pct CI: -5%–42%)

Adherence to Hand Hygiene Recommendations Can Vary Significantly in Community Settings

- **U.S., education intervention in 5 schools, ages 5–10:**
  - Statistically significant increases in hand washing or sanitizing in intervention group during flu season
  - Effect of intervention was observed across all grades

- **Bangladesh, observational study of hygienic practices in two communities at baseline**
  - In 2,248 episodes of sneezing/coughing in households or schools, hand washing was never observed following the episode

- **Mexico, household survey during 2009 pandemic**
  - Respondents reported increased hand washing (>75%) and use of hand sanitizer (>25%) as behaviors adopted to avoid becoming infected

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1. Stebbins, Downs, and Vukotich, J Pub Hlth Mgm Pr 2010 and 2011
COVER COUGHS AND SNEEZES
Respiratory Etiquette: No Direct Evidence—Widely Recommended

- Cough and sneeze recommendations have been made more on the basis of "plausible effectiveness" than on documented evidence\(^1\)
- Although the relative contribution of different modes of flu transmission is not known, recommendations arise from belief that large droplets play an important role
- Despite lack of direct evidence, respiratory etiquette is widely supported in the literature and recommended by experts\(^2\)

1 WHO, 2006
2 Aledort, Lurie et al, BMC Pub Hlth 2007
Adherence and Attitudes Towards Guidelines Vary with Setting and Situation

- **Bangladesh observational study**¹
  - In 81% of observed events, participants did not cover their mouths when coughing or sneezing
  - In 11% of observed events, they coughed/sneezed into their hands

- **Mexico household survey during 2009 pandemic**²
  - 14% to 22% of participants (depending on city) reported increased covering of their coughs/sneezes with tissue or elbow

- **Argentina household survey during 2009 pandemic**³
  - More than 89% of respondents believed covering their mouth when sneezing was important to be protected against influenza

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1 Nasreen, Azziz-Baumgartner et al, Trop Med & Int Hlth 2010
3 Basurto-Davila, Garza et al, 2010
Personal Protective Behaviors & Equipment

USE OF FACE MASKS AND RESPIRATORS
Limited Evidence Supporting Mask Use in Community Settings

- **Three RCTs found significant effects of mask use under certain circumstances**
  - Lower infection OR in HHs with mask use and hand hygiene when implemented **within 36 hrs** of index case illness onset (IC)
  - Lower ILI incidence among HH contacts **who adhered to correct use of masks and N95 respirators** (C)
  - Lower ILI incidence among university students randomized to mask use and hand hygiene **in weeks 4–6 of influenza season** (6-week study)

- **One RCT found no evidence of effectiveness of mask use in the household (IC)**

- **Survey of experts in 2007:**
  - No support for use by general public of masks or respirators **in early stages** of pandemic influenza
  - Divided opinion on their use in **advanced** pandemic stage

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1. Studies reviewed by Cowling, Zhou et al, Epi & Inf 2010

(IDC) Masks worn by index case and HH contacts
(C) Masks worn only by HH contacts
Not Enough Evidence on Other Issues Related to the Use of Masks

- **Are N95 respirators more effective than surgical masks?**
  - One RCT and one observational study found no significant differences between them\(^1,2\)
  - Evidence of aerosol transmission is still controversial\(^3-5\)

- **Should the infected wear masks?**
  - One study found that use of surgical masks by infected may be able to reduce infectiousness\(^5\)

- **Compliance with recommended use of face masks**
  - Some studies have reported lower compliance with use of face masks compared to hand hygiene and other NPIs\(^6,7\)

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\(^1\) Loeb, Dafoe et al, JAMA 2009  
\(^2\) Ang, Poh et al, Clin Inf Dis 2010  
\(^3\) Teller, J Roy Soc Int 2009  
\(^4\) Han, Zhu et al, Em Inf Dis 2009  
\(^5\) Brankston, Gitterman et al, Lancet 2007  
\(^6\) Johnson, Druce et al, Clin Inf Dis 2009  
\(^7\) Cowling, Zhou et al, Epi & Inf 2010  
\(^8\) Aiello, Coulborn et al, Am J Inf Ctrl 2010
Social Distancing

SCHOOL CLOSURES
Implementation of School Closures (SC) Has Been Recommended During Severe Pandemics

- **Rationale for intervention**¹,²
  - Children are important vectors of influenza transmission
  - They may shed virus for longer period than adults
  - High contact rates in schools

- **Expected benefits**²
  - Reduction in total number of cases
  - Slow epidemic to give time for vaccine production/distribution
  - Reduction in incidence of cases at peak time of virus circulation
  - Reduce peak in burden on healthcare system

¹ WHO, 2006
² Cauchemez, Ferguson et al, Lancet 2009
Direct Evidence on Effectiveness of SCs

- **Israel 2-week nationwide teacher strike, 2000**
  - Children physician visit rates decreased by 28% (95 pct CI: 26, 30)
  - Respiratory tract and viral infections fell by 42% (95 pct CI: 41, 43)
  - Respiratory illness visits increased after strike ended

- **U.S. and Australian cities, 1918 pandemic**
  - Overall mortality reduction of 10 to 30% (U.S.)
  - Peak mortality reduction of up to 50% (U.S.)
  - Cumulative attack rate reduction of up to 38% (Australia)

- **United States school closure, 2009 pandemic**
  - SC in a school district while schools in nearby area remained open
  - Reductions in respiratory illness from 52% to 74%

References:
1. Heymann, Chodick et al, Ped Inf Dis J 2004
6. Copeland, Basurto-Davila et al, 2010
Indirect Evidence of Effectiveness of SCs

- **France school holidays, 1984–2006**
  - Three zones with different holiday timings
  - School holidays prevent 16–18% increase in total cases
  - Prediction for a pandemic:
    - 13–17% reduction in total cases
    - 38–45% reduction in peak attack rates

- **Argentina school holidays, 2005–2008**
  - School holiday timing varies across years and across provinces
  - Estimated 17–37% reduction in ILI rates
  - Larger effect on school-age children than on younger children or adults

1 Cauchemez, Valleron et al, Nature 2008
2 Garza, Basurto-Davila et al, 2010
More Evidence is Needed on Other Issues Related to School Closures

- **Triggers for closing and reopening schools**
  - Use of school absenteeism as trigger signal: likely late closure¹
  - Sensitive triggers (lab-confirmed cases) might be the most reliable, but may also lead to long closures¹
  - Modeling studies:
    - Maximum effect if SCs occur before 1% of population is infected²
    - Short closures (<2 weeks) may result in 2 peaks and even increase AR³

- **School-level, local, or nationwide closures?**
  - Broader closures: Larger impact ➔ Higher social cost
  - Adequate plans need to be in place before closures
    - Minimize economic and other costs to families
    - Maintain communication with parents and teachers
    - Continue education during closures

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¹ Cauchemez, Ferguson et al, Lancet 2009
³ Lee, Brown et al, J Pub H Mgt Pract 2010
Costs of School Closures Can be Significant

- **Economic costs:**
  - Societal loss of productivity from working parents and teachers
  - Household costs due to lost income and additional expenses
  - Concerns about job security

- **Estimates of costs of closures:**
  - Modeling study for the UK\(^\text{1}\) estimated cost of 12-week closure equal to **0.2–1.0% of GDP**
  - Modeling study for the US\(^\text{2}\) estimated a 26-week closure would result in societal costs of **6% of GDP**
  - Study of closures in 3 schools in Argentina\(^\text{3}\) found that household costs due to SCs were higher among low-SES households when compared to high-SES households

\(^{1}\) Sadique, Adams et al, BMC Pub H 2008
\(^{2}\) Sander, Nizam et al, Val in Hlth 2009
\(^{3}\) Basurto-Davila, Garza et al, 2010
Community Mitigation Strategies

SUMMARY AND DISCUSSION
Summary of Documented Evidence

- More conclusive evidence for effectiveness of hand washing against respiratory illness
- Not much evidence for covering coughs and sneezes, but widely recommended by literature and experts
- Use of facemasks and/or respirators by general public is more controversial
- Evidence exists for effectiveness of school closures, but much remains to be understood
  - More information needed on when to start and when to stop
  - How to minimize negative secondary effects
  - Cost-effective?
Some Issues Are Relevant to Several or All Community Mitigation Measures

- **Communication channels during outbreaks/pandemics**
  - TV and radio were the highest reported sources of information by studies in Mexico\(^1\) and Argentina\(^2\) during 2009 pandemic
  - Internet and government toll-free numbers were not as important
  - Relative importance of information sources is likely to vary across countries

- **Barriers to adoption of community strategies\(^1,2,3\)**
  - Costs of soap, hand sanitizer, and masks
  - Inadequate compliance due to confusion about preventive measures, particularly among low-SES populations

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1 Aburto, Pevzner et al, Am J Prev Med 2010
2 Basurto-Davila, Garza et al, 2010
3 Blendon, Koonin et al, Em Inf Dis 2008
New Studies May Provide Needed Evidence on Effectiveness of Community Mitigation Strategies

- **Weaknesses in literature**
  - Significant risk of bias and confounding in existing studies
  - Laboratory-confirmed outcomes needed for more robust evidence
  - Little data on knowledge and attitudes towards NPIs among different populations
  - Extent of barriers to implementation of NPIs

- **Relative importance of different modes of transmission is still a controversial topic**
  - Studies in different locations during different times of the year could help elucidate role of temperature and humidity in mediating modes of transmission

1 Jefferson, Del Mar et al, Coch Sys Rev 2010
2 Aiello, Coulborn et al, Am J Inf Ctrl 2010
3 Cowling and Leung, Ev Bas Med 2010
4 Cowling, Zhou et al, Epi & Inf 2010
Conclusion: Community Mitigation Strategies

- Universally available
  - Self-empowering for individuals and communities
  - Complement other interventions
  - Select NPIs can be promoted as best practices/social norms

- Key considerations for implementation
  - Preparedness: Effectiveness & Feasibility
  - Response: Local decisions
  - Communication strategy critical for all levels

- Important gaps in knowledge remain
List of References (1)


List of References (2)


- Cowling, B. J., & Leung, G. M. (2010). Simple physical interventions such as hand washing and wearing masks can reduce spread of respiratory viruses. Evid Based Med, 15(1), 3.


List of References (3)


