HKU Research on the Effectiveness of Face Masks and Hand Hygiene to Prevent Transmission of Influenza in Households

School of Public Health
The University of Hong Kong

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Acknowledgements

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- We thank participating families for their time and support.

- We thank GPs, HCAs and study nurses facilitating and conducting fieldwork.
Influenza pandemics

- 3 pandemics in 20th century.
- High rates of infection (>25% of population within 1-2 years).
- Severe illness is uncommon.
- Vaccines can reduce risk of infection but take time to develop and produce.
- Antivirals useful for treatment but are expensive, stockpiles can be limited, and resistance may develop.
- What else can people do to reduce their risk of infection?
Background - NPIs

- ‘Non-pharmaceutical’ interventions encompass
  - Travel restrictions, border screening.
  - School and workplace closures.
  - Isolation of sick and quarantine of exposed.
  - Individual measures (hand washing, face masks).

- Little evidence on how effective NPIs are in mitigating a pandemic, although all are believed to have some effect.

- No previous data on how effective face masks and hand hygiene could be in preventing flu transmission in a household setting.
NPI RCT – Study design

Index subject

Visit GP with ILI → Rapid test

Study completed

−ve

Control group

Home visits by trained nurses

How many secondary cases?

Hand hygiene

HH plus masks

Household members

No ILI last 2 weeks → Recruitment to study

Informed consent to participate

306 households successfully followed up with lab-confirmed index case; in compliance with the protocol 47 households with co-index cases at the time of the intervention were excluded from subsequent analyses.
Interventions

- **Control** arm (health education). Index case and all household contacts received education on self care for flu-like illness, and the benefits of a healthy lifestyle and diet.
- Health education plus **hand-hygiene** arm. Index case and all household contacts were provided with soap dispensers and alcohol hand rub and educated on their use.
- Health education plus hand-hygiene plus **face mask** arm. Index case and all household contacts were provided with surgical masks and educated on their proper use and hygienic disposal.
Detailed follow-up

- After recruitment, first home visit same day or following day to implement the interventions.
- Two further visits after 3 and 6 days.
- Swabs taken from all household members at each visit for lab testing (regardless of illness).
- Each household member took temperature daily and recorded any symptoms in a diary.
- At the final home visit we reviewed compliance and counted the number of face masks used, and weighed the amount of soap/alcohol handrub used.
Recruitment vs flu activity – 2008 main study

Study recruitment rate
(subjects per day)

Community ILI circulation
(ILI cases per 1,000 GP consultations)

Positive laboratory isolates (QMH)
Main results – secondary attack ratios

Table: Secondary attack ratios in the contacts of 259 analyzed households.

<table>
<thead>
<tr>
<th></th>
<th>Secondary attack ratio</th>
<th>p-value</th>
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<tbody>
<tr>
<td></td>
<td>Control (n=279)</td>
<td></td>
</tr>
<tr>
<td>Lab-confirmed influenza</td>
<td>10%</td>
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</tr>
<tr>
<td>Clinical influenza$^{(1)}$</td>
<td>19%</td>
<td></td>
</tr>
<tr>
<td>Clinical influenza$^{(2)}$</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hand hygiene (n=257)</td>
<td></td>
</tr>
<tr>
<td>Lab-confirmed influenza</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Clinical influenza$^{(1)}$</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Clinical influenza$^{(2)}$</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mask+HH (n=258)</td>
<td></td>
</tr>
<tr>
<td>Lab-confirmed influenza</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Clinical influenza$^{(1)}$</td>
<td>21%</td>
<td></td>
</tr>
<tr>
<td>Clinical influenza$^{(2)}$</td>
<td>7%</td>
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</tr>
</tbody>
</table>

$^{(1)}$ is at least 2 of fever $\geq 37.8^\circ C$, cough, headache, sore throat, aches or pains in muscles or joints.

$^{(2)}$ is fever $\geq 37.8^\circ C$ plus cough or sore throat.
Main results – risk reductions

- Household contacts in the hand hygiene group had a 43% reduction in risk of infection (odds ratio: 0.57; 95% CI: 0.26-1.22) vs control group.

- Household contacts in the face mask plus hand hygiene group had a 23% reduction in risk of infection (odds ratio: 0.77; 95% CI: 0.38-1.55) vs control group.

- These estimates allowed for
  - higher risk of infection in younger contacts
  - higher risk of infection in contacts of younger index cases
  - lower risk of infection in vaccinated contacts
Delays between index symptom onset and intervention

- Delay from symptom onset to recruitment
- Delay from recruitment to intervention
- Delay from symptom onset to intervention

<table>
<thead>
<tr>
<th>Delay (days)</th>
<th>Number of subjects</th>
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<tbody>
<tr>
<td>0</td>
<td>4</td>
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<tr>
<td>1</td>
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<thead>
<tr>
<th>Number of subjects</th>
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<tr>
<td>0 30 60 90 120 150</td>
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推迟点

- 指标症状出现到干预
- 招募到干预
- 症状出现到干预

<table>
<thead>
<tr>
<th>延迟（天）</th>
<th>受试者人数</th>
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<tbody>
<tr>
<td>0</td>
<td>4</td>
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<td>1</td>
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<tr>
<td>0 30 60 90 120</td>
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Households with timely intervention

Table: Secondary attack ratios in the contacts of 154 analyzed households where the intervention was applied within 36 hours of symptom onset in the index case.

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<th>Secondary attack ratio</th>
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<th>p-value</th>
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<tbody>
<tr>
<td></td>
<td>Control (n=183)</td>
<td>Hand hygiene (n=130)</td>
<td>Mask+HH (n=149)</td>
</tr>
<tr>
<td>Lab-confirmed influenza</td>
<td>12%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Clinical influenza&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>23%</td>
<td>11%</td>
<td>18%</td>
</tr>
<tr>
<td>Clinical influenza&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>7%</td>
<td>4%</td>
<td>7%</td>
</tr>
</tbody>
</table>

<sup>(1)</sup> is at least 2 of fever $\geq 37.8^\circ C$, cough, headache, sore throat, aches or pains in muscles or joints.

<sup>(2)</sup> is fever $\geq 37.8^\circ C$ plus cough or sore throat.
Risk reductions for timely intervention

- Household contacts in the hand hygiene group had a 54% reduction in risk of infection (odds ratio: 0.46; 95% CI: 0.15-1.43) vs control group.

- Household contacts in the face mask plus hand hygiene group had a 67% reduction in risk of infection (odds ratio: 0.33; 95% CI: 0.13-0.87) vs control group.

- These estimates allowed for
  - higher risk of infection in younger contacts
  - higher risk of infection in contacts of younger index cases
  - lower risk of infection in vaccinated contacts
Adherence to interventions

(a) Reported frequency of hand washing with liquid hand soap/alcohol hand rub in the hand hygiene arm;
(b) Reported frequency of hand washing with liquid hand soap/alcohol hand rub in the mask+hand hygiene arm;
(c) Reported frequency of face mask use in the mask+hand hygiene arm.
Summary

• Hand washing and wearing surgical masks can prevent influenza transmission within households.

• Interventions will be more effective if implemented within 36 hours of symptom onset in an index case.

• “If someone in your household has flu-like symptoms, you can substantially reduce your risk of infection if you and the sick person practice careful hand hygiene and wear surgical masks, for the duration of illness.”
Strengths of our study

- Largest study of face masks and hand hygiene ever conducted.
- Randomised allocation to interventions is the ‘gold-standard’ study design.
- Detailed follow-up of household members should allow us to identify and confirm even mild secondary infections.
Limitations

- Delay between symptom onset and intervention may lead us to underestimate the true effectiveness of the interventions.
- Moderate adherence to the interventions, especially the reported use of the surgical mask in household contacts.
THANK YOU