Healthcare Workers and PPE: 
*Lessons from SARS*

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Conditions required for PPE to protect health care workers

- At-risk patients must be recognized as such
  
  UNRECOGNIZED AS SARS: 2.2 infections/patient day
  RECOGNIZED: 0.0034 infections/patient day

- Healthcare workers must choose to wear PPE

- PPE must be appropriate and functional
Problems

- If you ask HCWs to use inconvenient preventive practice when they think it is unnecessary
  - THEY WON’T DO IT

- Barrier precautions are associated with highly significant rates of PATIENT adverse effects
  - Half as many HCW visits, 33% less contact time, increased rates of depression, anxiety, anger,
  - 12% risk of preventable adverse events per one week admission
Objective

To assess adherence to barrier precautions among staff who cared for critically ill SARS patients during the Toronto SARS outbreak.
Methods

- **Design** – Retrospective cohort analysis
- **Cohort** – HCWs providing care for SARS patients immediately (<24h) before and during intubation during the Toronto outbreak (March-June, 2003)
- **Cohort identification** - HCWs identified from charts, staffing assignment forms, managers, and colleagues
- **Data collection** - Face-to-face interview using structured questionnaire, with chart available
Methods

Outcome measures

- **Outcome**:
  - Consistent adherence to PPE
    - eye protection, mask, gloves, and gown
    - “always wore”

- **Secondary**: Removal practices
PPE removal

- **Safest**
  - Gloves removed first
  - Consistent hand disinfection BEFORE hands touch face
  - Hand disinfection as terminal event
- **Some risk**
  - Gloves removed first
  - Hand disinfection at least once
- **At risk**
  - Gloves NOT removed first
  - No hand disinfection described
Methods
Predictor variables

• Patient-related:
  – Patient’s diagnosis, Severity of illness (APACHE II score), Precautions ordered

• HCW-related:
  – Age, gender, occupation
  – Hospital, type of ward (SARS unit, ICU, ED, other)
  – Time spent in patient’s room
  – Number of room entries
  – Involvement in patient care activities (N=34)
  – Infection control training
Results

- 56 patients intubated
- 15 hospitals (4 teaching, 11 community)
- diagnosis at time of care
  - 49 SARS
  - 3 pneumonia (during outbreak)
  - 1 contact + airborne
  - 1 MRSA (gown, glove, mask)
  - 2 pneumonia (prior to outbreak recognition)
Results

- 795 HCWs (90% of 879 eligible) enrolled
  - 46% (368) nurses
  - 14% (113) respiratory therapists
  - 14% (113) physicians
  - 10% (82) X-ray technologists
  - 16% (125) Other (eg. paramedic, physiotherapists)
- Most HCWs cared for 1 patient (range 1-8)
  - 164 (20%) cared for more than one patient
- 5146 patient care activities/procedures assessed
Results
Adherence with PPE over time

- Shifts with patients recognized as SARS
- Shifts with patients not known to be SARS

- Pts with diagnosis of SARS
- Pts not recognized as SARS

Adherence with PPE over time:

- March: 55.7%
- April: 53.9%
- May: 81.7%
- June: 97.4%
## Results: Multivariable analysis

<table>
<thead>
<tr>
<th>% adherence</th>
<th>PATIENT RECOGNIZED AS SARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recognized</td>
</tr>
<tr>
<td></td>
<td>Not Recognized</td>
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<table>
<thead>
<tr>
<th>PATIENT'S APACHE II score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20</td>
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<tr>
<td>More than 20</td>
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<table>
<thead>
<tr>
<th>HOSPITAL LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARS Unit</td>
</tr>
<tr>
<td>ICU</td>
</tr>
<tr>
<td>Other ward</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INFECTION CONTROL TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>In person</td>
</tr>
<tr>
<td>Written Instructions only</td>
</tr>
<tr>
<td>None</td>
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<table>
<thead>
<tr>
<th>NUMBER OF TIMES ENTERED A ROOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 -2 times</td>
</tr>
<tr>
<td>3-5 times</td>
</tr>
<tr>
<td>6-10 times</td>
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<tr>
<td>&gt; 10 times</td>
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Results
Adherence by type of procedure

<table>
<thead>
<tr>
<th>TYPE OF PROCEDURE</th>
<th>NUMBER OF ROOM ENTRIES</th>
</tr>
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<tbody>
<tr>
<td>Airway procedures</td>
<td>Performed, Assisted, Observed</td>
</tr>
<tr>
<td>Any other procedures</td>
<td>Performed, Assisted, Observed</td>
</tr>
<tr>
<td>1-5 times</td>
<td>Performed, Assisted, Observed</td>
</tr>
<tr>
<td>6 and more</td>
<td>Performed, Assisted, Observed</td>
</tr>
</tbody>
</table>

P<0.0001

p=0.0001
Results
Removal practices

- Safest – 15%
- Some risk – 62%
- At risk – 22%
## Results

Factors associated with safe removal

<table>
<thead>
<tr>
<th></th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nurses vs. other job category</strong></td>
<td>2.0 (1.3 - 3.2 )</td>
<td>.002</td>
</tr>
<tr>
<td><strong>Teaching vs. Community hospital</strong></td>
<td>7.6 (4.8 - 11.9)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>SARS Unit</td>
<td>3.4 (1.3 - 9.3)</td>
<td>.02</td>
</tr>
<tr>
<td>ICU</td>
<td>1.9 (0.7 - 5.0)</td>
<td>.22</td>
</tr>
<tr>
<td>Other</td>
<td>1 (ref)</td>
<td></td>
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</table>
Conclusions - I

- 6 weeks into the SARS outbreak, HCWs were still not making sufficiently conservative decisions about using PPE
Conclusions - II

- Decreased adherence with increased APACHE score suggests that HCWs may make decisions based on patient safety despite risk to themselves

- This cohort did not make PPE decisions based on the procedure they were about to undertake
Conclusions - III

- Education is critical
  - In person training > written materials > none
  - SARS units > other hospital areas
  - Teaching hospitals vs community for PPE removal

- Despite education, most HCWs did not clearly understand self-contamination with PPE removal
Research questions

- Why was education so important during SARS outbreak, when other research suggests that knowledge is not a particularly important factor in HCW PPE adherence?
- How do worker and patient safety interact? How do we balance priorities if they conflict?
- Is a continued focus on procedure-driven PPE feasible?
Acknowledgements

- Toronto SARS Hospital Investigation Team:

- Patients with SARS, their families and friends

- The staff, visitors and patients of greater Toronto area hospitals and public health departments and their families