Observational studies on PPE use by healthcare workers and barriers to use (knowledge post 2007)

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Outline: Barriers to Implementation

I. Quickly setting the stage

II. Conclusions from recent observational studies on PPE use by HCWs
   a. “Individual” factors:
      - Knowledge
      - Perception of risk
      - Comfort, communication – length of wearing
   b. Environmental factors:
      - Cost, availability, perceived cost (fit-testing especially)
   c. Organizational factors:
      - Subject of next panel - so briefly (safety climate)
      - Communication
      - Training
      - Excessive workload

III. Lessons from Vancouver 2009-2010 H1N1 pandemic

IV. Canadian Federation of Nurses Unions meeting June 1st, 2010

V. Conclusions
I. Setting the stage: What we know…

- N95 respirators filter out 95 to 99% of relevant aerosol particles.
- N95s function best when they are individually fitted but unfitted respirators do have efficacy.
- The tight fit and enhanced filtration capacity of these devices offer better protection against aerosol particles than do surgical/medical masks…
Factors which increased the risk to HCWs:

• short incubation period,
• contagiousness before emergence of symptoms,
• shedding variability,
• multiple transmission routes, and
• efficient person-to-person spread.
• exposure to patients, infectious HCWs and/or visitors.
Occupational situations leading to exposure for HCWs

Unprotected exposure:

- Patients with viral shedding and absence of respiratory symptoms (Patients presenting with non-respiratory illness/injury: elective surgeries, trauma, cardiac events, GI I bleeding, stroke, etc.)

- Patients with viral shedding and presence of respiratory symptoms (Respiratory symptoms attributed to different etiology: exacerbation of chronic lung disease, asthma, community-acquired bacterial pneumonias, congestive heart failure, etc.)

- Patients with suspected or confirmed 2009 H1N1 with isolation discontinued prematurely because of false-negative results, incomplete testing, or continued shedding after antiviral therapy

- HCW with viral shedding with or without respiratory symptoms

- Visitors with viral shedding with or without respiratory symptoms

(continued)

Occupational situations leading to 2009 H1N1 exposure for HCWs…continued

**Inadequately protected exposures**

**Improper use of PPE**
- Lack of N95 respirator fit-testing
- Deficiencies in donning PPE
- Self-contamination during PPE removal

**Use of less-than-recommended level of protection**
- Use of droplet precautions when aerosolization occurs
- Lack of PPE supplies
- Lack of training and education, including
- **HCW choosing** to utilize less-than-recommended PPE

**Lack of scientific evidence on transmission to make appropriate PPE recommendations**
I. Setting the stage continued: What we know…

• New studies (eg. **Fabian et al.** [2008] and **Blachere et al.** [2009]) support the hypothesis that influenza is emitted via droplets with small particles from infected individuals…..we still don’t know the exact distribution of the particles by size!

• Recent studies of the fit of surgical masks demonstrate that they offer very limited protection, allowing between 15 and 35% leakage of particles (e.g. **Oberg and Brosseau, 2008**; **Grinshpun et al. 2009**).


• Use of PPE is still poor:
  – Through self-report, >70% of HCWs contracted 2009 H1N1 through probable patient contact, although HCWs admitted to not using one or more components of the recommended PPE, (Poalillo et al. 2010, CDC MMWR Morb Mortal Wkly Rep 2009)

II. New studies: Individual factors

- Knowledge
  - Confusion around which PPE to use and when, especially among medical personnel
    - Ellison et al. (2007): medical residents lacked clarity on what PPE should be used (pediatric residents 59% unsure and emergency medicine residents 32% unsure)
    - Daugherty et al. (2009): only 63% of critical care clinicians correctly identified adequate influenza PPE
  - Deficits in knowledge about self-protection were partially corrected by education programs during the SARS outbreak (Shigayeva et al, 2007)


Individual factors cont’d

- Perception of risk
  - HCWs' adherence to self-protection guidelines was most closely associated with whether they provided care to patients who had received a definite diagnosis of SARS (Shigayeva et al., 2007).
  
  - Visentin et al. (2009) found that during SARS an N95-type particulate respirator was reported to be always used by 91.5% of emergency medical techs surveyed. Conversely, one year later, always used by 52.0%, reason given for non-use was judgment of non-necessity.

Individual factors cont’d

• Beliefs/attitudes
  – Daugherty et al. (2009) found that ICU HCWs who believed PPE adherence was inconvenient had lower odds of adherence

• Perception of safety culture
  – Only 56% of HCWs stated that non-adherence to precautions would be met with disapproval from supervisors and 53% reported that their colleagues often failed to use appropriate PPE (Daugherty et al. 2009)
Individual factors cont’d

- Comfort, skin irritation and fit
  - Discomfort, interference with ability to communicate/do job (auditory and visual interference), and skin irritation.
  - Radonovich et al. (2009): Participants discontinued wearing respirator before 8 hours in 59% of sessions, reporting diminished communication acuity and head and facial discomfort
  - Baig et al. (2010): Only 24% of HCWs stated their N95 respirator was comfortable most of the time or always. Only 6% reported being able to continuously wear a respirator for an 8 hour shift

II. New studies: Organizational factors

• Policies related to safety
  – Turnberg et al. (2009): nurses perceived that management support for implementing safe work practices resulted in greater adherence to recommended respiratory precautions.
  – Yassi et al. (2009): workers who were given time to take a training program during work hours perceived greater management support for following proper procedures and reported greater likelihood of compliance.

Organizational factors cont’d

Communication

• **Corley and colleagues (2010)**, during the first wave of the pandemic, found that among HCWs in Australia there was a perceived lack of firm recommendations and guidelines regarding what PPE was required. This created confusion amongst staff.
Organizational factors cont’d

• Training

[Turnberg et al. (2008)]

- 24% of MDs, 15% of nurses, nurse aides, and allied professionals, and 40% of admin staff self-reported not received any training on respiratory infection control and PPE practices during the previous 12 months

- Of those who received training, approximately half of medical practitioners (52%), nurses (47%), nurse aides (46%), allied professionals (48%), and admin staff (43%) reported, less than 1 hour of training during the previous year
Organizational factors cont’d

• Training cont’d
  – *Bryce et al.* (2009) found that of HCWs surveyed 72.8% self-reported that training on the use of facial protection equipment was ‘sufficient’ to ‘excellent’
  – 95% self-reported having been fit-tested, only 60% were tested annually
Organizational factors cont’d

• Excessive workload/staffing issues/time/over-work
  – *Ng et al.* (2009) surveyed HCWs and found the #1 reason given by the 133 HCWs for non-adherence to standard precautions was having an excessive workload (i.e., being “too busy”; 113 HCWs [85%])

  – HCWs in Australia the first wave of pandemic staffing was a key issue including difficulty matching nursing skill mix to high acuity of patients and perceived lack of support to junior staff at times - *Corley et al.* (2010)

  – Manitoba Nurses Union recommendations:
    1. decrease elective services to allow staff to cope with pandemic.
    2. maximize volunteer pool ready to be deployed at short notice
    3. Integrate seconded nurses with proper orientation
    4. Resource centre for RNs caring for H1N1 patients to call
    5. Regularly scheduled meetings with union/management

Organizational factors cont’d

- Low and middle income countries (LMICs) additional issues (Zimmerman 2008):
  - Capacity issues
  - Resource limitations
  - Institutional support
Environmental factors

• Access to fit-testing
  – NIOSH: (human studies and mathematical modeling): fit testing for N95 respirators reduces the average exposure to respirable particles from 33% to 4% of ambient levels
  – Lee et al. (2008): without instruction, only nearly 50% of the HCWs achieved an adequate facial seal with the most commonly used N95 respirator
  – Our study results: fit-check is no substitute for fit-test.
Environmental factors cont’d

– Bryce et al. (2008): even if HCWs knew they had failed the fit-test, 25% continued to use the same respirator
  • Possible reasons: preference for equipment with which they are most familiar despite the results of fit testing; lack of belief in the value of fit testing; and lack of understanding of the rationale behind fit testing

– Bryce, Yassi et al. (submitted) similar result for 4 hospitals across 2 health regions, plus ~30% of HCWs re-used respirators; 40% felt items were not always accessible; 45% had yearly fit-testing; and those fit-tested annually were less likely to select a N95 for which they had not passed fit-testing. Employers need to offer choice and test first with the brand with which the HCW is most comfortable.

Environmental factors cont’d

• Availability of PPE
  – Daugherty et al. (2009): 72% of HCW respondents reported that recommended PPE was readily available near patients’ rooms
  • Significant differences were noted regarding perceived availability of PPE across professional roles, with respiratory care professionals reporting significantly lower availability than nurses, house-staff, faculty and fellows (57% vs. 83%, 70%, and 74%).
  – Bryce, Yassi et al. (2008) : HCWs thought that plans and resources were available post-SARS to deal with a future event of that magnitude but audits found these were not available in many institutions.

Environmental factors cont’d

• Cost
  – *Au et al.* (2010) undertook a randomised controlled study to compare a compact reusable high-efficiency particulate air filtering mask that can be cut to size (Totobobo, Dream Lab One Pte Ltd, Singapore) with fit-tested N95 masks (1860 or 1860s or 1862; 3M, St Paul, MN, USA)
  – median reduction in airborne particle counts was significantly higher for N95 masks than for Totobobo masks but there was no statistically significant difference between the proportion of subjects achieving a reduction of $\geq100$-fold between N95 and Totobobo
  – While cost analysis was not part of the study, the approximate retail prices (without bulk discount or delivery) of the masks are US$20 for the reusable Totobobo mask, with replacement filters costing US$1.60, and US$0.97 for single-use 3M 1860 respirators
Environmental factors cont.

• Radonovich and others: Exhalation valve improves comfort and may show some promise in re-design

• Baig: safety more important than aesthetics in features for respirator re-design; comfort, facial hair, heat etc must be considered.
III. BC Experience (preliminary)

*personal communication: E. Bryce*

- For every 1 patient diagnosed, there were almost 5 suspect cases
- Patients in ICU spent much longer in isolation than planners estimated
- Pandemic planners severely underestimated the number of aerosol generating procedures
- There was almost 4-fold the normal number of sick days
- Respirator use increased by over 100%; mask use increased by almost 200%
BC Experience (Preliminary) - cont’d

• The pandemic was mild, but region’s healthcare facilities came close to exhausting the most commonly used types of PPE

• PPE use was appropriate (not in excess)

• Total cost for PPE during pH1N1 for the 3 tertiary care hospitals was less than $200,000….i.e. a drop in the bucket
Recommendations based on lessons from BC

- Don’t under estimate PPE needs
  - buy more respirators
    (the cost is not prohibitive - in Canada at least) –
  and rotate – rather than stockpile
- HCWs should be fit tested on more than one brand
Recommendations based on BC cont’d

- **Education and training** is needed to ensure that staff are comfortable using PPE before a pandemic
- Labs should be adequately resourced to ensure appropriate turn around times of specimens
- Respiratory algorithms are critical to ensure PPE is used appropriately, but must be kept simple
- Facilities should plan for at least double the rate of staff absenteeism during a pandemic and **staff up appropriately**
- Patients are kept in isolation longer than expected with influenza and therefore require more PPE
IV. Key messages from CFNU meeting
June 1, 2010 – personal view

• importance of precautionary principle
• need for cost info (cost-benefit analyses)
• need for more specific guidance on when to change respirators
• need an authoritative statement on limitations of the Loeb study
• stress integration of infection control, public health and occ health
• Make tools readily available…and
An interactive training module
IV. Key messages from CFNU meeting June 1, 2010 (personal view) ..cont’d.

• Make the basis for decisions transparent!
• If decisions are “evidence-informed value-based” – let’s say so!
• Emphasize the ethical value of “reciprocity” (those putting themselves at risk in order to care for others should be cared for in return).
V. Conclusion

“Put your own oxygen mask on first before you help another passenger”

- Healthcare workers need to be valued – let’s apply the precautionary principle – reciprocity.
  (Adequate PPE is not expensive in the bigger scheme of things!)

- Design less expensive, more comfortable PPE, and

- There must be
  • appropriate training
  • a strong safety climate
  • support for adequate staffing
  • adequate supplies and
  • clear communication