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Summary of Evidence in Support of N-95 Respirators during An Influenza Pandemic

"The point is not who is right and is wrong about airborne transmission. The point is not science, but safety. Scientific knowledge changes constantly...We should be driven by the precautionary principle that reasonable steps to reduce risk should not await scientific certainty…Until this precautionary principle is fully recognized, mandated and enforced… workers will continue to be at risk."

- Justice Campbell, Chair of the SARS Commission

Institute of Medicine of the National Academies. *Respiratory Protection for Healthcare Workers in the Workplace Against Novel H1N1 Influenza A: A Letter Report*. (2009) http://www.nap.edu/catalog/12748.html

Recommendation 1: Use Fit-Tested N95 Respirators

Healthcare workers (including those in non-hospital settings) who are in close contact with individuals with nH1N1 influenza or influenza-like illnesses should use fit-tested N95 respirators or respirators that are demonstrably more effective as one measure in the continuum of safety and infection control efforts to reduce the risk of infection.

- The committee endorses the current CDC guidelines and recommends that these guidelines should be continued until or unless further evidence can be provided to the effect that other forms of protection or other guidelines are equally or more effective.
- Employers should ensure that the use and fit testing of N95 respirators be conducted in accordance with OSHA regulations, and healthcare workers should use the equipment as required by regulations and employer policies.

Healthcare organizations and workers need consistent and clear nH1N1 guidelines that can be implemented across all healthcare facilities… It is not the intention of the committee to recommend that all healthcare workers use N95 respirators, rather the use of respirators should be for those in initial contact with individuals presenting with unidentified febrile respiratory illnesses and those healthcare workers in close contact with individuals with confirmed or suspected nH1N1.

As noted throughout the report, the committee emphasizes that respiratory protection is a critical component in the hierarchy of infection prevention and control strategies.

Tellier, Raymond. Aerosol transmission of influenza A virus: a review of new studies. *Journal of the Royal Society Interface*. (September 22, 2009)

The accumulating evidence for an important contribution of the aerosol route in the transmission of influenza implies that infection-control protocols must take it into account, and especially during a pandemic. As an additional consideration, it may well be that aerosol transmission is responsible for the most severe cases of disease involving viral infection of the lower respiratory tract. Whereas engineering control methods are useful, and indeed necessary, to prevent long-range infections, they would be of little help to healthcare workers in close proximity of a patient to provide care. Precautions should include the use of an N95 respirator (or better) when appropriate, including in close proximity of an infected patient.

Council of Canadian Academies. *Influenza Transmission and the Role of Personal Protection Respiratory Equipment: An Assessment of the Evidence.* The Expert Panel on Influenza and Personal Protective Respiratory Equipment. (2007) http://www.scienceadvice.caldocuments/(2007-12-19)

The panel found that the evidence about relative contribution of different modes of transmission in spreading influenza is sparse, but in the end all conceded that there is evidence that:

- influenza is transmitted primarily at short range;
- influenza can be transmitted via inhalation of tracheobronchial and alveolar-sized particles at short range;
- the current weight of evidence suggests that *transmission of influenza by inhalation is more probable than by indirect contact;*
- N95 respirators protect against inhalation;
- surgical masks offer no significant protection against inhalation of alveolar and tracheobronchial-sized particles; and
- the lack of sealed fit on a surgical mask will allow for inhalation of nasopharyngeal-sized particles.

Atkinson, Michael P. and Wein, Lawrence M. Quantifying the Routes of Transmission for Pandemic Influenza. *Bulletin of Mathematical Biology.* (2008)

Atkinson and Wein established a mathematical model of influenza transmission taking into account the three postulated routes of transmission: aerosol, large droplets, and contaminated hands to face. They conclude (p. 36) that, compared to large droplets and contaminated hands, aerosol transmission is "far more dominant". On p. 37 they also point out that sneezes and cough are typically directed downward, and that nasal openings are typically oriented downward. Thus the trajectories followed by large droplets (which by definition are not affected much by air resistance, in contrast to aerosols) make it extremely unlikely that large droplets would land on the nasal mucosa of a close range contact.

Nicas, M. and Best, D. A Study Quantifying the Hand-to-Face Contact Rate and Its Potential. Application to Predicting Respiratory Tract Infection. *Journal of Occupational and Environmental Hygiene*, 5:6, 347-352. (2008) Nicas and Best (2008) studied in details the issue of hand-to-face transmission. When applied to influenza (p.351), they estimate the probability of transmission by contaminated hands following a 30-minute exposure period to be about 0.011%. Of course repeated exposure increase the cumulated risk, and estimation of some parameters may be inaccurate; nonetheless it does not support the proposition that hand washing will have a major impact for influenza.
Blachere et al. 2009. Measurement of Airborne Influenza Virus in a Hospital Emergency Department. *BRIEF REPORT,* CID 2009:48, 15 February. 438-440. (2009) Blachere et al. demonstrated that influenza virus is able to remain suspended in the air, thus enabling airborne transmission.
SARS Commission If the Commission has one single take-home message, it is the precautionary principle that safety comes first, that reasonable efforts to reduce risk need not await scientific proof.
Ontario Health Plan for an Influenza Pandemic http://www.health.gov.on.ca/english/providers/program/emu/pan_flu/ohpip2/ch_07.pdf In addition to droplet precautions, OHPIP recommends the use of N95 respirators (instead of surgical masks) when in a room/area with influenza patients. This recommendation is based on the precautionary principle and is designed to protect workers from the risk of fine droplet spread.
Centers for Disease Control and Prevention All health care personnel who enter the rooms of patients in isolation with confirmed, suspected, or probable novel H1N1 influenza should wear a fit-tested disposable N95 respirator or better.