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The Lancet Infectious Diseases: Reflection and Reaction:

Can we stop the spread of influenza in schools with face masks?

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In the absence of a strain-specific vaccine and the potential resistance to antiviral medication, non-pharmaceutical interventions can be used to reduce the spread of an infectious disease such as influenza. The most common non-pharmaceutical interventions include school closures, travel restrictions, social distancing, enforced or volunteer home isolation and quarantine, improved hand hygiene, and the appropriate wearing of face masks. However, for some of these interventions, there are some unavoidable economic costs to both employees and employers, as well as possible additional detriment to society as a whole (**1**).

For example, it has been shown that school-age children are most likely to be infected and act as sources of infection for others (**2**), due to their greater societal interaction and increased susceptibility. Therefore, preventing or at least reducing infections in children is a logical first-line of defense. For this reason, school closures have been widely investigated and recommended as part of pandemic influenza preparedness (**3-5**), and some studies support this conclusion (**6**). Yet, school closures would result in lost work days if at least one parent must be absent from work to care for children who would otherwise be at school. In addition, the delay in academic progress may be detrimental due to mass school absenteeism. In particular, the pandemic influenza guidance by the U.S. Department of Health and Human Services (**7**) recommends school closures for less than four weeks for Category 2 and 3 pandemics (i.e., similar to the milder 1957 and 1968 pandemics) and one to three months for Category 4 and 5 pandemics (i.e., similar to the 1918 pandemic). Yet, given the above, it is clear that closing schools for up to three months is unlikely to be a practical mitigation strategy for many families and society. Thus modelers and policy makers need to weigh all factors before recommending such drastic measures, particularly if the agent under consideration typically has low mortality and causes a mild disease.

Therefore, we contend that face masks are an effective, practical, non-pharmaceutical intervention that would reduce the spread of disease among school-children, while keeping schools open. Influenza spreads through person-to-person contact, via transmission by large droplets or aerosols (droplet nuclei) produced by breathing, talking, coughing or sneezing, as well as by direct (though most people touch very few others in their daily lives) or indirect (i.e., via fomites) contact. Face masks act as a physical barrier to reduce the amount of potentially infectious inhaled and exhaled particles, although they would not reliably protect the wearer against aerosols; a recent study (**8**) also demonstrated that they can redirect and decelerate exhaled airflows (when worn by an infected individual) to prevent them from entering the breathing zones of others (**see Figure**). Thus, if a whole classroom were to don face masks, disease transmission would be expected to be greatly diminished. Another recent study on face masks and hand hygiene show a 10-50% transmission reduction for influenza-like illnesses (**9**). Furthermore, face masks can act as an effective physical reminder and barrier to transmission by preventing the wearer from touching any potentially infectious secretions from their mucous membranes (i.e., from the nose and mouth), which is another mechanism for direct and indirect contact transmission for influenza.

A recent systematic review has suggested that wearing masks can be highly effective in limiting the transmission of respiratory infections, such as influenza (**10**). Yet, admittedly, the effectiveness of this intervention strategy is highly dependent on compliance (i.e., the willingness to wear the mask in all appropriate situations), which in turn depends on comfort, convenience, fitness, and hygiene (**11-13**). Importantly, masks themselves must not become a source of infection (or reinfection); as such they should be replaced or sanitized daily (where possible) to maximize effectiveness.

One solution could be for masks to be touted as fashion accessories, which may be particularly effective in influencing trend-conscious children. With support from the fashion industry and a child-targeted public health campaign, it may be possible to encourage such a trend and make the mask an acceptable fashion item, as well as an important means of infectious disease control.

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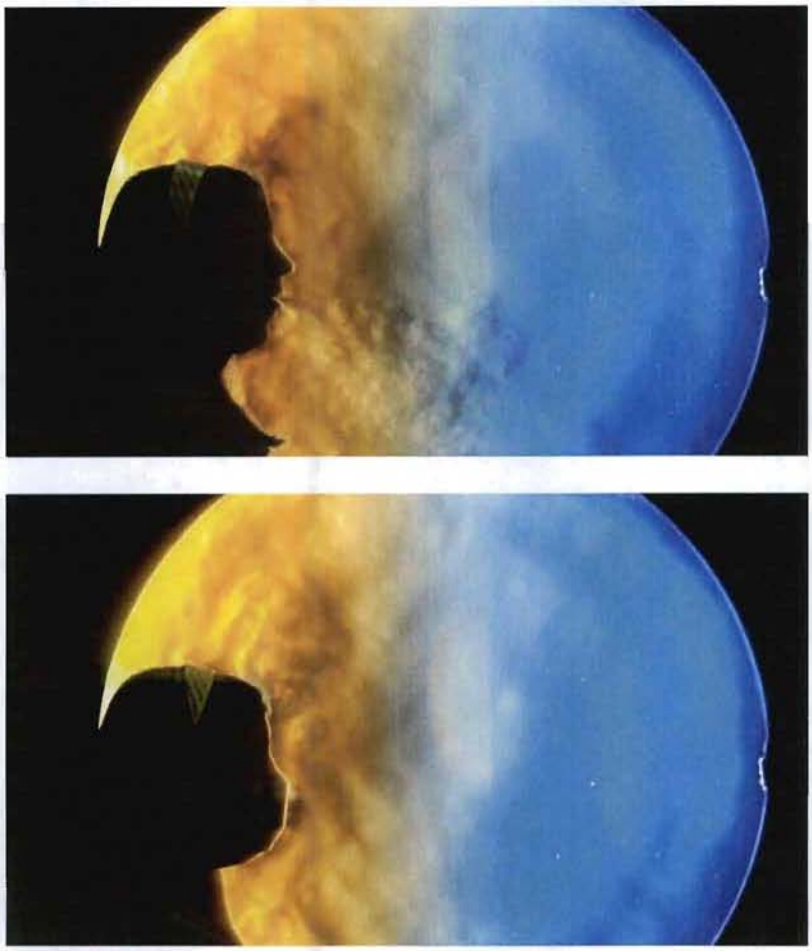

Figure. Coughing in a 12-year old female volunteer, without (top) and whilst wearing (bottom) a standard surgical mask. This technique of airflow visualization is known as Schlieren imaging. Warmer, exhaled air is at a lower density than the ambient air. This difference in density refracts light to different degrees, allowing the airflow patterns to be seen in real-time, without the use of irritant particulate or vaporous tracers (**14**). Around the volunteer's body a rising plume of warm air is also seen due to thermal convection from the skin: the *human thermal plume.* The experience of the volunteer during Schlieren imaging is just the same as if she is being photographed with a standard digital camera. The girl's mother was present throughout this experiment and gave written consent for her participation.