



Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses — Resource Use Implications: A Systematic Review

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Introduction

Viral epidemics or pandemics of acute respiratory infections like influenza or severe acute respiratory syndrome (or SARS) have each posed global threats over the past decade.^{1,2} The World Health Organization (WHO) interim guidelines document *Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care* has provided infection control guidance to help prevent the transmission of acute respiratory diseases in health care, with an emphasis on acute respiratory diseases that have epidemic or pandemic potential or may constitute a public health emergency of potential concern.³ The WHO current guidelines were published in 2007 and, since then, new evidence on some specific and controversial areas has emerged, necessitating an update of the guidelines.

It has been demonstrated that implementing barriers to transmission, such as physical interventions (screening at ports of entry, isolation, quarantine, social distancing, barriers, personal protection [e.g., wearing masks, gloves, and gowns], hand hygiene), can be effective in containing respiratory virus epidemics, or in health care settings such as hospital wards.⁴ Given that physical interventions can be instituted rapidly, are readily available, and may be independent of any specific type of infective agent, including novel viruses, they have the potential for widespread use. There is a growing interest in including economic considerations in

practice guidelines for physical interventions to allow users and policy-makers to evaluate the use of resources and costs within their particular setting.

This systematic review studies the resource use implications associated with physical interventions used for interrupting or reducing the spread of respiratory viruses, and serves to inform decision-makers when considering these interventions. It complements the updated Cochrane Review, *Physical interventions to interrupt or reduce the spread of respiratory viruses* (Jefferson et al., 2011),⁴ which shows that physical interventions to interrupt or delay the spread of viruses are effective in protecting against viral transmission.

Objective

The objective of the report was to answer the following research questions:

1. What are the resource use implications (e.g., number of units) associated with physical interventions (e.g., screening at ports of entry, isolation, quarantine, social distancing, barriers, personal protection [wearing masks, gloves, and gown], hand hygiene) used for the interruption of or reduction in the spread of respiratory viruses?
2. What are the economic implications (e.g., total cost and cost-effectiveness ratios) associated with physical barriers used for interrupting or reducing the spread of respiratory viruses?

Methods

The authors used a peer-reviewed search strategy to search the following electronic bibliographic databases: PubMed, Embase, MEDLINE, CINAHL, and The Cochrane Library, including the National Health Service Economic Evaluation Database (NHS EED) and Health Economic Evaluations Database (HEED). The initial search was completed in

November 2010, with regular alerts established in Embase, MEDLINE, and PubMed and running until September 19, 2011. The publications identified were limited to economic studies published between 1995 and 2010. The search was not limited by language. Additional relevant information sources were identified through searches of the websites of health technology assessment and related agencies, professional associations, and other specialized databases; searches of Google, Google Scholar, and other Internet search engines; and a review of bibliographies and abstracts of key papers, and consultation with experts.

The authors used a novel approach for determining resource use and costing information that necessitated the adaptation of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology.⁵ Although the GRADE methodology has been increasingly used as a transparent and evidence-based approach for grading the quality of evidence and strength of recommendations, using it to assess resource use and costs is in the early stages. Nonetheless, it offers the same transparent and evidence-based approach for assessing economic studies.

Results

The literature search yielded 1,146 citations, which were screened against inclusion criteria based on abstracts. A total of 158 were deemed potentially relevant and retrieved for more detailed evaluation, of which 39 studies were subjected to full review. Seven studies met the inclusion criteria for the systematic review; i.e., they reported information on resource use of physical interventions or assessed the cost-effectiveness of physical interventions.

The seven studies were observational in nature, had issues regarding indirectness and, in some cases, imprecision due to small sample size. In some cases where studies were based on modelling exercises, the sensitivity of results to changes in key parameters limited the confidence in study results. All of the economic studies were designed to address specific study

questions, resulting in single studies being available for the assessment of physical interventions for specific respiratory viruses. Furthermore, the studies were in settings subject to specific recommendations that varied by location. Given the differences in the economic studies, the results could not be directly compared, which complicates the assessment of consistency. Consequently, the quality of the evidence in the seven studies was found to be very low, based on the use of an adapted GRADE methodology.

Limitations

The generalizability of the results to different respiratory virus types and community settings requires further investigation. Additional studies are needed to inform the implications on resource use associated with physical interventions, including personal protective equipment, in interrupting or reducing the spread of various respiratory viruses.

While numerous economic evaluations in the area of respiratory viruses have been published, the purpose of many has been to evaluate the use of antivirals in treatment or prevention. Only a few economic studies evaluating physical interventions are available, and this might largely be due to the lack of sponsorship for these studies. Of the studies published, a small number have specifically reported resource use in their publications. Where studies have considered the use of antivirals in the assessment of personal protective equipment, the failure to consider harms (which is an emerging area of understanding) could significantly underestimate the cost-effectiveness.

Given the limited information on resource use associated with physical interventions in the interruption or reduction of the spread of respiratory viruses, information about the use of various physical interventions for specific respiratory viruses (SARS, H1N1, Spanish influenza, and influenza) is sparse. The feasibility of generalizing results among respiratory virus type needs to be evaluated. Similarly, because the majority of the evidence

pertains to hospital populations rather than communities, assessment on how these results might be applied to the community setting requires further investigation.

Studies measuring resource use (Murray et al.,⁶ Macartney et al.⁷) were based on local recommendations or guidelines, which could affect the generalizability of the results.

The economic studies evaluated different specific research questions, which may not directly inform this review. Given the differences in these studies, in most cases the results could not be directly compared.

Conclusions

Based on the updated Cochrane Review, the use of physical interventions to interrupt or reduce the spread of respiratory viruses during epidemics and pandemics is effective. Studies show that the use of physical interventions increases during epidemics and pandemics. Given the general low cost of these interventions, the economic studies that were reviewed showed that use of personal protective equipment was economically attractive. These results are sensitive to assumptions about rate of transmission, facility infection rate, and compliance with interventions, with economic attractiveness increasing when transmission and fatality rates are high. Where guidelines for personal protective equipment use are not followed, cost-effectiveness could be reduced.

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