

Summary Statement Title:

Physical interventions to interrupt or reduce the spread of respiratory viruses: Evidence and implications for public health

Review Quality Rating: 7 (moderate)

Review on which this summary statement is based:

Jefferson, T., Foxlee, R., Del Mar, C., Dooley, L., Ferroni, E., Hewak, B., Prabhala, A., Nair, S., Rivetti, A. (2008). **Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review.** *British Medical Journal*, 336, 77-80..

Note: The BMJ review that this summary statement is based on has been updated. This summary statement summarizes the above-cited version of this review, not the updated version. An updated summary statement will be provided as soon as possible. A summary statement is available for the 2011 Cochrane version of this review.

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This is a summary statement written to condense the work of the authors of this systematic review, referenced above. The intent of this summary is to provide an overview of the findings and implications of the full review. For more information on individual studies included in the review, please see the review itself.

Review content summary

This systematic review and meta-analysis of 51 studies aimed to determine the effectiveness of physical interventions to interrupt or reduce the spread of respiratory viruses. Participants studied were the general population. To be included, studies were: trials (individual level, cluster randomised, or quasirandomised); observational studies (cohort and case-control); and any other comparative design in people of all ages provided some attempt had been made to control for confounding. Interventions described in this review included: any intervention designed to prevent transmission of respiratory viruses (isolation, quarantine, social distancing, barriers, personal protection, and hygiene). Outcomes measured include: death; number of cases of viral illness; severity of viral illness, or proxies for these; and other measures of burden, such as admissions to hospital. Authors report that handwashing, masks, and isolation of potentially infected people, were effective in preventing the spread of respiratory virus infections.

Comments on this review's methodology

This is a methodologically moderate systematic review. A focused clinical question was clearly identified. Appropriate inclusion criteria were used to guide the search. A comprehensive search was not employed using only health databases and reviewing reference lists of primary studies. Primary studies were assessed for methodological quality using a set of criteria for randomized studies (effectiveness of randomization method, generation of allocation sequence, allocation concealment, blinding and follow-up) and non-randomized studies (presence of potential confounders). The methods were described in sufficient detail so as to allow replication and it is unclear if two reviewers were involved in quality appraisal. The results of this review were not transparent. Results were clearly presented in graphical form so as to allow for comparisons across studies. Heterogeneity was assessed. Appropriate analytical methods (fixed effects, random effects) were employed to enable the synthesis of study results. Heterogeneity precluded meta-analysis of most data except that from six case-control studies, and studies were weighted appropriately.

Why this issue is of interest to public health

Respiratory viral infections (RVIs) can be associated with a wide range of clinical manifestations from upper respiratory tract infections to pneumonia, all of which impact quality of life.¹ RVIs are also the most common reason for medical consultation in the world¹. Approximately 10% to 15% of people worldwide contract influenza annually, however rates can reach as high as 50% during major epidemics.^{2,3} Such rates strain health services, are responsible for excess deaths, and result in huge indirect costs due to absenteeism from work and school.^{2,3} The severe acute respiratory syndrome (SARS) epidemic affected approximately 8500 persons worldwide, and killed 900, causing social and economic crisis.⁴ In Canada, it affected 438 persons, and killed 44 as of August 2003.⁴ What's more is that a new avian influenza pandemic caused by the H5N1 strain might prove even more devastating.^{2,3} All of these circumstances call for interventions, in addition to vaccines and anti-viral medications, to interrupt or reduce the spread of respiratory viruses.

Evidence and implications

Evidence points are not in order of the strength of evidence

What's the evidence?	Implications for practice and policy:
<p>1. Interruption to transmission of SARS (6 case control studies)</p> <p>1.1. Frequent handwashing (>10 x/day) (6 studies)</p> <p>1.1.1. When participants washed their hands frequently, SARS virus transmission was 55% less likely than it was for controls. The true effect of frequent handwashing ranged from 64% to 43% less likely (OR=0.45, 95% CI 0.36 to 0.57).</p> <p>1.1.2. In order to prevent one case of transmission, 4 people would need to be treated (NNT=4.00, 95% CI 3.65 to 5.52) therefore, for every 4 participants exposed to an intervention to wash their hands more than 10x/day, one transmission of SARS would be prevented.</p> <p>1.2. Wearing masks (5 studies)</p> <p>1.2.1. When participants wore surgical masks, SARS transmission was 68% less likely than it was for controls. The true effect of wearing surgical masks ranged from 75% to 60% less likely (OR=0.32, 95% CI 0.25 to 0.40).</p> <p>1.2.2. In order to prevent one case of transmission, 6 people would need to be treated (NNT=6.00, 95% CI 4.54 to 8.03) therefore, for every 6 participants wearing a mask, one transmission of SARS would be prevented.</p> <p>1.3. Wearing N95 masks (2 studies)</p> <p>1.3.1. When participants wore N95 masks, SARS transmission was 91% less likely as compared with controls. The true treatment effect ranged from 97% to 70% less likely (OR=0.09, 95% CI 0.03 to 0.30).</p> <p>1.3.2. In order to prevent one case of transmission, 3 people would need to be treated (NNT=3.00, 95% CI 2.37 to 4.06) therefore for every 3 participants wearing N95 masks, one transmission of SARS would be prevented.</p> <p>1.4. Wearing gloves (4 studies)</p> <p>1.4.1. When participants wore gloves, transmission of SARS virus was 57% less likely as compared with controls. The true treatment effect ranged from 71% to 35% less likely (OR=0.43, 95% CI 0.29 to 0.65).</p> <p>1.4.2. In order to prevent one case of transmission, 7 people would need to be treated (NNT=7.00, 95% CI 4.15 to 15.41) therefore for every 7 participants wearing gloves one transmission of SARS would be prevented.</p> <p>1.5. Wearing gowns (4 studies)</p> <p>1.5.1. When participants wore gowns, SARS virus transmission was 77% less likely as compared with controls. The true treatment effect ranged from 86% to 67% less likely (OR=0.23, 95% CI 0.14 to 0.37).</p> <p>1.5.2. In order to prevent one case of transmission, 5 people would need to be exposed to the intervention (NNT=5.00, 95% CI 3.37 to 7.12) therefore for every 5 participants wearing gowns, one transmission of SARS would be prevented.</p> <p>1.6. Handwashing, mask, gloves, and gown combined (2 studies). In one of these studies the masks used were surgical masks and in the other study, masks included paper, surgical, and N95.</p> <p>1.6.1. In the study using surgical masks and this multi-method intervention, SARS virus transmission to health care workers when participants used this combination of interventions was 90% less likely as compared with controls (handwashing before and after patient contact). The true intervention effect ranged from 100% to 70% less likely (OR=0.1, 95% CI 0.0-0.30).</p> <p>1.6.2. In the study using masks (including paper, surgical, and N95), no health care workers contracted SARS when all four methods were used (mask, gown, gloves and handwashing). The most protective effect came when surgical or N95 masks were worn with a gown, gloves,</p>	<p>1. Interruption to transmission of SARS</p> <p>1.1. Public health organizations should, in order to reduce the transmission of the SARS virus, collaborate with hospitals and community-based care providers to ensure the availability and use of physical barriers that include (in order of priority):</p> <p>1.1.1. A combination of mask (surgical or N95), frequent handwashing, gown, and gloves</p> <p>1.1.2. N95 masks alone</p> <p>1.1.3. Surgical masks alone</p> <p>1.1.4. Gowns alone</p> <p>1.1.5. Gloves alone</p> <p>1.1.6. Frequent handwashing alone</p> <p>1.2. Rigorous program evaluations and high quality research should be conducted.</p> <p>1.3. Sub-analyses comparing particular methods, such as mask plus gown, were not reported in this review, but evaluations should be conducted.</p>

<p>and frequent handwashing.</p> <p>1.6.3. When participants used this combination of interventions (including particularly surgical or N95 masks), SARS virus transmission was 91% less likely as compared with controls. The true treatment effect ranged from 98%% to 65% less likely (OR=0.09, 95% CI 0.02 to 0.35).</p> <p>1.6.4. In order to prevent one case of transmission, 3 people would need to be treated (NNT=3.00, 95% CI 2.66 to 4.97), therefore for every 3 participants who used this combination of interventions (including either surgical mask or N95 mask), one transmission of SARS would be prevented.</p>	
<p>2. Results from RCTs (3 studies – all high risk of bias). Generally, the results among these studies were mixed.</p> <p>2.1. When participants painted hands with iodine, SARS virus transmission was no more or less likely than when participants painted their hands with a placebo. (p=0.06) (2 studies reported in one paper with combined results)</p> <p>2.1.1. When participants used salicylic acid or salicylic acid plus pyroglutamic acid, rhinovirus transmission was significantly less likely as compared with controls (p<0.05) (1 study).</p> <p>2.1.1.1. When participants used skin cleanser wipe containing 4% pyroglutamic acid formulated with 0.1% benzalkonium chloride, rhinovirus transmission was no more or less likely as compared with controls (skin cleanser containing ethanol) (1 study).</p>	<p>2. 2. Results from RCTs</p> <p>2.1. Based on the results of a limited number RCTs, public health organizations may consider, in order to reduce the transmission of the rhinovirus, collaborating with hospitals and community-based care providers to ensure the availability and use of physical barriers that include the use of</p> <p>2.1.1. salicylic acid</p> <p>2.1.2. salicylic acid together with pyroglutamic acid</p> <p>However, the evidence to guide this decision is limited and the poor methodological quality of these studies, likely over estimates the true treatment effect.</p> <p>2.2. Public health organizations should, in order to reduce the transmission of respiratory infections, not use a skin cleanser wipe containing 4% pyroglutamic acid formulated with 0.0% benzalkonium chloride as the only physical intervention.</p> <p>2.3. The limited number of high quality RCTs suggests the need for rigorous program evaluations and high quality research should be conducted to add to the body of knowledge on this issue.</p>
<p>3. Results from cluster RCTs (10 studies – risk of bias low for 2 studies, medium for 1 study, high for 6 studies, and not reported for one study). Generally the results among these studies were mixed.</p> <p>3.1. Of the 2 studies of higher methodological quality,</p> <p>3.1.1. Children up to age 5 years in households in which members used soap were 50% less likely to have pneumonia than those in control households. The true range was 66% to 35% less likely (RR=0.50, 95% CI 0.0.34 to 0.) (1 study).</p> <p>3.1.2. Children up to 24 months of age who participated in a handwashing program were 10% less likely to have acute respiratory infections compared with controls. The true effective of the handwashing program ranged from 27% to 3% less likely (RR=0.90, 95% CI 0.83 to 0.97).</p> <p>3.1.3. Children aged 2-3 years who participated in a handwashing program were no more or less likely to have acute respiratory infections than controls</p>	<p>3. Results from cluster RCTs</p> <p>3.1. Based on a limited number of cluster RCTs of higher quality, public health organizations, in order to reduce the transmission of respiratory infections among children, may consider collaborating with hospitals and community-based care providers to ensure the availability and use of physical barriers that include handwashing with soap, though perhaps only among younger age groups.</p> <p>3.2. Alternative or additional strategies may be required to reduce the transmission of infections among children older than 24 months.</p> <p>3.3. Due to the limited number of high quality studies, rigorous program evaluation and additional high quality research studies are required. This research should conduct analyses by age category to determine relative effectiveness of these interventions.</p>
<p>4. Methodological Issues with the Primary Studies in the Review</p> <p>4.1. RCTs and cluster RCTs were of poor quality</p> <p>4.2. Incomplete or lack of reporting of</p> <p>4.2.1. Randomization</p> <p>4.2.2. Blinding</p> <p>4.2.3. Interventions and intervention integrity</p> <p>4.2.4. Outcomes</p> <p>4.2.5. Numerators and denominators</p> <p>4.2.6. Loss to follow-up</p> <p>4.2.7. Confidence intervals</p> <p>4.2.8. Cluster coefficients</p> <p>4.3. Meta-analysis generally impossible due to heterogeneity</p> <p>4.4. Conclusions unsupported by data</p>	<p>4. Implications for Future Research</p> <p>4.1. Rigorous program evaluations and high quality (low risk of bias) research are required to contribute the limited body of knowledge related to the effectiveness of physical interventions to prevent or reduce the spread of respiratory infections.</p>

4.5. Failure to identify potential confounders 4.5.1. Variability of viral incidence over time 4.6. Inappropriate interventions for comparison 4.7. Issues with placebos 4.8. Testing conducted under impractical or unrealistic situations	
5. Cost Benefit or Cost-effectiveness Information 5.1. No cost related information was included in the review	5. Cost Benefit or Cost-effectiveness Information 7.1. Future research should assess cost benefit or cost-effectiveness of the interventions
General Implications <ul style="list-style-type: none"> • Certain physical barriers such as frequent handwashing, as well as wearing a mask (particularly surgical and N95 masks), gloves, or gown can be effective in reducing the transmission of respiratory infections • If all four methods cannot be used, the evidence suggests an N95 mask provides good protection against SARS transmission. • The limited number of high quality studies included in this review indicates the need for rigorous program evaluations and high quality research studies in order to contribute to the body of knowledge on this important public health issue. 	
Legend: CI – Confidence Interval; OR – Odds Ratio; RR – Relative Risk **please see the health-evidence.ca glossary of terms (found under 'How to Use This Site') for definitions	

References used to outline issue

1. Abed, Y. & Boivin, G. (2006). Treatment of respiratory virus infections. *Antiviral Research*, 70, 1–16.
2. Jefferson T., Foxlee R., Del Mar C., Dooley L., Ferroni E., Hewak B., Prabhala A., Nair S., & Rivetti A. (2007). Interventions for the interruption or reduction of the spread of respiratory viruses. *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD006207. DOI: 10.1002/14651858.CD006207.pub2.
3. Jefferson, T., Foxlee, R., Del Mar, C., Dooley, L., Ferroni, E., Hewak, B., Prabhala, A., Nair, S., & Rivetti, A. (2008). Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. *British Medical Journal*, 336, 77-80.
4. Public Health Agency of Canada: Learning from SARS. Renewal of Public Health in Canada. Executive Summary <http://www.phac-aspc.gc.ca/publicat/sars-sras/naylor/exec-eng.php>

Other quality reviews on this topic

- Gamage, B., Moore, D., Copes, R., Yassi, A., & Bryce, E. (2005). Protecting health care workers from SARS and other respiratory pathogens: A review of the infection control literature. *American Journal of Infection Control*, 33, (2), 88-96.
- Jefferson, T., Del Mar, C., Dooley, L., Ferroni, E., Al-Ansary, L.A., Bawazeer, G.A., van Driel, M.L., Nair, S., Foxlee, R., Rivetti, A. (2010). Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD006207. DOI: 10.1002/14651858.CD006207.pub3
- Langley, J.M., Faughnan, M.E. (2004). Prevention of influenza in the general population. *Canadian Medical Association Journal*, 171 (10), 1213-1222.
- van der Wouden, J.C., Bueving, H.J., & Poole, P. (2005). Preventing influenza: An overview of systematic review. *Respiratory Medicine*, 99 (11), 1341-1349.

Related links

- Centers for Disease Control and Preventions: <http://www.cdc.gov/>
- National Collaborating Centre for Infectious Diseases <http://www.nccid.ca/en/home>
- Public Health Agency of Canada: Infectious Diseases <http://www.phac-aspc.gc.ca/id-mi/index-eng.php>
- Public Health Agency of Canada: Respiratory Virus Detections/Isolations in Canada <http://www.phac-aspc.gc.ca/bid-bmi/dsd-dsm/rvdi-divr/index-eng.php>

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