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Handwashing and risk of respiratory infections: a quantitative systematic review

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Summary

OBJECTIVE To determine the effect of handwashing on the risk of respiratory infection.
METHODS We searched PubMed, CAB Abstracts, Embase, Web of Science, and the Cochrane library for articles published before June 2004 in all languages. We had searched reference lists of all primary and review articles. Studies were included in the review if they reported the impact of an intervention to promote hand cleansing on respiratory infections. Studies relating to hospital-acquired infections, long-term care facilities, immuno-compromised and elderly people were excluded. We independently evaluated all studies, and inclusion decisions were reached by consensus. From a primary list of 410 articles, eight interventional studies met the eligibility criteria.
RESULTS All eight eligible studies reported that handwashing lowered risks of respiratory infection, with risk reductions ranging from 6% to 44% [pooled value 24% (95% CI 6–40%)]. Pooling the results of only the seven homogenous studies gave a relative risk of 1.19 (95% CI 1.12%–1.26%), implying that hand cleansing can cut the risk of respiratory infection by 16% (95% CI 11–21%).
CONCLUSIONS Handwashing is associated with lowered respiratory infection. However, studies were of poor quality, none related to developing countries, and only one to severe disease. Rigorous trials of the impact of handwashing on acute respiratory tract infection morbidity and mortality are urgently needed, especially in developing countries.

keywords handwashing, respiratory infections, systematic review, meta-analysis

Introduction

Acute respiratory tract infections (ARIs) cause at least 2 million deaths a year (Guerrant & Blackwood 1999; WHO 2002). They are the leading cause of childhood morbidity and mortality in the world and the biggest cause of disability-adjusted life years lost (DALYs) (Murray & Lopez 1997). It was estimated that 21% of deaths in the 42 countries with the highest mortality are because of pneumonia (Black *et al.* 2003). Mortality and morbidity is concentrated in the under-fives and in the poorer countries (WHO 2002). Efforts are needed to identify interventions against ARIs if the international community is to achieve the millennium development goal of reducing child mortality by two-thirds by 2015 (Jones *et al.* 2003). Hands are known to transport bacterial and viral respiratory pathogens. Microbiological studies have identified respiratory pathogens on hands (Hendley *et al.* 1973; Reed 1975; Gwaltney & Hendley 1978; Gwaltney *et al.* 1978, 1980; Ansari *et al.* 1991) and fomites (environmental surfaces) are also implicated in the transmission chain (Mahl & Sadler 1975; Bean *et al.* 1982; Brady *et al.* 1990). Several viruses that were believed to use airborne or fomite routes exclusively are now thought also to be transmitted faeco-orally. Enteric adenoviruses are responsible for 2–24% of respiratory viral disease in children (Cherry 1998). The coronavirus causing severe acute respiratory syndrome (SARS) is readily isolated from the faeces of infected patients (WHO 2003a,b) and H5N1, the Asian 'flu virus, has recently been found in faeces (de Jong *et al.* 2005). Carriage of pathogens on the hands is an important link in the faecal–oral route of disease transmission. Hands are thus disease vectors: carrying respiratory micro-organisms shed from the nose, mouth or anus to the nasal mucosa, conjunctiva (Hendley *et al.* 1973), or mouth (WHO 2003b) of new hosts. Hands can be cleansed of viruses and bacteria by washing with soap (both plain and antibacterial) (Faix 1987; Ansari *et al.* 1989; Luby *et al.* 2001; Gibson *et al.* 2002; Montville *et al.* 2002; Larson *et al.* 2003) or other cleansers (Hoque & Briend 1991; Kaltenthaler *et al.* 1991; Hoque *et al.* 1995; Dyer *et al.* 2000; White *et al.* 2001, 2003). Furthermore, handwashing is known to reduce respiratory infection in healthcare settings (Isaacs *et al.* 1991; Falsey *et al.* 1999; Makris *et al.* 2000).

Handwashing is an effective (Curtis & Cairncross 2003), feasible (Khan 1982; Stanton & Clemens 1987; Pinfold & Horan 1996; Curtis *et al.* 2001) and cost-effective (Borghi *et al.* 2002) means of preventing gastroenteric infection in developing country settings and may offer a promising new intervention against ARIs. We conducted this quantitative systematic review to answer the question: What is the effect of handwashing on the risk of respiratory infection in the general population?

Methods

This systematic review aimed to recover all work published before June 2004 that related hand cleansing or washing to the risk of respiratory infection in the healthy population living in the community. Figure 1 outlines the selection and review process.

Identification of studies

We searched PubMed, CAB Abstracts, Embase, Web of Science and the Cochrane library for papers published before June 2004, in all languages. Papers in languages other than English, French and Spanish were translated into English. The medical subject heading (MeSH) and text words for the terms *handwashing*, or *hand hygiene* or *hand cleansing or hand cleaning* were used separately and in combination with MeSH terms for *acute respiratory infections*, *respiratory disease*, *respiratory illness*, *sinusitis*, *common cold*, *otitis media*, *pharyngitis*, *influenza*, *coryza*, *laryngitis*, *epiglottitis*, *croup*, *pneumonia*, *bronchitis*, *bronchiolitis*, *pertussis* and *whooping cough*. After hand searching of bibliographies of all relevant articles, including reviews, and removal of duplicates, the final citation total was 395. We also identified 15 additional articles from our own collections.

Eligibility criteria

We included interventional studies that calculated the risk of any respiratory outcome related to hand cleansing. Our focus was the impact of handwashing on the healthy general population and hence we excluded studies conducted in hospitals, healthcare or geriatric care settings, and studies with immuno-compromised subjects or people suffering from genetic disorders.

Screening process

Initially, both authors reviewed the full citation list independently and then came to a consensus on 61 potentially relevant abstracts for retrieval. Three hundred and sixteen were rejected because they did not meet the eligibility criteria, concerned microbiology, vaccination, pharmacology, animal disease or organisms irrelevant to ARI, or because they were not peer-reviewed reports.

Next, both authors then read all 61 abstracts and agreed to retrieve the 16 full papers that appeared potentially eligible to either, or both of them. Forty-five abstracts were rejected as they concerned children with disabilities, hospital settings, microbiology, studies relating to handwashing but not ARIs, studies relating to ARIs but not handwashing, observational studies, or studies that included several components other than handwashing, so the effect of handwashing *per se* could not be disentangled.

Both authors then read all 16 remaining papers and reached a consensus on eight papers from which to extract data (Master *et al.* 1997; Niffenegger 1997; Ladegaard & Stage 1999; Dyer *et al.* 2000; Roberts *et al.* 2000; Ryan *et al.* 2001; White *et al.* 2001, 2003). Five studies were excluded because they used several interventions and it was not possible to attribute the reported effect to handwashing alone (Kotch *et al.* 1994; Krilov *et al.* 1996; Carabin *et al.* 1999; Uhari & Möttönen 1999; Ponka *et al.* 2004). Three studies concerned school absenteeism associated with not washing hands, but did not provide sufficient detail regarding respiratory infections and were also excluded (Kimel 1996; Hammond *et al.* 2000; Guinan *et al.* 2002).

Data abstraction

Data concerning the study design, sample size, measures of effect (abstracted or computed: see Box 1), nature of the intervention, location, study population and methodological shortcomings of the studies were abstracted and tabulated independently by both authors.

Entry to meta-analysis

Studies were retained for the meta-analysis if they provided risk or rate ratio estimates and 95% CI, or the means to calculate them, of hand cleansing in association with a respiratory tract infection. According to Deeks *et al.* (2003), pooling risk and rate ratios is acceptable provided that statistical heterogeneity is tested for.

Data synthesis

The estimates of the measures of effect from all eight studies were pooled in a meta-analysis using a random effects model and tested for heterogeneity using Chi-squared tests. Statistical analysis was performed using

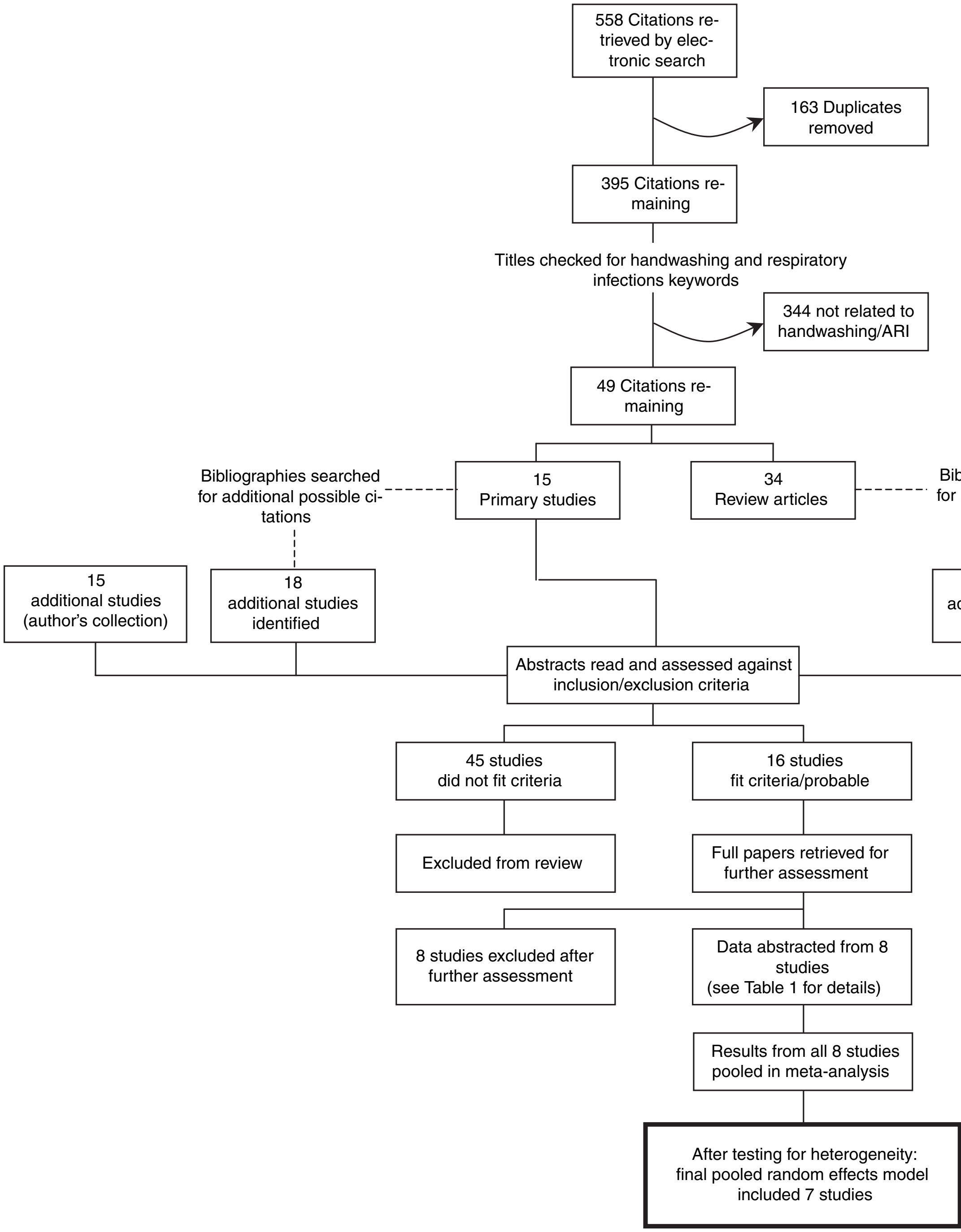

Figure 1 Selection and review process.

STATA8 (Stata Statistical Software 2003). One study concerned three different outcomes and were combined (Ladegaard & Stage 1999). A forest plot and a random-effect pooled estimate of the relative risk were generated (Egger *et al.* 1997). No further sub-group pooled analyses were attempted because studies were too few.

1) Relative Risks (RRs)

$$R_1/R_0$$

where 'R_1' is the risk/rate of developing/having a respiratory infection in the non-handwasher group and 'R_0' in the handwasher group

2) 95% Confidence Intervals (For Rate Ratios)

$$RR \div EF \text{ to } RR \times EF$$

where 'EF' is the error factor and is calculated using the following formula:

$$\exp\left[1.96\sqrt{(1/d_1)+(1/d_2)}\right]$$

d_1 and d_2 are the population sizes in the handwasher and non-handwasher groups

3) 95% Confidence Intervals (For Risk Ratios)

$$\exp\left[\ln\hat{\phi} \pm (1.96)\left(se_{\ln\hat{\phi}}\right)\right]$$

where '$\ln\hat{\phi}$' is the natural log of the risk ratio of non-handwashers versus handwashers and '$se_{\ln\hat{\phi}}$' is its standard error, which is calculated using the following formula:

$$\sqrt{\frac{1-R_1}{N_1 \times R_1}+\frac{1-R_0}{N_1 \times R_0}}$$

'N_1' and 'N_0' are the total number of subjects (ARI cases & non-cases) in the handwasher group and non-handwasher group respectively.

Box 1 Computation of risk and rate ratios and 95% CI.

Sensitivity analysis

We first tested for methodological heterogeneity by excluding the uncontrolled study (Ryan *et al.* 2001) and then the cross-over trial (Dyer *et al.* 2000). This study had a 2-week wash out period, and as we only included the first period to minimise the risk of bias originating from the carry-over effect, this may have constituted a form of selection bias (Curtin *et al.* 2002). We further tested for methodological heterogeneity by excluding the two studies of poorest quality (Niffenegger 1997; White *et al.* 2001). We constructed a funnel plot and used Begg's-adjusted rank correlation test (Begg & Mazumdar 1994; Egger *et al.* 1997) to assess the likelihood of publication bias.

Results

Table 1 shows the data abstracted from the eight qualifying studies. All were conducted in developed country settings, three concerned schools, three concerned childcare facilities, one a university hall of residence and one a navy base. All concerned hand cleansing interventions: three mentioned soap use (Master *et al.* 1997; Niffenegger 1997; Ryan *et al.* 2001) and 3 sanitisers (Dyer *et al.* 2000; White *et al.* 2001, 2003), while the remaining two did not specify either (Ladegaard & Stage 1999; Roberts *et al.* 2000).

Only two studies were randomised-controlled trials (RCTs) and all had methodological flaws (Table 1). Two studies were especially poor (Niffenegger 1997; White *et al.* 2001), having one intervention and one control group, but analysed as if children and episodes were independent of each other. The relative risk of ARIs associated with not washing hands ranged from 1.06 to 1.80. The combined random effects estimate of the relative risk was 1.32 (95% CI 1.06–1.66), implying that handwashing could cut the risk of respiratory infection by 24% (95% CI 6–40%).

Evidence of heterogeneity

The pooled random effects model was tested for heterogeneity and showed a chi-square of 194 on 7 degrees of freedom with a significant *P*-value of >0.001, denoting that there was heterogeneity between the studies included in the meta-analysis. After exclusion of the Ryan study, the chi-square was 5.8 on 6 degrees of freedom with a *P*-value = 0.45, showing that the heterogeneity was because of the inclusion of this study. The resultant pooled random effect estimate of the relative risk was 1.19 (95% CI 1.12–1.26).

Sensitivity analysis

Once this study had been removed from the pool, we conducted sensitivity analysis to determine whether the effect of removing studies for other reasons (cross-over trial, poorest studies) affected the results. Table 2 shows that there was very little change in the pooled effect measure and no evidence of heterogeneity between the remaining studies.

We therefore retained the random effects estimate for the relative risk based on seven studies, yielding a relative risk of 1.19 (95% CI 1.12–1.26). This implies that the relative risk of respiratory infections associated with not cleansing hands is 16% (95% CI 11–21%). Figure 2 below gives the forest plot for the seven studies in the meta-analysis. We plotted a funnel graph to test for publication bias and computed Begg's-adjusted rank correlation. Our results showed no evidence of publication bias (Begg's-adjusted rank correlation test, $P = 0.55$).

Discussion

Our results suggest that hand cleansing can cut the risk of respiratory tract infection by about 16% (95% CI 11–21%). The implications of this finding for preventing ARIs in developing countries are uncertain because of the poor quality of the studies, their geographical limitations and the use of non-severe outcome measures.

Table 1 Characteristics of the eight studies of handwashing included in the review

Study	Location/setting	Study design	Exposure/intervention	Age group	Methodological shortcomings*	Outcome	Measure of effect (95% CI)	Sample size and follow-up
(A) Dyer *et al.* (2000)	Private elementary school in California	Cross-over intervention	Hand sanitiser given to all study children for supervised use after entering classroom, before eating, after sneezing or coughing, after using restroom	5–12	1/2/5/6/8/9/	Days of respiratory illness	Risk ratio 1.37 (0.78–2.40)	Four hundred and twenty children in 14 classes 4 weeks plus 4 weeks
(B) Ladegaard & Stage (1999)	Eight child day-care centres, Denmark	Intervention trial using blocked randomisation	Training of centre personnel and distribution of t-shirts with the imprint 'Clean hands – yes please' to all children. Older children were given handwashing exercises, heard a fairy tale about handwashing, coloured drawings from fairy tale, sang 'wash your hands' songs and received a copy of the fairy tale. Children also given material to pass on to parents about handwashing.	0–6	4/5/6/8/9/	Parents/personnel reporting of common cold/sore throat Parents/personnel reporting of bronchitis/pneumonia Parents/personnel reporting of otitis media Combined	Risk ratio 1.25 (0.81–1.92) Risk ratio 1.13 (0.36–3.51) Risk ratio 1.93 (0.69–5.41) Risk ratio 1.29 (0.90–1.84)	Four intervention centres with 212 children, four control centres with 263 children. 2 months baseline, 2 months intervention, and 2 months post-intervention.
(C) Master *et al.* (1997)	Elementary school, MI, USA	Intervention in six classes, none in eight classes: experimental	Required to WHWS 4× a day plus after toilet	5–12	1/2/5/6/8/9/	URI days of illness	Risk ratio 1.06 (0.78–1.44)	Three hundred and five children in 14 clusters 37 days
(D) Niffenegger (1997)	Two childcare facilities, IN, USA	Intervention in one facility compared with none in control facility	Instructional programme on germs and WHWS for teachers and children	3–5	1/4/5/8/9/	Incidence of colds	Risk ratio 1.47 (1.01–2.13)	Twenty-six intervention children, 12 control 70 days
(E) Roberts *et al.* (2000)	Childcare centres Australian Capital Territories	Cluster randomised-controlled trial	Training sessions for staff using 'GloGerm', visits and newsletters. Staff and child handwashing after toileting, before eating, after changing a diaper, after wiping a nose	0–3 years	2/5/	Parental recall of illness symptoms over 2 weeks by telephone interview, plus illness calendars	Rate ratio compliant children 1.12 (1.03–1.22)	Eleven intervention, 12 control centres 458 children 113 677 child days
(F) Ryan *et al.* (2001)	US Navy Recruits, IL, USA	Intervention baseline and follow-up	Directive to recruits to WHWS 5× daily, wet sinks allowed, liquid soap dispensers, monthly education and inspection	Young adults	1/3/6/8/	Self-reporting of respiratory infection	Rate ratio 1.80 (1.78–1.82)	A total of 44797 recruits in pre-intervention year – 45714 (average) in 2 years post-intervention

Table 1 (Continued)

Study	Location/setting	Study design	Exposure/intervention	Age group	Methodological shortcomings*	Outcome	Measure of effect (95% CI)	Sample size and follow-up
(G) White *et al.* 2001	One private and two elementary schools, CA, USA	Double-blind placebo controlled	Hand sanitiser, placebo without active ingredients upon entering classroom, before and after eating, before leaving class	5–12	1/2/4/6/7/8/9/	Days of illness with respiratory symptoms	Risk ratio 1.34 (0.96–1.89)	Thirty-two classes 769 children 5 weeks
(H) White *et al.* (2003)	Student residence halls, CO, USA	Intervention in two halls, not in two controls	Gel dispensers installed in rooms and public places of intervention halls plus handwashing campaign	Students	1/2/5/6/7/8/9/	Weekly self-report of symptoms	Risk ratio 1.25 (1.14–1.37)	Four residence halls 430 students 8 weeks

*Methodological shortcomings of studies: 1/intervention not randomised, 2/baseline incidences not given, 3/no concurrent control group, 4/unsatisfactory case definition, 5/no placebo intervention, 6/impact on behaviour not assessed, 7/high loss to follow-up, 8/no correction for repeated episodes and 9/no control for clustering.
WHWS, wash hands with soap; URI, upper respiratory tract infection; RR, relative risk.

Though we find a consistent pattern of impact of handwashing on ARI, our pooled estimate can only be seen as indicative, as studies were few, of poor quality and limited in geographical scope. Some major studies were also excluded. All of the studies included in the review had methodological flaws. Of the eight intervention studies, only two (Ladegaard & Stage 1999; Roberts *et al.* 2000) were RCT. Though all used a control group, only one used a placebo intervention to blind investigators and participants to the study hypotheses (White *et al.* 2001). Only one dealt with clustering and the non-independent nature of subsequent illness episodes correctly in the analysis (Roberts *et al.* 2000). Only three studies gave an adequate description of the outcome measure (Niffenegger 1997; Roberts *et al.* 2000; Ryan *et al.* 2001). Very few reported a baseline risk of respiratory infections (Niffenegger 1997; Ryan *et al.* 2001) and most gave unsatisfactory case definitions (Niffenegger 1997; Ryan *et al.* 2001; White *et al.* 2001). There were too few studies to carry out subgroup analyses to determine which hand cleansing regimes were most effective. Few studies offered compliance data, and those that did showed low values (Roberts *et al.* 2000; White *et al.* 2003). It may be that handwashing, when complied with, can have a much bigger impact than reported in these studies.

Because of methodological issues, our review excluded a number of, otherwise eligible, studies showing strong effects of handwashing on respiratory infection. In what was a very large study, Ryan demonstrated a 45% reduction in the risk of clinical reports of ARI in navy recruits practising handwashing. St Sauver *et al.* (St Sauver *et al.* 1998) carried out a retrospective cross-sectional study of reported handwashing by children and providers and showed two- to threefold average reductions in the odds of respiratory infection with handwashing.

Though the major burden of ARI disease falls in developing countries, clearly the major burden of research has fallen in developed countries, especially in the US. The poor geographical distribution of studies is surprising and may reflect the fact that in the US handwashing is commonly believed to protect against colds and flu, but not elsewhere (anecdotal evidence). Most studies concerned upper respiratory infections such as colds and influenza and few included patients with serious illness. This means that extrapolating the results of this review to developing countries, and to the severe pneumonias which are responsible for most ARI deaths in those settings, is uncertain. On the other hand, the fact that the pooled studies referred to communal settings may be relevant to the often more crowded and communal aspects of life in poorer settings within developing countries.

Table 2 Sensitivity analyses

	RR (95% CI)	Number of studies	Heterogeneity Q (*P*-value)	Interpretation of results
All studies pooled in meta-analysis	1.32 (1.07–1.66)	8	194.07 (>0.001)	Results show a 24% (95% CI 6–40%) relative risk reduction associated with handwashing. However, there is an evidence of heterogeneity between the pooled estimates denoted by the high chi-squared value with a statistically significant *P*-value.
Excluding the uncontrolled study (Ryan *et al.* 2001)	1.19 (1.12–1.26)	7	5.76 (0.45)	After excluding the uncontrolled study, the pooled relative risk reduction associated with handwashing came down to 16% (95% CI 11–21%). There was no evidence of heterogeneity between the remaining seven data points.
Excluding cross-over trial (Dyer *et al.* 2000)	1.19 (1.11–1.27)	6	5.51 (0.36)	Dyer *et al.* (2000) was the only cross-over trial, all other studies followed a parallel group design. Effect of excluding it showed a relative risk reduction as above. No evidence of heterogeneity.
Excluding poorest studies (Niffenegger (1997) and White *et al.* 2001)	1.18 (1.11–1.25)	5	3.91 (0.41)	Niffenegger (1997) and White *et al.* (2001) were excluded to test the pooled effect without the two studies with poorest quality. The resultant relative risk reduction was as above. No evidence of heterogeneity.

RR, relative risk.

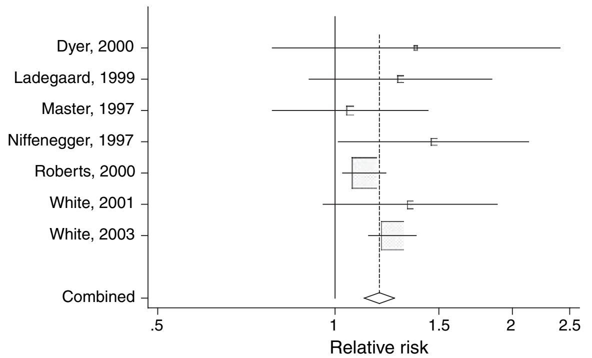

Figure 2 Forest plot of the seven studies pooled in meta-analysis.

Despite these limitations, the results show a coherent and significant pattern of impact of hand cleansing on ARI infection. This is impressive, but possibly not surprising, given the substantial body of evidence that handwashing can cut the risk of microbial and viral hand contamination and prevent nosocomial infection. This study adds evidence to a pattern of findings suggesting that ARIs and other contagious illnesses can be prevented by handwashing. These include microbiological studies, hospital-based studies and studies concerning other infections (Curtis & Cairncross 2003). Huge sums have been spent on the search for effective counter-measures to ARIs, especially to develop vaccines against influenza, respiratory syncytial virus, Hib B, SARS (Chin *et al.* 1969; Fulginiti *et al.* 1969; Osterhaus & De Vries 1992) and now Asian 'flu. As ARIs are caused by over 200 different organisms, any one vaccine will have a limited effect on the burden of disease.

If hand cleansing can reduce the risk of ARIs by 16% and diarrhoeal disease by almost half (Curtis & Cairncross 2003), then it may represent a feasible option for developing countries, where handwashing rates are currently low, but soap and water are, in most cases, readily available (Scott *et al.* 2003). Small-scale studies have shown that improving handwashing is possible (Pinfold & Horan 1996; Curtis *et al.* 2001) and a recent global public–private partnership for handwashing (http://www.globalhandwash.org) is promoting handwashing in national scale programmes.

Although suggestive, the quality of the current evidence concerning handwashing and ARIs is very poor. Randomised-controlled trials to rigorously investigate the impact of handwashing on morbidity and mortality in all settings, but especially in developing countries, are urgently needed.

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in the writing of the report or in the decision to submit the paper for publication.

Conflict of interest statement

The grant from Unilever PLC could be viewed as constituting a conflict of interest as we suggest that handwashing with soap could prevent respiratory tract infection. However, our main commercially related interest is in encouraging soap companies to do more to promote hygiene and public health.

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Le lavage des mains et le risque d'infections respiratoires: Une révision systématique quantitative

OBJECTIF Déterminer l'effet du lavage des mains sur le risque d'infections respiratoires.
MÉTHODES Nous avons effectué des recherches sur PubMed, CAB Abstracts, Embase, Web of Science et la bibliothèque Cochrane pour des articles publiés avant Juin 2004 en toutes langues. Nous avons aussi recherché manuellement les listes de références de toute publication primaire ou des articles de révision. Les études ont été incluses dans notre révision si elles rapportaient l'impact d'une intervention à promouvoir le lavage des mains sur les infections respiratoires. Les études portant sur les infections acquises à l'hôpital ou dans les services de santé avec prise en charge à long terme ou par des personnes à immunité compromise ou âgées ont été exclues. Nous avons évalué chaque étude indépendamment et les décisions pour l'inclusion ont été prises par consensus. D'une liste de départ de 410 articles, 8 études d'intervention ont satisfait aux critères d'éligibilitè.
RÉSULTATS Toutes les 8 études ont rapporté que le lavage des mains diminuait le risque d'infections respiratoire. La diminution du risque allait de 6 à 44% (valeurs cumulées 24%; IC95%: 6–40%). Le seul cumule des résultats de 7 études homogènes a donné un risque relatif de 1,19 (IC95%: 1,12–1,26%), suggérant que le lavage des mains peu réduire le risque d'infection respiratoire de 16% (IC95%: 11–21%).
CONCLUSION Le lavage des mains est associé avec une diminution des infections respiratoires. Cependant, les études étaient de pauvre qualité, aucune ne portait sur des pays en développement et une seule portait sur des maladies sévères. Des essais plus rigoureux de l'impact du lavage des mains sur la morbidité et la mortalité des infections respiratoires aigues sont urgemment nécessaires et plus particulièrement dans les pays en voie de développement.

mots clés lavage des mains, infections respiratoires, révision systématique, meta-analyse

Lavado de manos y riesgo de infecciones respiratorias: una revisión cuantitativa sistemática

OBJETIVO Determinar el efecto del lavado de manos en el riesgo de infección respiratoria
MÉTODO Se hizo una búsqueda en PubMed, CAB Abstracts, Embase, Web of Science, y la Cochrane library de artículos publicados, en todos los idiomas, antes de Junio del 2004. Se buscó a mano las listas de referencias de todos los artículos primarios y de revisión. Se incluyeron en la revisión aquellos estudios que reportaran el impacto sobre infecciones respiratorias de una intervención para promover el lavado de manos. Se excluyeron los estudios relacionados con infecciones nosocomiales, instalaciones de cuidados a largo plazo, personas inmuno-suprimidas o personas mayores. Nosotros, independientemente, evaluamos todos los estudios, y la decisión de incluirlos o excluirlos fue consensuada. De una lista inicial de 410 artículos, ocho estudios de intervención tenían los criterios para ser elegidos.
RESULTADOS Los ocho estudios elegibles reportaban que el lavado de manos disminuía el riesgo de infecciones respiratorias, con reducción del riesgo de entre un 6 a un 44% (valor combinado 24% (95% IC 6%-40%). Agrupando los resultados de los sete estudios homogéneos se obtenía un riesgo relativo del 1.19 (95% IC 1.12 – 1.26), lo cual implica que el lavado de manos puede disminuir el riesgo de infección respiratoria en un 16% (95% IC 11 a 21%).
CONCLUSIONES El lavado de manos está asociado con una disminución de la infección respiratoria. Sin embargo, los estudios analizados eran de baja calidad, ninguno relacionado con países de baja renta, y solo uno de ellos con enfermedad severa. Se requieren con urgencia ensayos rigurosos sobre el impacto del lavado de manos en la morbilidad y mortalidad por infecciones respiratorias, especialmente en países de baja renta.

palabras clave lavado de manos, infecciones respiratorias, revisión sistemática, meta-análisis