

Effectiveness of handwashing in preventing SARS: a review

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Summary

This review examines the literature, including literature in Chinese, on the effectiveness of handwashing as an intervention against severe acute respiratory syndrome (SARS) transmission. Nine of 10 epidemiological studies reviewed showed that handwashing was protective against SARS when comparing infected cases and non-infected controls in univariate analysis, but only in three studies was this result statistically significant in multivariate analysis. There is reason to believe that this is because most of the studies were too small. The evidence for the effectiveness of handwashing as a measure against SARS transmission in health care and community settings is suggestive, but not conclusive.

keywords severe acute respiratory syndrome, handwashing, hygiene, communicable disease control, public health intervention

Introduction

Severe acute respiratory syndrome (SARS) is a novel disease caused by a newly discovered coronavirus (Donnelly *et al.* 2004; Poon *et al.* 2004). Its outbreak in 2002 and 2003 caused great concern and panic globally (Anderson *et al.* 2004), especially in the epidemic areas, namely Guangdong (He *et al.* 2003; Zhong *et al.* 2003), Beijing (Pang *et al.* 2003; Liang *et al.* 2004), Hong Kong (Leung *et al.* 2004; Peiris & Guan 2004), Taiwan (Hsieh *et al.* 2004; Hsueh & Yang 2005), Hanoi (Le *et al.* 2004; Vu *et al.* 2004), Singapore (Ooi *et al.* 2005; SARS Investigation Team from DMERI and SGH 2005) and Toronto (Svoboda *et al.* 2004).

It is now widely accepted that the primary transmission modes of SARS are respiratory droplet and direct contact (World Health Organization 2003). The evidence for airborne transmission is limited (Olsen *et al.* 2003; Wilder-Smith *et al.* 2003; Breugelmans *et al.* 2004; Tong *et al.* 2004; Yu *et al.* 2004; He *et al.* 2005) but the risk of environmental infection and transmission through human excreta and fomites should not be excluded (Dowell *et al.* 2004; Lau *et al.* 2004b; Poutanen & McGeer 2004; Wang *et al.* 2005).

Handwashing and the prevention of acute respiratory infections

Handwashing has long been regarded as a significant preventive measure against diarrhoeal diseases. However, its effectiveness against respiratory infections has been

neglected. Recently, there has been growing awareness of its importance not only as a diarrhoeal disease prevention measure (Curtis & Cairncross 2003; Fewtrell *et al.* 2005) but also as part of a wider public health effort to relieve the disease burden of acute respiratory infections worldwide (Roberts *et al.* 2000; Ryan *et al.* 2001; Luby *et al.* 2005; Rabie & Curtis 2006). The importance of handwashing has also been underlined in a recent review of measures to control the spread of pandemic influenza (World Health Organization Writing Group 2006).

It has been suggested that there are two possible links between the prevention of diarrhoeal diseases and of respiratory diseases through handwashing (Cairncross 2003). The first is that certain pathogens might cause both. The second is transmission through hand contact with fomites. Both enteric and respiratory pathogens are often transmitted on surfaces of domestic and communal objects. Frequent contact between fomites, hands and faces is a likely transmission route. Handwashing (preferably with soap) can interrupt this transmission. The SARS outbreak has given this issue greater urgency. In a recent review of SARS prevention measures, Gamage *et al.* (2005) mentioned handwashing as a type of environmental decontamination. However, they located only the study by Seto *et al.* (2003) and not the others discussed below.

There has also been a growing interest in alcohol-based hand sanitizer or hand gel for home and institutional use. Intervention studies using alcohol gel hand sanitizer reported a reduction in school absenteeism as a result of respiratory illnesses (Hammond *et al.* 2000), fewer upper

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respiratory symptoms, lower illness rates and lower absenteeism among university dormitory residents (White *et al.* 2003, 2005), reduced nosocomial respiratory infections in extended care facilities (Fendler *et al.* 2002) and lower secondary respiratory infection rates in the home setting (Lee *et al.* 2005). However, no studies of the impact on SARS of these specific products were located in this review.

The purpose of this review is to examine the currently available evidence for handwashing as a protective measure against SARS infection.

Methods

Data for this review were identified by searches online through Pubmed, Cochrane Library and Wan Fang database (<http://www.wanfangdata.com.cn>), where archives of most mainland Chinese biomedical journals published in the last 5 years are available online, as well as references from relevant articles; many articles were identified through searches of the extensive files of the authors. Search terms were 'SARS', 'respiratory tract infections', 'handwashing' and 'communicable disease control'. English and Chinese language papers were reviewed. Altogether, at least 600 papers in English and Chinese were identified by their titles and more than 100 were obtained and screened for inclusion in this review. Only studies providing a measure of the effect of handwashing or other hand hygiene procedures against SARS were included.

Pooled analysis was not performed, as studies were observational, with heterogeneous settings and subject to confounding (Chalmers *et al.* 2001).

Results

We found 10 case-control studies which examined the effectiveness of different protective measures, including handwashing, against SARS. Four of these were published in Chinese. Six studies investigated the effect of personal protective equipment as precautionary measures against SARS infection but did not cover handwashing practices (Le *et al.* 2004; Ho *et al.* 2003; Fan *et al.* 2004; Loeb *et al.* 2004; Park *et al.* 2004; Chia *et al.* 2005). One study excluded hand hygiene because accurate assessment was difficult (Chen *et al.* 2005). In a retrospective study in a hospital designated to receive SARS patients in Shenzhen City, Guangdong, China, self-reported compliance with handwashing practices among the health care workers (HCWs) who had contacts with SARS patients was 100% ($n = 72$) and no nosocomial infections were reported (Luo *et al.* 2004).

Effectiveness of handwashing as a protective measure against severe acute respiratory syndrome

Of the 10 epidemiological studies found of the effectiveness of handwashing and other protective measures against SARS infection, one was performed in Singapore (Teleman *et al.* 2004), two in Guangdong province (Yin *et al.* 2004; Zou *et al.* 2004), two in Guangzhou, the provincial capital of Guangdong (Gao *et al.* 2003; Lin *et al.* 2003), one in Hanoi (Nishiura *et al.* 2005), three in Hong Kong (Seto *et al.* 2003; Lau *et al.* 2004a,c) and one in Beijing (Wu *et al.* 2004). All 10 were case-control studies, of which nine showed that handwashing was a protective factor when comparing infected cases and uninfected controls in univariate analysis (Table 1).

Singapore (nosocomial). The Singapore hospital-based case-control study involved 36 cases and 50 controls, who were 'all HCWs from SARS-affected wards who reported exposure to patients with probable SARS during the same period' (Teleman *et al.* 2004) with the controls being uninfected workers from the same wards. Exposure of the controls was established 'where there was a history of being within close physical proximity (1 m) of a patient subsequently confirmed with SARS. For all patients not subsequently confirmed by serology, controls were excluded from final analysis'. Those controls whose exposure was not established were also excluded. Telephone interviews were conducted, using a closed questionnaire. Among other questions, the interviewees were asked whether they washed their hands consistently after contacting each patient.

Using univariate analysis, handwashing consistently after contacting each patient was protective [crude odds ratio (OR) = 0.06, 95% confidence interval (CI) 0.007–0.5, $P = 0.03$]. Wearing of N95 masks also conferred protection (OR = 0.1, 95% CI 0.03–0.4, $P = 0.001$). With logistic regression analysis, the adjusted OR for handwashing was 0.07 (95% CI 0.008–0.66, $P = 0.02$), while that for wearing N95 masks was 0.1 (95% CI 0.02–0.86, $P = 0.04$). Thus handwashing after attending each patient reduced the odds of infection 15-fold, after adjustment for the use of masks and other possible confounding factors. In this study, the respondents were not asked whether they used soap to wash their hands.

Guangdong 1 (nosocomial). This Guangdong case-control study (Yin *et al.* 2004), by the Chinese Centre for Disease Control and Prevention (CDC), Guangdong Provincial CDC and Guangzhou (i.e. Canton) Municipal CDC, involved 77 cases and 180 controls, who were HCWs from

I. C-H. Fung & S. Cairncross **Effectiveness of handwashing in preventing SARS****Table 1** Results of epidemiological studies of handwashing as a protective measure against SARS infection

Location (reference)	Definition of 'handwashing'	Total number of cases	Total number of controls	Univariate analysis		Multivariate analysis	
				OR (95% CI)	P-value	OR (95% CI)	P-value
Singapore (Teleman <i>et al.</i> 2004)	Wash hands consistently after contacting each patient	36 HCWs	50 HCWs	0.06 (0.007-0.5)	0.03	0.07 (0.008-0.66)	0.02
Guangdong 1 (Yin <i>et al.</i> 2004)	Handwashing and disinfecting	77 HCWs	180 HCWs	0.49 (0.28-0.85)	<0.05	NS	NS
Guangdong 2 (Zou <i>et al.</i> 2004)	Sterilizing hands after every contact with SARS patients	152 HCWs	1493 HCWs	0.64	<0.01	0.24 (0.063-0.92)	<0.001
	Presence of non-contact handwashing equipment in the office			0.46	<0.01	0.15 (0.025-0.86)	<0.001
Guangzhou 1 (Gao <i>et al.</i> 2003)	Disinfect and wash hands every time	22 HCWs	64 HCWs	0.11 (0.01-0.90)	0.034	N/A	N/A
Guangzhou 2 (Lin <i>et al.</i> 2003)	Wash hands and disinfect	118 HCWs	308 HCWs	Not available§	<0.05	NS	NS
Hanoi (Nishiura <i>et al.</i> 2005)	Stage 1: wash hands before contacts with a patient	25 (22 HCWs, two administrative staff and one patient's relative)	90 (48 HCWs, 11 administrative staff and 41 patients' relatives)	1.0 (0.4-2.3)	0.94	NS	NS
	Wash hands after contacts with a patient			1.1 (0.5-2.8)	0.77	NS	NS
	Stages 2 & 3: wash hands before contacts with a patient	4 HCWs (doctors and nurses only)¶	26 HCWs (doctors and nurses only)¶	NC	1.00	N/A	N/A
Hong Kong 1 (Seto <i>et al.</i> 2003)	Wash hands after contacts with a patient			NC	1.00	N/A	N/A
	Wash hands during patient care ('yes' and 'most of the time')	13 HCWs	241 HCWs	0.2 (0.053-1.0)	0.047	NS	NS
Hong Kong 2 (Lau <i>et al.</i> 2004a)	Handwashing after contact with SARS patients‡	72 HCWs	144 HCWs (matched)	0.21 (0-2.63) †	0.22	N/A	N/A
	Handwashing after contact with patients in general‡			1.00 (0.05-50.00) †	1.00	N/A	N/A
	Handwashing when there was no patient contact‡			0.16 (0.03-0.61) †	0.004	NS	NS
Hong Kong 3 (Lau <i>et al.</i> 2004c)	Wash hands >10 times a day	330 with undefined source of infection	660 matched controls drawn from random telephone survey	0.44 (0.31-0.63) †	<0.005	0.58 (0.38-0.87)†	0.008

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Location (reference)	Definition of 'handwashing'	Total number of cases	Total number of controls	Univariate analysis		Multivariate analysis	
				OR (95% CI)	P-value	OR (95% CI)	P-value
Hong Kong 3 (continued)	Wash hands >10 times a day	118 whose source of infection remained undefined (likely to be community-acquired)	236 matched controls	N/A	N/A	0.44†	0.008
Beijing (Wu <i>et al.</i> 2004)	Always washed hands before eating	94 unlinked, probable SARS patients (not HCWs)	281 matched controls drawn from telephone sequential digit dialling	0.6 (0.3–1.1) †	0.11	NS	NS
	Always washed hands after using restrooms			0.5 (0.2–1.2) †	0.10	NS	NS
	Always washed hands after returning home			0.3 (0.2–0.7) †	0.003	NS	NS

CI, confidence interval; HCW, healthcare workers; OR, odds ratio; SARS, severe acute respiratory syndrome; N/A, not applied; NC, not calculable; NS, not significant.

†Matched odds ratio.

‡Frequency of hand-washing coded into two categories: used consistently ('most or all of the time') and used inconsistently ('never or occasionally').

§Between 0.160–0.698, exact figure not available from the paper.

¶Excluding radiologists and other co-medical workers.

10 hospitals who accessed the isolation wards of SARS patients and participated in direct first aid for severe SARS patients. 'Handwashing and disinfecting' gave an OR of 0.49 (95% CI 0.28–0.85), which indicates that it was protective against SARS infection. However, this variable was not included in the final model of stepwise logistic regression as it was not significant. Three protective measures were significant in the regression model: the use of 12-layer masks (OR = 0.78, 95% CI 0.60–0.99), goggles when necessary (OR = 0.20, 95% CI 0.10–0.41) and footwear (OR = 0.58, 95% CI 0.39–0.86). Again, soap was not mentioned in this study and we are not sure how the investigators defined 'disinfecting'. It could refer to the use of soap, but more probably to the use of disinfectants.

Guangdong 2 (nosocomial)

Another Guangdong case-control study involved 152 cases and 1493 controls, who were HCWs from nine hospitals in the province (seven in Guangzhou city and two in Jiangmen city; Zou *et al.* 2004). All of them had contacts with confirmed or probable SARS cases. 'Sterilizing your hands after contact with SARS patients every time' gave an OR of 0.64 ($P < 0.01$) in univariate analysis and 0.24 (95% CI 0.063–0.92, $P < 0.001$) in multivariate analysis. 'Sterilizing' might include the application of alcohol-based hand gels. The use of soap was not mentioned but might be included.

The presence of non-contact handwashing equipment in the office gave an OR of 0.46 ($P < 0.01$) in univariate analysis and 0.15 (95% CI 0.025–0.86, $P < 0.001$) in multivariate analysis. The authors of the paper suggested that traditional water taps should be replaced by automatic or paddle taps to avoid transmission via fomites. However, it had been reported that although introducing an automated sink in intensive care units might lead to a significant improvement in the quality of handwashing among HCWs, it might also reduce handwashing frequency because of the additional time involved (Larson *et al.* 1991; Naikoba & Hayward 2001).

Guangzhou 1 (nosocomial)

This small case-control study was conducted in Guangzhou city, the provincial capital of Guangdong, in one of the first hospitals in the province to receive SARS patients (Gao *et al.* 2003). The hospital received its first case (a severely ill SARS patient from another place in Guangdong province) on 22 December 2002. The first case of nosocomial infection of a HCW in the hospital was on 13 January 2003, while the last was on 23 April. Altogether 25 HCWs (11 physicians, 12 nurses and two other staff members) were infected.

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The study involved 22 cases and 64 controls. They were all HCWs. It was found that 'disinfecting and washing hands every time' was protective with an OR of 0.11 (95% CI 0.01–0.90, $P < 0.034$) in univariate analysis. Multivariate analysis was not performed. The term 'disinfecting' might imply that alcohol-based hand gels were used. The use of soap was not mentioned but might be included.

Guangzhou 2 (nosocomial). This study included nine hospitals in Guangzhou city which received a relatively large cohort of patients and thus were representative of the scenario in the city (Lin *et al.* 2003). The case-control analysis section of the study involved 426 HCWs who had participated in treating SARS patients in seven of the nine hospitals. 118 were cases and 308 were controls. It was found that 'washing hands and disinfecting' was among the 11 protective factors in univariate analysis. The exact OR of each factor was not published, but the range of OR of these 11 protective factors was 0.160–0.698 (all $P < 0.05$). However, 'washing hands and disinfecting' was found to be non-significant in multivariate analysis. As noted before, 'disinfecting' might include the application of alcohol-based hand gels. The use of soap was not mentioned but might be included.

Hanoi (nosocomial). This case-control study was performed in Hanoi French Hospital (HFH) where the first SARS case in Viet Nam was hospitalized (Nishiura *et al.* 2005). The outbreak in HFH consisted of three stages: Stage 1, from admission of the index case to the onset of secondary cases; Stage 2, from the suspicion of nosocomial spread to closure of the hospital; and Stage 3, from strict isolation to local eradication.

The study involved 29 cases (out of 38 laboratory-confirmed SARS cases) and 98 controls in total. Of the 29 cases, 28 were HFH employees (26 HCWs and two receptionist and administrative staff) and one was a patient's relative. The other nine SARS patients who did not participate were either dead because of SARS and/or respiratory failure (five or 13.2%), refusing to participate (one or 2.6%) or had been relocated (three or 7.9%). Controls were selected among 'those thought to have had contact with confirmed cases inside the hospital based on contact investigations', provided that they were Vietnamese, aged more than 20 years and had given their written consent. Among the controls, 57 were HFH employees (46 HCWs and 11 receptionists and administrative staff members) while 41 were relatives of patients.

Univariate analysis of precautionary measures taken by 25 cases and 90 controls in Stage 1 found no association between handwashing, whether before or after contact

with a patient and being infected, with ORs of 1.0 (95% CI 0.4–2.3) and 1.1 (95% CI 0.5–2.8) respectively (Table 1).

Analysis in Stages 2 and 3 was limited to doctors and nurses who had probable contact in these stages and whose incubation period was within 95% CI of having occurred after the beginning of Stage 2 (four cases and 26 controls). It is not possible to find any association as all the four SARS cases and 25 of the 26 controls claimed that they washed their hands before and after having contact with a patient. This study did not mention whether the participants washed their hands with soap.

Hong Kong 1 (nosocomial). The case-control study performed by the University of Hong Kong, also hospital-based, involved 13 cases and 241 controls using self-completed questionnaires (Seto *et al.* 2003). Both the cases and controls were HCWs 'with documented exposures to 11 index patients with SARS during patient care.... They were listed on the current roster in the clinical regions providing care for index patients with SARS'. Only those who affirmed that they had cared for the named index patients were interviewed. Among other questions, they were asked whether they washed their hands during patient care (options available: yes, most of the time or no). Univariate analysis showed that handwashing ('Yes' and 'most of the time' were grouped together) was protective (OR = 0.2, 95% CI 0.053–1.0, $P = 0.047$). However, logistic regression (with forward stepwise selection) of the use of masks, gowns, gloves and handwashing showed that only use of masks was significant while the other measures were not. The authors concluded that in hospital, handwashing adds no significant protection to the mask, which seems to be essential for protection. In this study, the respondents were not asked whether they used soap to wash their hands.

Hong Kong 2 (nosocomial). This was a 1:2 matched case-control study of 72 cases and 144 controls (Lau *et al.* 2004a). Both groups were hospital workers who had been working in wards with SARS inpatients, some of which also included non-SARS patients. Controls were recruited by asking the cases to nominate 'two colleagues who had been working in the same job position, in the same ward and in proximity with the case-patient before he became ill' (Lau *et al.* 2004a).

In the questionnaire, three questions were asked about the frequency of handwashing after making contact with (1) SARS patients, (2) patients in general and (3) when there was no patient contact. The four possible answers to each question were grouped into two categories for

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analysis: inconsistently ('never' or 'occasionally') and consistently ('most of the time' and 'all of the time').

Most cases and controls reported that they consistently washed their hands after direct contact with SARS patients and patients in general, so these two factors are not significant in the univariate analysis ($P = 0.22$ and $P = 1.00$ respectively, Table 1). On the other hand, washing hands consistently when there was 'no patient contact' was found to be a statistically significant protective factor (matched OR = 0.16, 95% CI 0.03–0.61) in the univariate analysis. However, it was not statistically significant in the multivariate analysis.

Inconsistent handwashing when there was 'no patient contact' was one of the seven factors identified in the unadjusted analysis as significantly associated with a risk of SARS infection. The other six were (1) inconsistent use of at least one type of personal protection equipment when having contact with SARS patients or (2) with 'patients in general' or (3) when there was 'no patient contact', (4) SARS infection control training <2 h, (5) the respondent reported not understanding SARS infection control procedures and (6) at least one item of personal protection equipment was perceived to be in inadequate supply in the three settings. The authors constructed an indicator variable by counting how many of the above factors applied to each individual. It was found that the risk increased greatly with the number of factors (OR = 44.2 for three or more problems, $P < 0.0001$) (Lau *et al.* 2004a).

Hong Kong 3 (community acquired). This 1:2 matched case-control study performed by the Chinese University of Hong Kong was different from the eight above. It was a telephone survey of households of 'all probable SARS patients whose cases were reported to the Department of Health on or before May 16, 2003 ($n = 1690$)' (Lau *et al.* 2004c). Of the 1690 probable cases, 140 patients (8.2%) did not have a correct telephone number, 163 (9.6%) could not be contacted after at least five attempts, 163 (9.6%) refused to participate and 10 (0.6%) were either not in Hong Kong or could not communicate in English or Chinese. The remaining 1214 patients (72%) from 996 households were interviewed. Apart from 22 with incomplete questionnaires, the data for 1192 of these 1214 patients were analysed. A total of 727 patients fell into one or more of the following four categories: (1) probable cases of secondary or tertiary household transmission, (2) hospital workers, (3) residents in the Amoy Gardens or (4) inpatients who had been hospitalized for diseases other than SARS and kept on wards with SARS patients. Another 118 patients were in contact with a SARS patient within a 10-day period before onset of fever. The source of infection

of the remaining 347 (29.1% of 1192) was undefined. Excluding 17 patients who were below 16 years of age, 330 SARS patients aged 16 years or above became the cases of the case-control study. Two controls per case, matched for age and sex, were drawn by a random telephone survey.

Univariate analysis showed that cases were less likely than controls to have washed their hands more than 10 times a day (18.4% *vs.* 33.7%, OR = 0.44, 95% CI 0.31–0.63, $P < 0.005$). Multivariate analysis gave an adjusted OR of 0.58 (95% CI 0.38–0.87) and P -value of 0.008. The other protective factors included in the regression model were: using a mask frequently in public places (adjusted OR = 0.27, $P < 0.001$) and disinfecting the living quarters thoroughly (adjusted OR = 0.41, $P < 0.001$). The significant risk factors included in the regression model were (1) having visited mainland China (OR = 1.95, $P = 0.020$), (2) having visited Amoy Gardens where a cluster of cases had occurred (OR = 7.63, $P < 0.001$), (3) having visited the Prince of Wales Hospital (OR = 7.07, $P < 0.001$) and (4) having visited other hospitals and clinics (OR = 3.70, $P < 0.001$).

The study authors then moved on to a second round of analysis, in which they excluded the 212 cases 'who may have contracted SARS after visiting Amoy Gardens, the Prince of Wales Hospital, other hospitals or an affected country, including mainland China, Singapore and Taiwan' and their matched controls (Lau *et al.* 2004c). The remaining 118 cases were considered likely to have acquired SARS through unknown sources of transmission in the community. Once again, univariate and multivariate conditional logistic regression analyses gave similar results. The adjusted OR for washing hands more than 10 times a day was 0.44 and the P -value was 0.008. Wearing a mask in public places (adjusted OR = 0.36, $P < 0.001$) and disinfecting the living quarters thoroughly (adjusted OR = 0.36, $P < 0.001$) were also protective. The respondents were not asked whether they used soap to wash their hands.

Beijing (community acquired). This 1:3 matched case-control study examined the risk factors for SARS among those without known contact with SARS patients (Wu *et al.* 2004). A total of 94 unlinked, probable SARS patients were compared with 281 community-based controls matched for sex and age group. Patients who met the 'probable case definition and reported no close contact with any known, probable or suspected SARS patients' were eligible for enrolment. Patients who were HCWs were excluded from the study.

Three controls were selected for each case by sequence digit dialling, by adding to or subtracting from the last digit of the case-patient's home telephone number by one digit

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in an alternating sequence until three controls were enrolled, matched by age group and sex. As telephone number prefixes are geographically clustered in Beijing, this strategy was intended to provide neighbourhood matching.

Of a total of 1091 probable SARS case-patients without a history of contact with other SARS patients, 373 were called from the master list until 100 were successfully interviewed. The refusal rate was about 50% among patients who could be reached. Six matched sets were excluded; four cases were reclassified as HCWs after interview and controls in the other two sets were below 14 years of age.

In the univariate analysis, it was found that having 'always washed hands after returning home' was a protective factor, with a matched OR of 0.3 (95% CI 0.2–0.7, $P = 0.003$). However, it was not significant in the multivariate analysis. Having 'always washed hands before eating' (matched OR = 0.6, 95% CI 0.3–1.1, $P = 0.11$) and having 'always washed hands after using restrooms' (matched OR = 0.5, 95% CI 0.2–1.2, $P = 0.10$) were protective yet statistically insignificant in the univariate analysis.

The authors mentioned the possible limitations of this study, including recall bias (interviewed late in the Beijing epidemic), low participation rate raising the possibility of selection bias, unknown representativeness of the control population from the telephone survey and the insufficient number of samples for serological tests.

Discussion

Is handwashing an effective measure against SARS transmission? The evidence available is somewhat ambivalent. Nine out of the 10 epidemiological studies which evaluated the effect of handwashing as a precautionary measure against SARS found that handwashing was significantly associated with reduced chances of acquiring SARS, whether in hospital or community settings, in the univariate analysis; but once entered into multiple regression, the association remained significant in only three studies (Table 1). The study in Hanoi found no association at all.

A possible contributory factor is the use of self-reported, rather than observed compliance with hand hygiene as the exposure in the studies reviewed. However, the fact that a significant association with SARS was found in three studies and a recent evaluation of self-reporting in a hospital setting (Moret *et al.* 2004), suggest that self-reporting has some validity for detecting differences if not for measuring the overall compliance rate.

Two other factors make it difficult to obtain irrefutable evidence for the effect of handwashing. First, there is a

problem of collinearity between handwashing and other protective measures, especially mask wearing, because most of the time, the same people apply both methods of protection, although a survey during the SARS outbreak among travellers crossing the Hong Kong-mainland China border suggests that this might not always be true (Lau *et al.* 2004d).

Secondly, the very high rates of compliance with handwashing advice found in some studies, particularly among health workers (e.g. Hong Kong 2; Lau *et al.* 2004a) meant that the numbers in the exposed groups were too small to detect a significant association. We believe that it is no coincidence that the largest two of the studies we have found are among the three which found a significant effect of handwashing. We conclude that the evidence suggests that handwashing may be effective against SARS. However, it is not conclusive.

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Efficacité du lavage des mains dans la prévention du SRAS: une revue de la littérature

Cette revue a analysé des articles chinois sur l'efficacité du lavage des mains comme intervention contre la transmission du syndrome respiratoire aigu sévère (SRAS). 9 sur 10 études épidémiologiques analysées rapportent que le lavage des mains est protecteur contre le SRAS dans la comparaison de cas infectés à des contrôles sains dans des analyses univariées. Mais, seules 3 études avaient des résultats statistiquement significatifs dans une analyse multivariée. Cela pourrait être due au faible nombre d'échantillons dans la plupart des études. L'évidence de l'efficacité du lavage des mains contre la transmission du SRAS dans les services de soins de santé et dans la communauté est suggestive mais non conclusive.

mots clés syndrome respiratoire aigu sévère, lavage des mains, hygiène, contrôle de maladies contagieuses, intervention de santé publique

I. C-H. Fung & S. Cairncross **Effectiveness of handwashing in preventing SARS****Revisión sobre la efectividad del lavado de manos en la prevención del SARS**

Se ha revisado la literatura disponible, incluida la China, sobre la efectividad del lavado de manos como una intervención contra la transmisión del SARS. Nueve de diez estudios epidemiológicos revisados demostraban que el lavado de manos era protector frente al SARS cuando se comparaban mediante un análisis univariado los casos infectados y los controles no infectados, pero solo en tres de estos estudios era el resultado estadísticamente significativo en un análisis multivariado. Existen razones para creer que esto se debe a que la mayoría de los estudios eran demasiado pequeños. La evidencia de la efectividad del lavado de manos como una medida frente a la transmisión del SARS en la atención sanitaria y la comunidad es sugerente, más no concluyente.

palabras clave síndrome respiratorio agudo severo, lavado de manos, higiene, control de enfermedades comunicables, intervención en salud pública