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Handwashing practices and challenges in Bangladesh

B.A. HOQUE

Environment and Population Research Center, EPRC, Bangladesh

Handwashing is universally promoted in health interventions. Studies in Bangladesh and elsewhere have shown a 14–40% reduction of diarrhoeal diseases with handwashing. The perceptions and methods related to washing of hands vary widely in Bangladesh. Socio-economic factors are also associated with methods practised. In general, the effectiveness of handwashing practices is poor. Faecal coliform bacteriological counts were reported to be high for both left and right hands. About 85% of women studied who lived in slums and 41% of rural women washed their hands using only water. However, most women rubbed their hands on the ground, or used soil, and rinsed them with water during post-defecation handwashing. Most women claimed that they could not afford to buy soap. Experimental trials showed that use of soap, ash or soil gave similar results when women washed their hands under the same conditions. The washing of both hands, rubbing of hands, and the amount and quality of rinsing water used were found to be important determinants in the reduction of bacterial counts on hands. Although handwashing messages have been revised by most of the main programmes after these studies, there is scope for further improvement, as well as evaluation of their impact.

Keywords: handwashing; defecation; Bangladesh; ash; soil.

Introduction

Studies in Bangladesh (Kahn 1982; Aziz *et al*. 1983; Rahman 1983; Stanton and Clemens 1988) and elsewhere (Black *et al*. 1981; Pinfold *et al*. 1988; Kaltenhaler *et al*. 1988; Wilson *et al*. 1991) have shown that there is a reduction in the incidence of diarrhoeal disease of 14–40% associated with handwashing. Worldwide, handwashing is one of the few practices that has been universally promoted by people of various religions and cultures throughout the ages. However, it still remains an important challenge in the prevention of disease. This paper describes the practices and challenges of handwashing in Bangladesh.

Handwashing as a practice has been shaped by culturally learned patterns. Long-standing religious and secular patterns are involved in the ideas and behaviours of people with respect to cleanliness and handwashing techniques. Cleanliness for prayer is a particularly important concept among Muslims who must perform *ozu* by washing both their hands, arms up to the elbow, face and legs up to the knees – all of this three times – using clean water before every prayer session. The prayers are mandatory five times a day and there is a need to be 'clean' both in body and mind to perform them. Most South Asian groups share strong traditional concepts concerning the separation of the left hand from the right hand – each hand is used for specific purposes. One reason for this

Correspondence: B.A. Hoque, Environment and Population Research Center (EPRC), 1/7 Block E, Lalmatia, Dhaka, Bangladesh. Tel.: 880-2-8115376. E-mail: eprc@bol-online.com

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separation is that the left hand is used for cleaning post-defecation. Under these circumstances it may be surprising that Muslim people do rub their hands together in *ozu*. This suggests that handwashing behaviours on the Indian subcontinent are affected both by religious and secular ideas. Handwashing is also influenced by the availability of soap or another agent (Hoque and Briend 1991; Hoque *et al*. 1995a). Use of soap or ash is not common on the subcontinent because most of the population are very poor and cannot afford to buy soap (Nath 1993).

Method

A study was set up which reviewed data from earlier research by the author (Hoque *et al*. 1995a,b). The observations and implications were then compared in current contexts based on secondary data and the literature. The research included two studies on observation in rural and experimental conditions funded by the World Health Organization, Geneva and the United Nations Children's Fund (UNICEF), Bangladesh. During field research, existing rural handwashing practices after defecation and their effect on cleanliness outside toilets, were studied (Hoque *et al*. 1995a). One hundred women from randomly selected households in rural Bangladesh were observed and interviewed about handwashing. Bacteriological samples from the hands of women were collected and tested to measure the number of faecal coliform colony forming units found on each hand (Hoque *et al*. 1995b).

The experimental research included studying of modified and improved techniques of handwashing under controlled conditions (Hoque *et al*. 1995b). Sixty women washed their hands after defecation following five types of suggestion for improving handwashing techniques. The handwashing suggestions were designed based on observational data. Bacteriological samples were collected from the hands and tested to measure the number of faecal coliform colony forming units on each hand after the suggested improvement in handwashing. Of the five methods, the suggested technique that showed the best result compared with traditional washing – the control – was recommended and developed as an appropriate technique.

UNICEF has been promoting handwashing and other hygiene practices in Bangladesh for several decades. Subsequently, UNICEF included an important component of the developed technique in their national monitoring survey. They have collected information about use of soap, soil, ash and water only for handwashing after defecation and included the results in their reports since 1998 (Mitra *et al*. 1998; UNICEF 2002). Finally, data of handwashing practice from people who were interviewed during the recent survey by UNICEF was reviewed in the light of existing challenges.

Data analysis

The analysis of observational data was descriptive. A composite score for handwashing behaviour was computed based on observed handwashing components: use of both hands (= 1, other = 0), use of a washing agent (= 1, other = 0), rubbing hands more than three times (= 1, other = 0), and use of 0.7 litres of water or more (= 1, other = 0). The scores were then weighted by the proportion positive for each element. The score for washing agent use was computed to give different weights for soap and soil; 17 of a total of 90 women used soap giving a score for soap use of $1 - (17/90) = 0.81$. Thirty-six mothers used soil and therefore the score for soil use was weighted by a ratio of 36/73 (i.e. the number of

mothers remaining who did not use soap) to give a score of $1-(36/73) = 0.5$, i.e. a lower score than for soap use. This approach of weighting gave a higher score for those behaviours that were observed less frequently.

The women were divided into those having median scores or less and those having scores above the median, indicating poor or good handwashing behaviour, respectively. The association between socio-economic indicators and handwashing behaviour was evaluated. An analysis was also run without weighting the scores, giving a score of 2 for soap use and 1 for soil use and the results were not different. The experimental data were compared following *t*-test.

Results

Observational results

Of the 90 women observed washing their hands after defecation, 38% used mud, 2% used ash, 19% used soap, and 41% used water only without a rubbing agent. Those who used mud either rubbed their fingers and palms on the ground or scooped out a small amount of soil and rubbed it between their fingers and palms. Mud from different locations was used from near the cooking area, defecation site or living quarters. Altogether, 81% of non-soap users stated that they might use soap but they were unable to afford it.

A total of 44% of women washed both hands, while 56% washed only their left hands. Seventy-four per cent rinsed their hands with 0.7 litres of water or less, 48% used tube-well water and the rest used surface water. During 62% of all washing events, fingers were rubbed three times or more and the majority of women who used soap rubbed their fingers more than three times. About 78% of the women dried or wiped their hands on their clothes and the rest let them air dry.

Faecal coliform counts of hands before handwashing were 8,511 and 977 units per hand for left and right hands, respectively. Although the counts for the left hands were reduced significantly ($P < 0.01$) after the observed (usual) handwashing practices, they were still high (geometric mean: left hand = 1,995 and right hand = 1,318 faecal coliform units/hand).

A positive association was demonstrated between better socio-economic indicators or water sanitation practices, and good handwashing behaviour (Table 1). The age of the women, the education of the head of the family, and the size of the family were not associated with the quality of handwashing.

Experimental results

In order to test and develop appropriate techniques for handwashing, the various handwashing components during the observational study were tested separately and in different combinations. The optimal technique was found to involve the following components: washing of both hands, use of an agent, rubbing of the hand with the agent, and rinsing with water and drying.

Under experimental washing conditions all local washing agents – soil, soap and ash – showed similar results (Table 2). Although faecal coliform counts in soil varied according to the location of the soil (geometric mean counts in soil near the cooking area, soil near latrine and wet soil near latrine were 3,877, 4,000 and 7,010 of faecal coliforms/gramme of soil, respectively), their quality did not significantly affect the efficiency of handwashing. However, it is likely that dry soil from a clean place produces better results. The counts of faecal coliforms

Table 1. Association of socio-economic indicators with good handwashing behaviour for 90 women in rural Bangladesh

Socio-economic indicators	*Handwashing behaviour after defecation* [+]		*Relative rate* (95%CI)*
	Good	*Poor*	
1. Three or more years of schooling (women)			
Yes	24	14	1.64 (1.08 – 2.50)
No	20	32	
2. Tube-well water used for all needs			
Yes	18	10	1.53 (1.03 – 2.29)
No	26	36	
3. Own sanitary latrine used			
Yes	22	11	1.73 (1.15 – 2.59)
No	22	35	
4. Owner of a radio			
Yes	16	16	1.04 (0.67 – 1.60)
No	28	30	
5. Owner of agricultural land			
Yes	36	24	2.25 (1.20 – 4.22)
No	8	22	
6. Belief in washing hands to prevent disease			
Yes	26	27	1.01 (0.66 – 1.55)
No	21	18	

[+] See text for definition; composite weighted score was divided into < median = poor, > median = good.
*Indicates the association of good handwashing behaviour with the presence of the socio-economic indicator.

of hands after handwashing by rubbing hands on the ground (geometric mean of left hands = 971 and of right hands = 562 faecal coliforms/gramme) were significantly higher than every other handwashing practice. Lower faecal coliform counts of hands were observed with increased rubbing frequency. Also, an increased volume of water showed a lower faecal coliform count and the difference was found to be statistically significant when rinsing was performed using between 0.5 and 2 litres of water.

Compared with tube-well water, the use of pond water showed significantly higher counts for right hands. However, the quality of water also varied significantly. The geometric mean of the count of tube-well water was 32 faecal coliforms/100 ml and that of pond water was 17,330 faecal coliforms/100 ml. The practice of drying of hands on clothing tended to contaminate the hands (Table 2).

Handwashing practices reported by UNICEF

The difference is often substantial between what people know they should do and what is actually done (Mitra *et al*. 1998). The Baseline Survey of Awareness of 'Facts for Life' showed that two-thirds of the people interviewed, for example, are aware that after defecation hands should be washed with water and soap. Unfortunately, in reality, only about 9% actually do so. The 2000 UNICEF survey (UNICEF 2002) has reported information about handwashing practices (Table 3).

Table 2. Comparison of faecal coliform of count of hands under various experimental conditions

Experimental conditions	*Left hand: geometric mean (P values, 95% CI)*	*Right hand: geometric mean (P values, 95% CI)*
*Reference washing		
Soil (near kitchen), 6 rubbings and rinsing with 2 litres of tube-well water ($n = 83$)	129	89
(A) Washing agent		
Testing agents:		
Ash	98	54
($n = 84$)	($P = 0.5$; 0.33 – 1.74)	($P = 0.23$; 0.26 – 1.38)
Soap	195	112
($n = 60$)	($P = 0.25$; 0.74 – 3.02)	($P = 0.52$; 0.63 – 2.45)
(B) Testing of soil		
Soil (near latrine)	132	110
($n = 75$)	($P = 0.97$; 0.48 – 2.19)	($P = 0.57$; 0.6 – 2.45)
Soil (wet)	240	159
($n = 65$)	($P = 0.07$; 0.95 – 3.72)	($P = 0.09$; 0.91 – 3.47)
Rubbing hands on ground	977	562
($n = 65$)	($P = 0.001$; 3.63 – 13.18)	($P = 0.001$; 2.88 – 13.49)
(C) Testing rubbing frequencies		
3 times	200	132
($n = 73$)	($P = 0.20$; 0.79 – 3.02)	($P = 0.30$; 0.71 – 3.09)
(D) Testing volume of water used		
0.5 litres	269	234
($n = 75$)	($P = 0.05$; 1.01 – 4.37)	($P = 0.02$; 1.23 – 5.25)
1 litre	128	79
($n = 64$)	($P = 0.99$; 0.48 – 2.04)	($P = 0.71$; 0.44 – 1.74)
(E) Testing type of water		
Pond	288	263
($n = 75$)	($P = 0.01$; 1.23 – 4.17)	($P = 0.000$; 1.62 – 5.25)

*Reference handwashing for statistical comparison with every group. P value is for t-test of $\log_{10}$ transformed data comparing the reference washing group and the test group. The confidence interval is expressed as a ratio of the geometric means of the two compared groups.

Table 3. Handwashing practice post-defecation (%) according to area: UNICEF survey, 2000 (UNICEF 2002)

Area	*Water only*	*Water + soil*	*Water + ash*	*Water + soap*	*Other*
Metro city slum	30.8	44.3	18.0	6.3	0.6
Metro city non-slum	13.9	22.7	13.3	49.9	0.2
Metro cities	16.4	25.9	14.0	43.4	0.3
Other municipalities	10.0	38.6	20.5	30.4	0.4
All urban	13.3	32.1	17.2	37.0	0.3
All rural	21.5	55.5	19.5	3.4	0.2
All urban + rural	20.6	53.0	19.3	7.0	0.2

Discussion

Handwashing is a complex behaviour made up of several components. It involves the use of a cleaning agent, rubbing of hands (at varying frequency), rinsing hands with water and drying. During the unannounced visits of the observation studies most women were recorded as having washed their hands after defecation, but the method and handedness varied (Hoque *et al.* 1995a,b). Soil was used by most women who used a washing agent, while a substantial proportion of women washed one hand (the left hand) using water only. However, the efficiency of practical washing was questionable because in spite of the significant reduction in bacterial count after post-defecation handwashing, the hands remained highly contaminated. Socio-economic status and better sanitation practices were associated with use of soap and relatively good handwashing practices. People in Bangladesh tended to use soap more for peace of mind or for the physical feeling of cleanliness than for health reasons (UNICEF 2002).

Several studies over the decades have demonstrated that improvements in handwashing practices can lead to a reduction in morbidity caused by diarrhoeal disease (Black *et al.* 1981; Kahn *et al.* 1982; Aziz *et al.* 1983; Rahman 1983; Stanton and Clements 1988; Pinfold *et al.* 1988; Kaltenhaler *et al.* 1988; Wilson 1991). This would indicate that handwashing practices reduce the bacterial concentration of hands. Some projects in Bangladesh have tried to promote the use of ash for handwashing (Kahn *et al.* 1982; Aziz *et al.* 1983; Rahman 1983), while other programmes have emphasized the use of soap (Kahn *et al.* 1982; Wilson 1991). However, use of soap or ash is not common on the subcontinent as most of the 1.2 billion people are too poor to afford soap (Aziz *et al.* 1983; Stanton and Clements 1988; Hoque and Briend 1991; Hoque *et al.* 1995a). Ash is not easily available in city slums where gas or kerosene is used for cooking (Hoque and Briend 1991). Promoting a behaviour that conflicts with economic and other factors is unlikely to be effective. Moreover, it may be inappropriate to design behavioural interventions without considering existing practices.

Under controlled experimental conditions, soap, soil and ash gave similar microbiological results for hand cleaning when both hands were rubbed, and the rubbing frequency and rinsing conditions were similar. This indicates that the rubbing of both hands using an agent and rinsing with water actually cleans hands. Clearly, proper adoption of handwashing technique with soap as an agent is likely to be the best option. As use of soil and ash may pose health risks, it can be further tested for by measuring virus and bacteria under varying conditions. In the meantime, the promotion of the complete technique using clean and dried soil or ash may be preferable over no agent when soap is not affordable or available. However, appropriate efforts should be undertaken to make soap available and affordable for all people.

Conclusion

Appropriate handwashing technique should involve the following procedure: use of both hands, use of an agent, rubbing of hands with the agent, rinsing with water and finally drying. Generally, handwashing practice is still poor in Bangladesh. Further studies and follow-up programmes are required for the appropriate development and promotion of handwashing in developing countries.

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