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Prevention of diarrhoea and dysentery by hand washing

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Abstract

A 'non-blind' randomized hand washing intervention study was conducted in a low socioeconomic community in Rangoon to determine if hand washing by 494 children under 5 years old and their mothers could reduce the incidence of diarrhoea and dysentery in these children. Children and mothers in the intervention group were asked to wash their hands after defaecation and before preparing or eating their 3 main meals; 2 bars of plain soap were provided. The control group was left to follow customary practice. Diarrhoea and dysentery incidences in the 2 groups were monitored during 4 months by comparing the incidence density ratios (IDR). The diarrhoeal incidence among the children in the hand washing households was significantly lower than that among those in the control households (IDR = 0·70, 95% confidence interval (CI) = 0·54–0·92). For dysentery incidence, although there was a 40% reduction (IDR = 0·58, 95% CI = 0·22–1·55) in the children under 2 years, there seemed to be no impact in older children (IDR = 1·2, 95% CI = 0·52–2·80). The study indicates that hand washing is effective in reducing the morbidity from diarrhoea and dysentery.

Introduction

Transmission of diarrhoeal pathogens from faeces to susceptible host involves many pathways, of which hands are one. Dirty, contaminated hands can act as mechanical carriers for the aetiologic agents to the susceptible host directly or indirectly through food and water or through household contamination (SAMADI *et al.*, 1983; AUNG MYO HAN *et al.*, 1986).

A number of studies have shown that proper hand washing with soap is effective in reducing acute diarrhoea and dysentery. These studies have been carried out either to determine the impact on diarrhoea alone in closed institutions where compliance can easily be monitored (BLACK *et al.*, 1981) or to prevent the secondary transmission of dysentery within families (KHAN, 1982).

We are not aware of any study examining the impact of proper hand washing on both diarrhoea and dysentery in a community setting, taking care to monitor objectively the compliance of the intervention group. Very few people in Burma practise hand washing with soap and water after defaecation or before eating or handling food (AUNG MYO HAN & THEIN MAUNG MYINT, 1986). Therefore, this study was conducted to determine if proper hand washing by children and their mothers with plain bar soap after defaecation and before preparing and eating 3 main meals could reduce the incidence of acute diarrhoea and dysentery in the children.

Materials and Methods

Study population and admission

The study was conducted between June and November 1985 in a low socioeconomic grade community (Nga-Kha ward of Thin-Gun-Kyun township) in Rangoon. During June 1985, household screening (for inclusion in the study) was done in each contiguous electoral unit in the community, starting with electoral unit 1, until the required sample was obtained.

The required sample size of 400 children was determined by using the sample size formula for the detection of difference between 2 proportions (ABRAMSON & PERITZ, 1983) and using the mean diarrhoeal incidence rate of 0·2877 episode/child/month in the control group (DMR/JICA, 1983) and 0·2158 episode/child/month in the intervention group (targetted event rate after 25% reduction by intervention).

Households selected were those which had one or more children between 6 and 59 months old, those in which the mothers gave their informed consent, those in which regular follow-up was possible and those in which the mothers and children were not allergic to soap. The mothers of children admitted to the study were informed of the purpose and procedures and informed consent and demographic data were obtained. 350 mothers and 494 children in 350 households were selected for study. Of the children, only 12 (7 from intervention and 5 from control households) moved out of the community before the end of the study.

Base-line surveillance and intervention

After one month (July) of monitoring diarrhoea and dysentery incidence to obtain base-line data, the participating households were randomly allocated to intervention and control groups. The mothers and children in the intervention group were asked to wash their hands after defaecation and before preparing or eating their 3 main meals (early morning, late morning and evening). Two bars of weighed plain soap in 2 empty condensed milk tins were provided, one for use after defaecation and the other before food preparation or eating. The soap was replenished as necessary every 2 weeks during surprise random visits to monitor compliance. No hand washing intervention was given to the control group.

Outcome assessment and compliance monitoring

Daily surveillance (24 h recall) for diarrhoea and dysentery incidence was made from July to November 1985 by 6 trained community health workers (CHWs). The reliability of their surveillance data was independently monitored each week by random unannounced visits, during which staff from the Department of Medical Research (who were unaware which households were receiving soap) monitored diarrhoea and dysentery occurrence during the preceeding day. The data sets collected by these 2 different observers were compared and their kappa

values and percentage agreement were calculated (FLEISS, 1981) and assessed. The median kappa values and the percentage agreement between these observers ranged from 0·4 to 0·7 and 97·7 to 98·5 respectively.

Compliance with the intervention procedure was maintained by daily checks and reminders on soap usage by the CHWs, by establishing close contacts with subjects and reinforcing the intervention procedure, and by checking the soap usage by weighing the distributed soap (with an electronic balance) during random visits.

The operational definitions of acute diarrhoea and dysentery used were those described by NEWELL (1965) and WOODRUFF & BELL (1978) respectively. If 7 or more days separated 2 attacks of diarrhoea or dysentery, they were considered as 2 separate episodes.

Statistical analysis

The base-line variables in the hand washing households (HWH) and control households (CH) were compared using the differences between 2 means or proportions as appropriate. For the ordinal data, the median test was used. A large sample Z test for the incidence density differences (IDD) was used for the base-line diarrhoeal and dysentery incidence. Comparison of outcome variables in the 2 groups was made by using the incidence density ratio (IDR) (KLEINBAUM *et al.*, 1982). IDD and IDR were calculated on an HP41CV calculator using the program for comparison of rates (incidence density data) of ABRAMSON & PERITZ (1983).

Results

Comparability of hand washing and control households

236 children (162 households) were allocated to the intervention group and 258 (188) to the control group. The groups were comparable concerning almost all the important variables (Table 1). Although the base-line diarrhoea and dysentery incidences in the control group were slightly higher than those in the hand washing group, the IDDs were not statistically significant ($Z = -0·41$ and $-1·65$ respectively).

Impact of hand washing on the incidence of diarrhoea and dysentery

The impact of hand washing on the incidence of diarrhoea and dysentery among the children is given in Table 2. The diarrhoeal incidence for all children in the HWH was significantly lower than that for those in the CH (IDR = 0·70, 95% confidence interval (CI) = 0·54–0·92). Similarly, the incidences for the 2 age groups (<2 and ≥2 years) in the HWH were significantly lower than those in the CH (IDR = 0·69, 95% CI = 0·48–1·01 and IDR = 0·67, 95% CI = 0·45–0·98 respectively). The corresponding percentage reductions in diarrhoeal incidence for the 0–4, <2 and ≥2 years age groups were 30% (1·4/4·9), 31% (2·3/7·4) and 33% (1·3/3·8) respectively.

Table 1. Comparison of base-line variables between hand-washing and control households, Thin-Gun-Kyun (Rangoon), July 1985

Variable	Households	
	Hand-washing	Control
Age of children (years) (mean ± standard deviation)[a]	2·6 ± 15·5	2·7 ± 15·3
Age of mothers (years) (mean ± standard deviation)[b]	28·5 ± 6·6	28·2 ± 6·5
Sex of children[a]		
No of males (%)	121 (51·3)	126 (48·8)
No of females (%)	115 (48·7)	132 (51·2)
Median no. of persons in family (range)[b]	6 (3–13)	6 (3–13)
Median maternal education score (range)[bc]	2 (0–5·5)	2 (0–6·0)
Median water use, litres/person/day (range)[b]	36 (5·5–145)	36 (5·5–169)
Latrine type[b]		
No. (%) of pit	142 (87·7)	161 (85·6)
No. (%) of surface	15 (9·3)	20 (10·6)
No (%) of others	5 (3·0)	7 (3·7)
Diarrhoea episodes per 1000 child-days[a]	11·6	12·5
Dysentery episodes per 1000 child-days[a]	3·2	5·1

[a] All children: 236 hand-washing, 258 control; values expressed as mean ± standard deviation.
[b] All mothers (households): 162 hand-washing, 188 controls; values expressed as mean ± standard deviation.
[c] Maternal education score: illiterate = 0, primary school = 0·5–2·5, middle school = 3·0–4·5, high school = 5–5·5, university = 6.

Table 2. Incidence of diarrhoea and dysentery in children under 5 years old in hand-washing and control households during intervention period, Thin-Gun-Kyun (Rangoon), August-November 1985

Age of children and type of households	Child-days of observation	Diarrhoea[a]			Dysentery[a]		
		EPS	ICD	IDR	EPS	ICD	IDR
< 2 years							
Control	9771	72	7·4	1	15	1·5	1
Hand washing	9994	51	5·1	0·69[b] (0·48–1·01)[d]	9	0·9	0·59 (0·22–1·55)[d]
⩾ 2 years							
Control	20717	78	3·8	1	20	0·9	1
Hand washing	17148	43	2·5	0·67[b] (0·45–0·98)[d]	20	1·2	1·21 (0·52–2·80)[d]
All children							
Control	30488	150	4·9	1	35	1·1	1
Hand washing	27142	94	3·5	0·70[c] (0·54–0·92)[d]	29	1·1	0·93 (0·39–2·23)[d]

[a] EPS = episodes of diarrhoea or dysentery; ICD = incidence of diarrhoea or dysentery per 1000 child-days of observation; IDR = incidence density ratios.
[b] $P<0·05$.
[c] $P<0·01$.
[d] 95% confidence intervals.

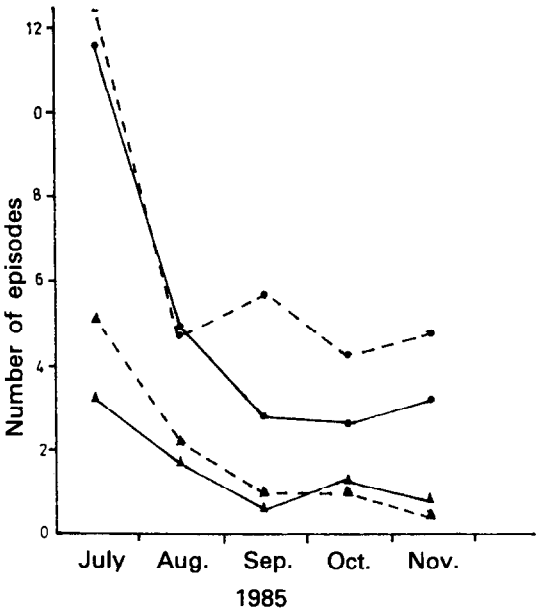

Figure. Episodes of diarrhoea (circles) and dysentery (triangles) per 1000 child-days in children under 5 years old in hand-washing (continuous lines) and control (broken lines) households in Thin-Gun-Kyun (Rangoon).

However, very little difference in the incidence of dysentery was seen between the HWH and CH in the 0–4 years group (IDR = 0·93, 95% CI = 0·39–2·23) and the ⩾ 2 years group (IDR = 1·2, 95% CI = 0·52–2·80). Although there was a 40% reduction in the incidence in the HWH < 2 years age group (IDR = 0·59, 95% CI = 0·22–1·55), the difference was not statistically significant.

The Figure illustrates the impact of hand washing on the incidence of diarrhoea and dysentery from the base-line to the end of follow-up. Hand washing intervention started at the beginning of August, and from September the diarrhoeal incidence in the HWH was significantly lower than that in the CH throughout the intervention period. However, there was little difference in the dysentery incidence in the 2 groups.

Discussion

The risk of diarrhoeal pathogens spreading from cases or carriers to susceptible children within families or day-care centres is increased by poor hygienic practices (AUNG MYO HAN *et al.*, 1986; BLACK *et al.*, 1977). To interrupt this transmission, proper hand washing with soap and water has been shown to be effective (BLACK *et al.*, 1981; KHAN, 1982; TORUM, 1982; STANTON & CLEMENS, 1987). Our study also found that hand washing intervention was effective in reducing the incidence of diarrhoea. The diarrhoeal incidence rates were significantly reduced in the HWH and the percentage reductions were within the range found in other studies (FEACHEM, 1984).

However, although our data suggest that the intervention was also effective against dysentery incidence in children less than 2 years old, it seemed not to be so for older children. A number of reasons can be given for this.

(i) Inadequate sample size may result in failure to obtain a statistically significant reduction. The sample size was based on diarrhoeal incidence rates only and not on dysentery incidence. We estimated the study power (ABRAMSON & PERITZ, 1983) using the observed dysentery incidence and found that with the number of children below 2 years in the study (171), and at an alpha level of 0·05, the study had a power of only 54% to detect the difference.

(ii) As our intervention focused on washing hands only after defaecation and before food handling or eating the 3 main meals of the day, snacks eaten

between meals may not have been affected. Children older than 2 years who are ambulatory usually have more contact with contaminated environment outside their houses and also more person-to-person contacts with other children during play. It is likely that our intervention was unable to prevent dysentery transmission during such contacts.

However, the failure to find an impact was probably not due to inadequacy in the conduct of the intervention, to the parallel occurrence of hand washing in the control group, or to major compliance failure because, if these effects were operating, we would not have found any reduction in diarrhoeal incidence. Our findings are corroborated by a similar study in another community in Rangoon (Ohn Kyi, unpublished data).

Our study was not conducted 'blind' because it was difficult to maintain 'double-blindness' without more money and personnel. But we attempted to avoid bias by employing our permanent staff, who did not know which households were on intervention, to assess the outcome variables independently and compare their data with those of the CHWs. We found reasonably high kappa values and percentage agreement between these two categories of workers. Furthermore, another argument against bias was the lack of an intervention effect on dysentery rates in children older than 2 years. If bias in favour of intervention had operated, this would not have occurred.

Poor compliance with the intervention might also affect the study. However, this was subjectively and objectively assessed as minimal throughout the study.

Bias could also occur from differential migration in the hand washing and control groups, but this was not so because only 3% and 2% from the HWH and CH, respectively, migrated during the study period.

Hand washing intervention in Burmese homes is effective in reducing diarrhoea and dysentery morbidity. But for a long lasting positive behaviour change to occur, sustained and culturally appropriate health education programmes need to be implemented (FEACHEM, 1984). Similarly, in parallel with these educational programmes, soap must be made cheaply and readily available.

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