The effect of soap distribution on diarrhoea: Nyamithuthu Refugee Camp

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Background In January 1993, Nyamithuthu Camp in Malawi housed 64,000 Mozambican refugees. Communicable diseases, primarily diarrhoea, pneumonia, malaria and measles, contribute to substantially higher mortality rates in refugee populations compared to similar non-displaced populations.

Method A systematic sample of 402 households in one portion of the camp were surveyed for diarrhoeal risk factors, and then interviewed twice weekly for 4 months regarding new diarrhoea episodes and the presence of soap in the household. Two-hundred grams of soap per person was distributed monthly.

Results Households had soap on average only 38% of the interview days. Soap was used primarily for bathing and washing clothes (86%). Although 81% of mothers reported washing their children's hands, only 28% of those mothers used soap for that purpose. The presence of soap in a household showed a significant protective effect: there were 27% less episodes of diarrhoea in households when soap was present compared to when no soap was present (RR = 0.73, 95% CI: 0.54 < RR < 0.98). Potential confounding factors were assessed and did not appear to be responsible for the association between the presence of soap and reductions in diarrhoea incidence.

Conclusion In summary, our findings suggest that the provision of regular and adequate soap rations, even in the absence of a behaviour modification or education program, can play an important role in reducing diarrhoea in refugee populations. If subsequent study confirms the soap as a cheap and effective measure to reduce diarrhoea, its provision in adequate amounts should be a high priority in refugee settings.

Keywords Diarrhoea, prevention, soap, hygiene, refugee

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diarrhoeal risk factors, focused on availability of soap in households, soap use patterns, and possible associations with diarrhoeal disease incidence.

**Methods**

**Study design**

Every fourth house in the southernmost portion of Nyamithuthu camp was marked to participate in the study. Marked households were excluded if no occupants were available to interview after two visits: 402 houses were included in the study. Each female head of the household was interviewed by a Malawian health worker in the appropriate local language at the beginning of the study (January), and if available again midway through the study (March). The questionnaire included demographic factors and questions on a number of potential risk factors for diarrhoea. Following the baseline survey, interviews of the female heads of household were carried out twice a week for 4 months (25 January to 26 May 1993), during these interviews health workers recorded the age and sex of any household member with diarrhoea and the presence or absence of soap in the household. Presence or absence of soap was verified by visual inspection during the first month of the study and self reports were found to be reliable. Final households were defined as any household available for one or more interviews during the final 2 weeks of the study (May). This study was part of a larger study in Nyamithuthu Camp on water, sanitation factors, and diarrhoeal risk factors.\(^3\) (Diarrhoeal risk factors evaluated in that study were number of huts assigned to household, number of water containers used by household, enclosed bucket, presence of latrines, second set of clothing for children, breastfeeding, hand washing, and number of animals in the household.)

**Definitions**

We defined a *New Diarrhoea Episode* as the onset of diarrhoea (\(\geq 3\) watery stools in 24 h) reported by the female head of the household, in a household that had no diarrhoea reported for any household member on the previous two interview days (i.e. diarrhoea free for at least one week). *Soap Presence* was defined as the presence of any amount of soap in a household on the day of the interview.

**Analysis**

Questionnaire data on demographics, diarrhoeal risk factors, hygiene, and soap use were coded using information from both surveys. Possible associations between diarrhoeal incidence and soap use, hygiene practices, and demographic factors were analysed using \(\chi^2\) and Kruskal-Wallis. Identified diarrhoeal risk factors\(^3\) were similarly analysed for association with soap presence or soap use practices. Only the households that were available for both the initial and mid-study surveys were included in the analysis using survey data \((N = 356)\). Soap presence and new diarrhoea episodes were plotted over time.

**Time-linked analysis**

In a time-linked analysis, we compared the rate of new diarrhoea episodes when households had soap to the rate of new diarrhoea episodes when households did not have soap. We stratified by household and report the relative risk and \(\chi^2\) from a Mantel-Haenszel analysis. To take into consideration the incubation periods of diarrhoeal pathogens, we also did a similar analysis linking soap presence with new diarrhoea episodes 4 days later (the next interview day).

**Results**

**Households and observations**

Of the initial 402 households, 356 (87%) were available for the second survey in mid March and 322 (80%) households were available at the end of the study period. The initial, mid, and final households were similar in the male-female ratio, age distribution, and household size (Table 1).

The median number of interviews per household was 29 (of a possible 34), and only 8% of the households were interviewed on less than half of the observation days. Households with more interviews (\(\geq 29\)) were similar to those with fewer interviews (<29) for soap presence, diarrhoea incidence, demographics and potential diarrhoeal risk factors.

**Soap**

Ration distribution occurred every 2 weeks for food and every 4 weeks (concurrently with the food rations) for soap. Initially, fewer than 10% of households had soap (Figure). Three peaks of soap presence occurred in mid February, March, and May, corresponding to soap ration distribution days. The percentage of households with soap dropped gradually to less than 10% again after each soap peak. Refugees received food rations but no soap in April. On average households reported soap on 38% of the interview days (range: 9–78%). Only 10% of the households had soap on more than half of the observation days. Neither reported selling of soap nor specific soap use practices were associated with presence (or absence) of soap in households.

The 276 households which had soap at the time of either survey were asked about soap use during the 2 days before the survey: 82% reported using soap for washing clothes and 71% for bathing (which due to ambiguous wording included bathing and hand washing). Only 0.6% used soap exclusively for hand washing, and 13% of the households with soap reported no soap use in the preceding 2 days.

In 168 households with children under 5, 81% (136 of 168) of mothers reported washing their children's hands during the preceding 2 days, although 60% of those (82 of 136) did so only one or two times in a day. Just 28% (38/136) of the mothers reporting using soap for washing their children's hands, and only
45% (17/38) of those who used soap did so with every hand washing.

There was no association between frequency of hand washing (with or without soap) and frequency of new diarrhoea episodes, soap availability, or exposure to hygiene education. Hygiene education included instructions to wash hands after latrine use and before cooking or eating, to use soap, and to keep hands out of drinking water buckets.

**Diarrhoea**

The percentage of households with new diarrhoea episodes was initially high (33/356 or 9% of households). This dropped sharply in the first 2 weeks, followed by a gradual decline over the remaining study period (Figure), the average weekly per cent of households with new diarrhoea episodes being 0.9% in May. Small peaks in diarrhoeal incidence appear about every 2 weeks.

During the 4-month study period, 217 (61%) households had no diarrhoea, 94 (26%) households had one episode, and 45 (13%) households had two or more new diarrhoea episodes.

**Association between soap and diarrhoea**

In an ecologic comparison of soap and diarrhoea trends (Figure), diarrhoeal incidence appears to be low when soap presence in the camp is high and seems to increase as soap presence decreases. The diarrhoeal incidence shows variation that could be seen as bi-weekly peaks.

The time-linked analysis showed a significant association with between household soap presence and diarrhoeal incidence in the household. There was a 27% reduced risk (RR = 0.73, 95% CI: 0.54–0.98) of diarrhoea in households on days when soap was present, compared to days when soap was not present in the same household (Table 2). Similarly, there was a 25% reduced risk (RR = 0.75, 95% CI: 0.51–1.1) of diarrhoea in households who had soap in the household on the previous interview day (4 days earlier).

**Discussion**

The major finding of this study is that the presence of soap in households is associated with a decreased incidence of diarrhoea. The advantage of the time-linked analysis is its ability to assess the effect of soap—specifically when soap is in the household—and able to impact disease transmission. The time linked analysis in this study showed a 27% decrease in diarrhoeal incidence on those days when soap is present in the household. Since use of soap actually protects against future diarrhoeal illness a delayed protective effect should also be seen. The 25% decrease in diarrhoeal incidence in the 4-day lagged analysis supports this expected protective association. The time-linked analyses, which use each household as a separate stratum, also has the advantage of thus controlling for household-specific factors.
diarrhoeal risk factors (e.g. number of children under age 5, water quantity, maternal education) by the nature of its stratified design.

Time stable potential confounders (diarrhoeal risk factors identified in Roberts' study) were found to have no association with our variable of interest, soap presence. However, in the Figure, the peaks in diarrhoea incidence suggest the possible existence of a time dependent confounder(s). Food distribution days (occurring every 2 weeks) seems to frequently have a temporal link with the small peaks in diarrhoeal incidence, though this relationship is not statistically significant. An ecolo-logic analysis, such as the Figure represents, is more for hypothesis generating than causation proving. Food distribution may itself be a risk, but also includes other events such as the congre-gation of large numbers of refugees in the same place, or the consumption of market or leftover food, which may be diarrhoeal risk factors. Note, that if such a ratio-distribution-day confounder does exist and is increasing incidence of diarrhoea at the same time as soap presence is increased by concurrent distribution times, then its effect would be to obscure the temporal association of soap presence and diarrhoea incidence. Thus controlling for such a confounder (if that were possible), would be expected to increase the strength of soap and diarrhoea association. Certainly, future studies to assess the existence of distribution day risk factors would be helpful to refugee programme planners.

The study has limitations. The study period coincided with the end of the diarrhoea season, as is seen in the figure and decreasing average monthly incidence. We found an overall diarrhoea incidence equivalent to 1.3 episodes/child/year, compared to Bern's estimate of 2.6 episodes/child/year for children 5 and under in sub-Saharan Africa. A higher diarrhoeal incidence would have given our study more power to examine an association between diarrhoea, soap, and other factors such as hand washing.

Of the study population, 18% was lost to follow-up over the 4-month study period, mainly due to repatriation to Mozambique. However, the beginning, mid, and end populations were similar for all demographic and identified diarrhoeal risk factors. Thus, it appears that little bias was introduced by this loss to follow-up.

Prior to the study, we presumed soap would prevent diarrhoea through its use in hand washing. In this study, the frequency of hand washing varied greatly between households but generally was low (once or twice per day). Studies of hand washing practices in southern Africa have shown similar low levels of hand washing. This study was not designed primarily as a hand washing study and there were unexpected ambiguities to the soap questions that limited as thorough an analysis as we would have wished. Given that problem, and the low frequency of reported hand washing, it is perhaps not surprising that no association was found between hand washing and diarrhoea incidence.

Nonetheless, soap presence was reliably ascertained and was associated with decreased diarrhoea. The dominant reported uses for soap, clothes washing and bathing, were ones that would functionally wash the hands of the women who usually carry out these chores. Women are also generally the primary water carriers, food preparers and child care providers, and these activities have been associated with transmission of diarrhoea in similar settings. Thus, it seems that hands cleaned using soap—albeit for household tasks other than ‘hand washing’—are a plausible mechanism for the observed protective soap effect. This possible mechanism of effect, and the size of soap ration required to meet refugees' washing and hygiene needs, should be further evaluated.

In summary, our findings suggest that the provision of regular and adequate soap rations may play an important role in reducing diarrhoea in refugee populations, despite low frequency of hand washing and limited water resources. Soap appeared effective when available and as used by the refugees: it required no behaviour modification or education programme to be effective. In a refugee situation, where simplicity is important, this is a vital finding. Although soap provision is already mandated for refugees, it is not always adequately provided, perhaps because of a lack of recognition of its importance. If the presence of soap is similarly effective in non-refugee populations, current diarrhoea prevention programmes could also be enhanced. These findings warrant both action, provision of soap to refugees, and further investigations.

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References

Appendix
The UNHCR requirement for soap for refugees is 250 mg/capita/month in bar form. The bar must have a minimum of 70% fatty acid and a maximum of 20% moisture, 0.5% NaCl, 0.2% NaOH, and no mercury content. In Malawi a 240 mg bar of soap that otherwise met the requirements was locally available and was used.