Tackling diarrhoea in India's children: Identifying variation in soap availability and use in Indian schools

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INTRODUCTION

Diarrhoea remains one of the leading causes of childhood morbidity and mortality in India. Over 450,000 children (0-6 years: ~158,000; 6+ years: ~296,000) were estimated to have died from diarrhoea in India in 2001.[1] The morbidity and mortality associated with diarrhoeal disease is tightly linked with it causing and exacerbating malnutrition[2]; which is particularly problematic in India where over 30% of children are undernourished.[3] Further to this, diarrhoeal disease is also associated with decreased cognitive function in children, thus having serious implications for a child's future development.[4]

In an effort to identify the interventions that have been shown to have the greatest impact on reducing diarrhoeal disease burden, Esrey et al. reviewed 144 international studies and concluded that four interventions led to the greatest reduction in diarrhoea: safe disposal of excreta; hygiene (personal and household); hand washing; and quantity and quality of water used.[5, 6] Of these interventions, hand washing, particularly before eating and after defecation, was shown to be a simple and highly effective means to prevent diarrhoea. Indeed, a Cochrane review of fourteen randomized control trials in both high income and low and middle income countries indicated that hand washing could reduce diarrhoea episodes by 30%, which is comparable to providing clean water in low and middle income countries.[7]

A well-recognized means to instil and increase hand washing behaviour in children is via School Sanitation and Hygiene Education (SSHE) programmes. SSHE programmes consist of hardware (e.g. improved facilities, safe drinking water) and software (e.g. education and training of both children and teachers) components that can produce a healthy school

environment and drive children to make correct choices regarding sanitation and hygiene-related behaviours.[8]

India's primary education system has the potential to serve as a key intervention point for SSHE programmes - there are over 700,000 primary and upper primary schools, which employ over 3 million teachers and reach over 100 million children.[6] Recognising the opportunity that India's primary school infrastructure presents, the Government of India has been systematically expanding SSHE programmes beginning with some pilots in 58 districts in 1999; to the Total Sanitation Campaign across India in 2000; and more recently the more intensive School Water and Sanitation Towards Health and Hygiene (SWASTTH) initiative being delivered in three states in collaboration with the IRC International Water and Sanitation Centre and UNICEF.[6]

In this study we analysed baseline data to determine hand-washing practices in over 2000 school children in 20 schools from the state of Maharashtra. The data was collected as part of the India Nourishing Schools Initiative, which was launched in 2014 by Ashoka Innovators for the Public in partnership with the Swiss Re Foundation[9] to:

develop young changemakers who can take charge of their own nutrition and that of their communities. The initiative improves nutrition by focusing on various dimensions such as improving the quality of midday meals, communicating nutrition messages through the curriculum and increasing access to hand washing facilities.

Our goal was to determine if there was any variation in hand washing practices and if this was correlated with diarrhoea prevalence. Our objective with this study was for the results

of our analyses to inform schools to make targeted interventions to improve hand-washing practices among children attending their schools.

METHODS

Study sample

The study sample consisted of 2093 children aged 9-14 from 20 schools across four districts (Osmanabad, Pune, Sangli and Satara). Data was collected by the Nourishing Schools Initiative to better understand the hardware and software components that might contribute to poor health outcomes including:

- If soap is available in their school
- If they washed their hands before eating
- If they washed their hands after going to the toilet
- If they had diarrhoea in the past month (with diarrhoea being defined as having having 3 or more loose stools or liquid bowel movements per day)

Schools were anonymised to protect their identities and are indicated by letters. Schools are grouped together by district.

Analysis

Secondary analysis of the Nourishing Schools data was carried out to identify variation for several metrics:

Soap availability: We determined the variation in self-reported knowledge of soap availability within schools and between schools within a district and between districts.

Soap usage: For schools where greater than 75% of the children reported soap availability, we analysed soap usage before eating and after toilet use.

Following our analysis of soap usage behaviour, we carried out analyses to determine if soap usage was correlated with self-reported diarrhoea. Tests of statistical significance were carried out using a 1% alpha level. All statistical analyses were carried out using Microsoft Excel.

RESULTS

Soap availability

Figure 1 shows the proportion of children who believe soap is available within their schools. Schools, which have been anonymised and are designated by letters, are grouped into their respective districts (Osmanabad, Pune, Sangli and Satara) within Maharashtra. The data in Figure 1 indicate variation across three dimensions: variation in children's knowledge of soap availability; variation in soap availability in schools within a district; variation in soap availability between districts.

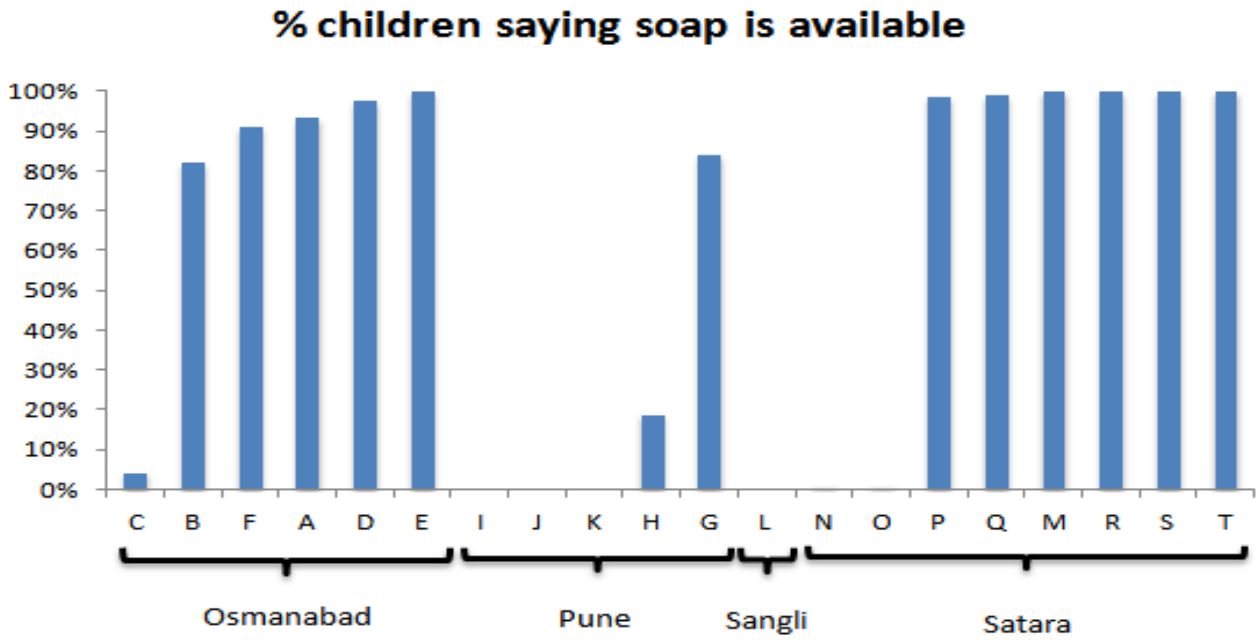


Figure 1. Percent of children who say soap is available in their school. 20 schools across four districts of Maharashtra are indicated above. School identities have been anonymised.

Children's knowledge of soap availability within a school

A surprising finding of our analyses was the variation in children's knowledge of soap availability within schools. For example, see schools B, F, A, H and G where less than 100% of the children believe soap is available.

Soap availability in schools within a district

In addition to intraschool variation, we also observed variation in the reported availability of soap in schools within a district. For example, in Pune we see only 2 out of 5 schools reporting soap being available and 6 out of 8 schools in Satara reporting soap being available.

Soap availability between districts

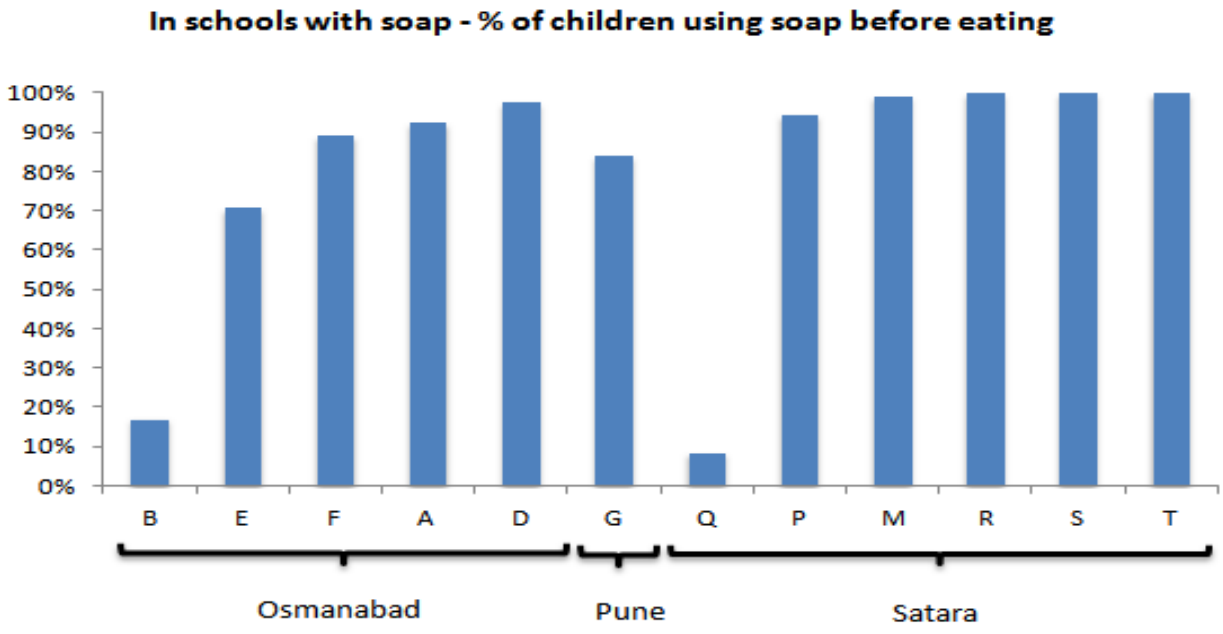
Finally, we observed clear variation between districts (see, for example, Osmanabad where 5 out 6 schools had a majority of children reporting soap availability – 83%; Satara where 6 out of 8 schools reported soap availability - 75%; and Pune where 2 out of 5 schools reported soap availability - 40%).

Soap usage

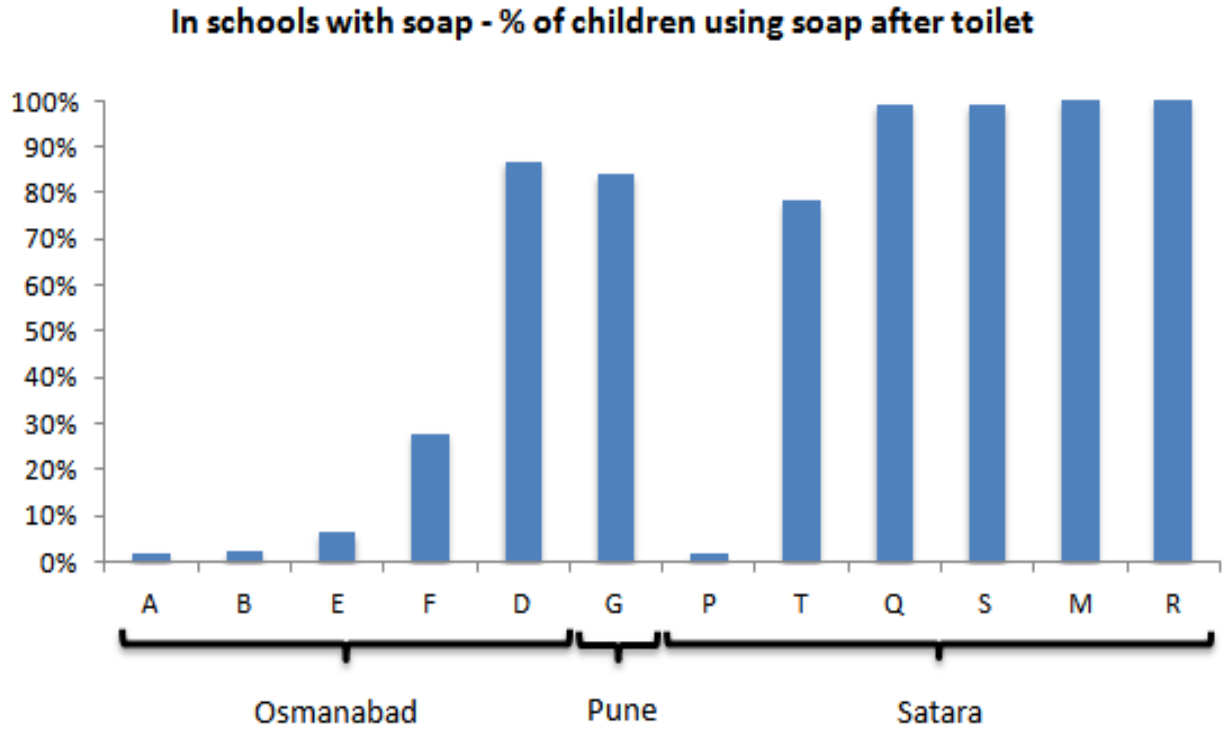
A further point of inquiry is whether children actually use soap in the schools where a majority of the children say soap is available - this would indicate a behavioural and knowledge based element to the children's hygienic practices. Figures 2a-c highlight the use of soap by children before eating or after using the toilet in schools where greater than 75% of the children stated soap was available.

The hope is that if a majority of children knew soap was available, they would actually use it before eating and after using the toilet. Our findings here are quite worrying because despite knowledge of soap availability, we see substantial variation in soap usage.

A.


In schools with soap - % of children using soap before eating
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
B
E
F
A
D
G
Q
P
M
R
S
T
Osmanabad
Pune
Satara

B.


In schools with soap - % of children using soap after toilet
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
A
B
E
F
D
G
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T
Q
S
M
R
Osmanabad
Pune
Satara

C.

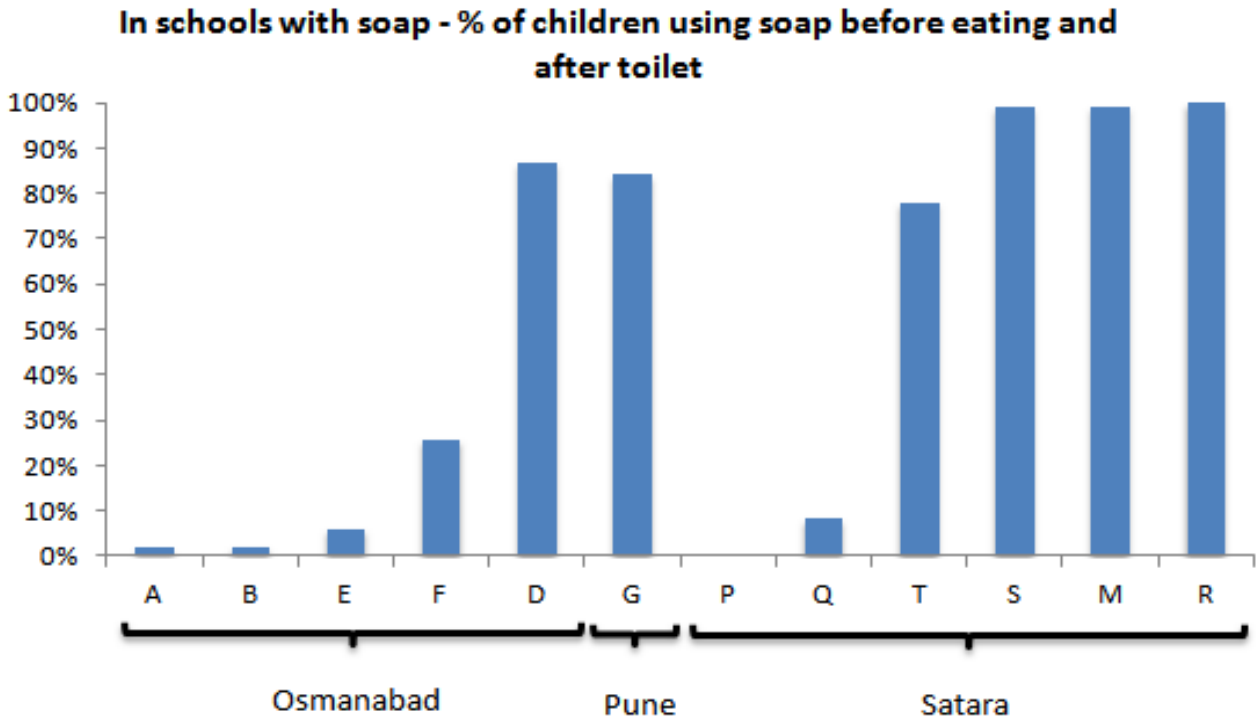

Figure 2. Hand washing behaviour in children in schools where >75% of children said soap was available. A. Percentage of Children who use soap before eating. B. Percentage of children who use soap after using the toilet. C. Percentage of children who use soap before eating and after using the toilet.

Before eating

Figure 2a highlights the variation trends in soap usage before eating. Looking at the data the most clear finding is the variation in soap usage between schools within a district and between districts (see schools F, A, D, G, P, M, R, S and T where >80% of children reported washing their hands before eating versus schools B, E and Q where <70% of children reported washing their hands – with schools B and Q being <20%). Further to this, it is interesting to note that there is still intra-school variation in soap usage before eating – i.e. all of the children are not using soap. A more worrying trend is revealed comparing data from Figures 1 and 2a where we notice that in some schools where a majority of children

reported soap availability but do not report soap usage before eating (see schools B, E and Q in Figures 1 versus 2a).

After toilet use

The results for hand washing after toilet use is even more worrying than the data for soap usage before eating. There is high variation in the use of soap after using the toilet particularly in the Osmanabad schools. Even in schools where there is a high proportion of children using soap before eating, we see a much lower utilisation of soap after using the toilet (see, for example, School A, E, F and P in Fig 2a. vs. 2b). Further to this we see the same trend of schools where a majority of children reporting soap being available but not reporting its usage after toilet use (see schools in Fig 1 versus Fig 2b).

Before eating and after toilet use

We also analysed soap usage before eating and after toilet use with results that were similar to the usage characteristics observed in 2b with the exception of school Q which had a very low proportion of children using soap before eating (2a) which likely explains the lower rate seen in 2c versus 2b.

Soap usage and diarrhoea prevalence

While the variation in soap usage is worrying, a larger question is if this has any impact on diarrhoea prevalence in these children. Table 1 below displays four different scenarios of hygienic behavior and how these scenarios relate to children getting diarrhoea:

- Soap use before eating and after using the toilet
- Soap use before eating only

- Soap use before toilet use only
- No soap use before eating or after toilet use

	Total Number of Children	Number of Children with Diarrhoea	Diarrhoea Prevalence	Correlation with diarrhoea prevalence: p-value and significance
Children who use soap before eating and after toilet use	**648**	**3**	**0.46%**	**1.6 E -05**: Statistically significant at 1% alpha level
Children who use soap before eating but not after toilet use	**371**	**27**	**7.27%**	**4.9 E -09**: Statistically significant at 1% alpha level
Children who don't use soap before eating but do use soap after toilet use	**93**	**1**	**1.07%**	0.31: not significant
Children who don't use soap before eating or after toilet use	**981**	**27**	**2.75%**	0.96: not significant

Table 1: Correlation between soap usage and diarrhoea prevalence

Only two of the scenarios have a statistically significant relationship with diarrhoea prevalence: children who use soap before eating and after toilet use (0.46% diarrhoea prevalence: p-value 1.6 x 10^{-5}) and children who use soap before eating but not after toilet use (7.27% diarrhoea prevalence: p-value 4.9 x 10^{-9}). Looking at the proportion of children who get diarrhoea in both cases, it is notable that children who use soap before eating but not after using the toilet are 16 times more likely to get diarrhoea than children who use soap before eating and after toilet use. This finding suggests that, controlling for soap usage before eating, using soap after using the toilet plays a crucial role in decreasing the probability of a child getting diarrhoea.

DISCUSSION

Despite the tremendous progress made in India's SSHE programmes, there is still wide variation in school sanitation and hygiene hardware and software components that lead to unwarranted variation in sanitation and hygiene-related outcomes in India's school children.

Addressing variation in soap availability and usage

There could be several reasons that account for the variation in soap availability and usage in schools in our sample and in Indian schools in general:

- Variation in education for children on soap usage and its importance (this was also demonstrated in the 1993 All India Education Survey[8])
- Variation in education for teachers on soap usage and its importance
- Inconvenient location of soap, which makes it difficult for children to use it before eating and/or after using the toilet

A critical next step for Indian schools is to begin to tackle the variation in soap availability and usage. The lowest hanging fruit is to develop strategies to educate and encourage children to begin to use soap before eating and after using the toilet in schools where children know soap is available. This will involve educating children about the links between hand washing and diarrhoea as well as informing teachers and school administrators about the unwarranted variation that exists within schools, between schools and between districts in hand washing practices and its clear links to an increased prevalence of diarrhoea. The approach we are encouraging is one of positive deviance[11] - namely, identifying and

spreading the context appropriate practices in schools where high proportions of children use soap before eating and after using the toilet. In addition to this, the guideline-driven approach used for soap use before eating may be an approach to emulate to encourage hand washing after toilet use.

The importance and potential impact of this is best summarised by Snel et al.:

Considering that an estimated 60 million primary school children in the country are under an organized school based network with the potential to reach out to siblings, parents and other family members, the impact of empowering children with basic knowledge of wat-san-hygiene-health and nutrition cannot be emphasized enough.[8]

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