SOAPLAY

Using Soap Bars as an Environmental Cue ("nudge") for Handwashing among Children

Prepared by:
Markus Petersson
markus@ecosoapbank.org

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Abstract

Introduction: Despite the lifesaving quality of handwashing with soap, attempts to establish handwashing as a habitual behavior among children have often failed to produce tangible results. As global efforts to improve handwashing promotion for children continue, there is a growing body of evidence suggesting that a key solution can be found within the subconscious realm of nudges and incentivizing cues. Building on these insights, Eco-Soap Bank designed SOAPLAY – soap bars made in a variety of fun shapes and colors – to serve as an environmental cue, or "nudge", for handwashing among children. This study, comparing regular square soap bars to SOAPLAY, represents a first large-scale attempt to assess SOAPLAY's ability to influence handwashing with soap among children in school settings.

Methods: The study utilized a randomized control group design including 16,000 children attending 18 rural primary schools in Dabalo and Mpwayungu, Tanzania. Measurements focused on change within three main outcome indicators 1) observed handwashing after using the toilet 2) self-reported handwashing practices, and 3) soap usage – reflecting the total soap volume used in each school during the test period. Data was collected using pre-post direct observations and surveys in both the group receiving regular, square-shaped recycled soap bars (control) and the group receiving SOAPLAY (intervention). In total, 8,032 observations and 6,710 surveys were completed during a 9-week intervention period.

Results: Findings showed handwashing improved greatly in both groups, with a slight, yet statistically significant, advantage for children in the SOAPLAY group. Children in the SOAPLAY group were 3.78 times more likely (95% CI: 3.4-4.1, p=<0.001) to wash their hands with soap at endline compared to baseline, with an odds ratio of 24.3 (95% CI: 20.3–29.0, p=<0.001). In the control group, children were 3.65 times more likely to wash hands with soap after the intervention compared to baseline (95% CI: 3.4-3.9, p=<0.001) with an odds ratio of 16.3 (95% CI: 13.9-18.9, p=<0.001). Following the intervention, children in the SOAPLAY group were 7% more likely to be observed washing their hands with soap compared to children in the control group (95% CI: 1.04-1.09, p=<0.001). The difference in observed handwashing was further supported by findings from surveys and soap usage measurements, which captured signs of greater engagement and handwashing frequency among children in the SOAPLAY group. Significant improvements could also be found within key health indicators. Overall, children missing school due to illness in the two weeks preceding the endline survey decreased by 35% compared to the baseline.

Discussion: The findings support the notion that modified soap bars have the potential to add an important new dimension to handwashing promotion for children. While the distinction between the control and SOAPLAY group were relatively subtle in some areas, the result showed important differences indicating that SOAPLAY bars can generate a different level of engagement and enthusiasm for handwashing among children. The findings are crucial as they open new avenues of influence for nudge-based handwashing programming across the world. Either as part of a larger handwashing package or on its own, the new SOAPLAY bar represents an easy, highly affordable tool to enhance the basic humanitarian handwashing infrastructure. With the aid of these child-friendly soap bars, children can engage with handwashing on a level that moves beyond abstract notions of germs and illnesses, and tap into the powerful realm of play in a way that subconsciously nudges them towards improved handwashing practices.

SOAPLAY |

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1. Introduction

Throughout the least developed countries, the burden of (highly) preventable illnesses continue to cause death and irreparable damage to the life and development of young children (Black et al 2003; Biran et al 2014: 145; Burns et al 2018: 2). Handwashing with soap is the most cost-effective method to prevent hygiene-related illnesses and deaths (Black et al 2016). The simple practice removes 92% of harmful germs and has been linked to important reductions in a range of deadly diseases (GHP 2020).

Despite the lifesaving quality of routine handwashing with soap, attempts to establish handwashing as a habitual behavior have often failed to produce tangible results (McMichael & Robinson 2016; Bulled et al 2017). In fact, even when hygiene facilities exist and knowledge of the link between dirty hands and illness is high, handwashing with soap remains a rare activity in many resource-scarce settings (Biran et al 2014; Rajaraman et al 2014).

Significant effort has been devoted to uncovering the factors behind previous handwashing promotion problems (see for example Curtis et al 2009), and there is now a growing body of evidence suggesting a key solution can be found within the subconscious realm of nudges and incentivizing cues (Dreibelbis et al 2016; Burns et al 2018; Watson et al 2019). The introduction of "nudges" (environmental cues for handwashing) has been a highly useful addition to handwashing promotion (see Dreibelbis et al 2016). When children are targeted, tools that evoke a sense of play and curiosity are proving to be especially potent drivers of change (Watson et al 2019). In the wake of these discoveries, new handwashing hardware is being designed to capture notions beyond pure information and gently "nudge" children towards improved handwashing practices (Watson & Dreibelbis 2020).

Building on these new insights, Eco-Soap Bank – a non-profit organization employing disadvantaged women to recycle leftover soap from factories and redistribute it to vulnerable communities across the world – launched SOAPLAY. The SOAPLAY bar – soap made in a variety of fun shapes and colors – is designed to tap into the sense of curiosity and play that has been shown to constitute key cognitive elements of childhood realities (Watson et al 2019). Considering recent findings from the field of nudge theory, it is hypothesized that these child-friendly soap bars can serve as good environmental cues for handwashing among children.



Up until now, most research studying the application of nudge theory on soap products to promote children's handwashing has focused on toy soap (clear soap embedded with a plastic toy). The research has yielded largely positive results, with some studies showing that children given toy soap were four times more likely to wash their hands with soap (Watson 2019).

The affordability and scalability of toy soap, and other early nudge soaps, have, however, been a clear humanitarian limitation (see Burns et al 2018; Watson et al 2019). To date, modified soap bars for children have been very expensive and labor intensive to produce and, in the current climate of cutbacks and restricted funding, none represent a viable alternative for large-scale production and distribution to vulnerable populations in resource scarce settings.

In contrast, SOAPLAY bars – made from unused recycled, high-quality raw material from well-known soap manufacturers – are both extremely affordable and already set-up for mass-production and distribution to humanitarian crisis areas across the world. Initial pilot studies on SOAPLAY have produced promising results. An early pilot study, conducted among households in Cambodia, found that children given SOAPLAY were over twice as likely to wash their hands regularly throughout the day compared to children given regular soap bars (Eco-Soap Bank: 2024). A second study, focusing on schools in Myanmar, found comparable statistically significant results, reinforcing the potential of SOAPLAY as an effective handwashing intervention for children (Eco-Soap Bank: 2024). However, both studies were limited by a small sample size, prompting the need for further investigation to determine the consistency of results.

This randomized control school study, comparing regular, square-shaped soap bars to SOAPLAY, represents the first large-scale attempt to test SOAPLAY's ability to influence handwashing among children in school settings. To the best of our knowledge, there have been no similar attempts to follow-up on the encouraging findings from earlier modified soap bar trials and analyze the effects of different soap characteristics (i.e., soap with different shapes and colors). The study is therefore not only evaluating the viability of SOAPLAY but also aiming to provide new fragments of information that can help fill crucial knowledge gaps within existing handwashing research.

2. Methods

The research was implemented by World Vision Tanzania in partnership with World Vision US and Eco-Soap Bank. Data collection was conducted between January 27th and April 4th, 2025, across eighteen schools in the Dodoma region in central Tanzania. Dodoma, the administrative capital of Tanzania, has some of the highest poverty rates in the country (MPI: 2024). The target population was rural, living in agricultural districts outside the urban capital.

2.1 Study Design

The study utilized a pre-post randomized control group design, including 16,000 children attending 18 primary schools in the rural Dabalo and Mpwayungu districts. Participating schools were initially identified based on practical criteria – including the presence of working toilets with adjacent handwashing stations and the ability to monitor handwashing behaviors – and then divided into either a control group (N=9) or an intervention group (N=9). Stratified random sampling was used to ensure that key handwashing factors – e.g. type of handwashing facility, number of students, etc. – were as equally represented as possible in both the control group (receiving regular, square-shaped soap) and the intervention group (receiving SOAPLAY bars).

The intervention consisted of a short session where students were introduced to the soap and informed it would be placed at all handwashing stations. The same session was delivered at both the control and intervention schools. After the sessions, the soap was distributed and school staff ensured it was visibly placed and always available throughout the entirety of the test period.

2.2 Outcome Indicators and Data Collection Procedures

Three primary outcome indicators were used to evaluate the effectiveness of the different soap types: 1) observed handwashing after using the toilet 2) self-reported handwashing practices and illnesses, and 3) soap usage – reflecting the total soap volume used in each school during the test period. Data

was collected using pre-post direct observations and surveys in both the group receiving regular recycled soap and the group receiving SOAPLAY. In total, 8,032 observations and 6,710 surveys were completed during a 9-week intervention period.

2.2.1. Observed Handwashing Practices

Direct observations of students' handwashing behaviors were carried out by teachers working within target schools. The approach was selected to reduce disturbance from outside forces and minimize the risk of observation bias among students. Teachers received two full days of training on observation best practices, data collection, the scientific method, and research ethics. They were instructed to be subtle in their placement and not to tell the children that they were watching for handwashing. They were also clearly informed that the study was not an evaluation of their school, but purely a research project aiming to understand the influence of soap to provide better support in the future. It was emphasized that the measured handwashing frequency in a school would have no effect on the support they get after the study is completed. Observations were divided into 4 sessions conducted at 2 separate days:

1. Before class morning session (arriving) ≈30 min
2. Morning break session ≈ 20 min
3. Lunch break session ≈ 30 min
4. After school session (leaving) ≈ 30 min

Observations were completed prior to the surveys, to ensure that the survey questions did not influence subsequent handwashing practices.

2.2.2 Self-Reported Handwashing and Illness Prevalence

Self-reported data on handwashing and health were collected through surveys. Survey participants, selected through simple randomization, were given a form with a list of questions on handwashing practices and recent illness symptoms. The endline survey also included a short section with user feedback and soap preference questions.

2.2.3 Soap Usage

Soap usage data was collected at endline to provide additional quantitative evidence into the handwashing practices among children in the control and intervention schools. To measure soap use, the total weight of soap bars remaining at each school at the end of the test period (including soap bars in current use at handwashing stations) were weighed. The weight was then subtracted from the original weight of the bars distributed at the beginning of the test and ultimately divided by the number of students attending the school. The results gave an estimation of the total grams of soap used per student in each school during the test period.

Together with the two other main outcome indicators, soap usage measurements help provide a comprehensive view into the use of SOAPLAY versus regular bars of soap in promoting increased handwashing among children.

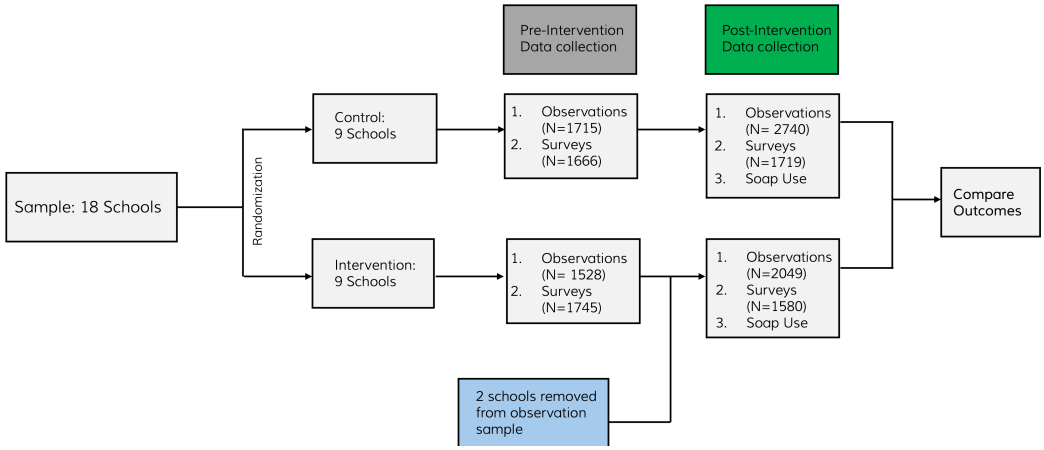
2.3 Limitations

After completing the baseline data collection process, two of the target schools displayed clear outlier characteristics in observed handwashing practices. In these schools – both belonging to the intervention group – observers reported a handwashing rate compliance of over 99% at baseline, severely skewing the baseline comparison between the control and intervention group. The two outlier schools were subsequently removed from the sample. After removing the schools, the control and

intervention group were equal in all relevant handwashing characteristics, and statistically viable comparisons could be made.[1]

It should also be noted that some schools displayed very strong improvements in observed handwashing practices, indicating some potential observation bias or, most likely in this case, a strong latent desire among the children to gain access to handwashing opportunities. Irrespective, the tendency was equally present in both the control and intervention group and would thus not skew the results in either favor. If anything, the phenomenon would make it more difficult to detect a statistically significant difference between regular soap and SOAPLAY users, skewing the results toward the null hypothesis (no difference in handwashing).

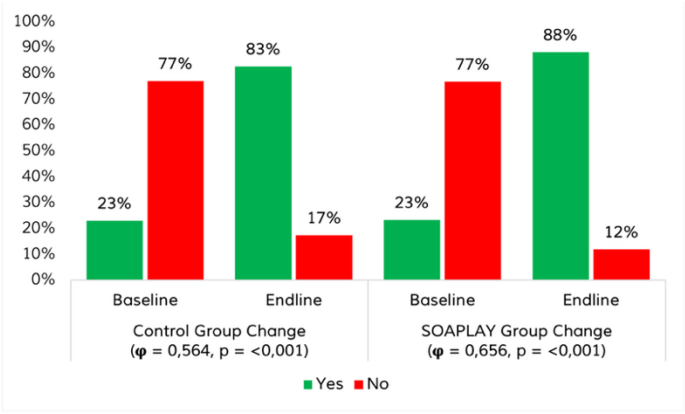
Figure 1. Pre-Post Randomized Control Design – Overview



3. Results.

3.1 Observed Handwashing with Soap After Using the Toilet

Figure 2. Observed Handwashing with Soap After Using the Toilet



Observed handwashing with soap after using the toilet improved greatly across both groups. In the SOAPLAY group, handwashing with soap increased from 23% at baseline to 88% after the intervention, while the corresponding change in the control group went from 23% at baseline to 83% at endline. Children in the SOAPLAY group were thus 3.78 times more likely (95% CI: 3.4-4.1, p=<0.001) to wash their hands with soap compared to baseline, with an odds ratio of 24.3 (95% CI: 20.3–29.0, p=<0.001). In the control group, children were 3.65 times more likely to wash hands with soap compared to baseline (95% CI: 3.4-3.9, p=<0.001) with an odds ratio of 16.3 (95% CI: 13.9-18.9, p=<0.001). After the intervention, children in the SOAPLAY group were 7% more likely to wash their hands with soap compared to the control group (95% CI: 1.04-1.09, p=<0.001).

Table 1. Observed Handwashing with Soap After Using the Toilet

	Baseline			Endline			Difference			
	n	x	%	n	x	%	x	%	p	Effect
Observed HWWS After Toilet										
Control	**1715**			**2740**					**<0.001**	**0.594** [1]
No handwashing		702	41%		217	8%	**-485**	**-81%**		
Handwashing with water only		625	36%		259	9%	**-366**	**-74%**		
Soap and Water		388	23%		2264	83%	**1876**	**265%**		
SOAPLAY	**1528**			**2049**					**<0.001**	**0.656** [1]
No handwashing		589	39%		71	3%	**-518**	**-91%**		
Handwashing with water only		583	38%		173	8%	**-410**	**-78%**		
Soap and Water		356	23%		1805	88%	**1449**	**278%**		

[1] Phi Coefficient

[1] A two proportion Z-test with a p=0.05 as the significance levels was conducted to compare handwashing rates at baseline, finding that there was no statistically significant difference between the groups handwashing with soap levels at baseline (p=<0.33).

3.2 Self-Reported Handwashing Practices and Illness Prevalence

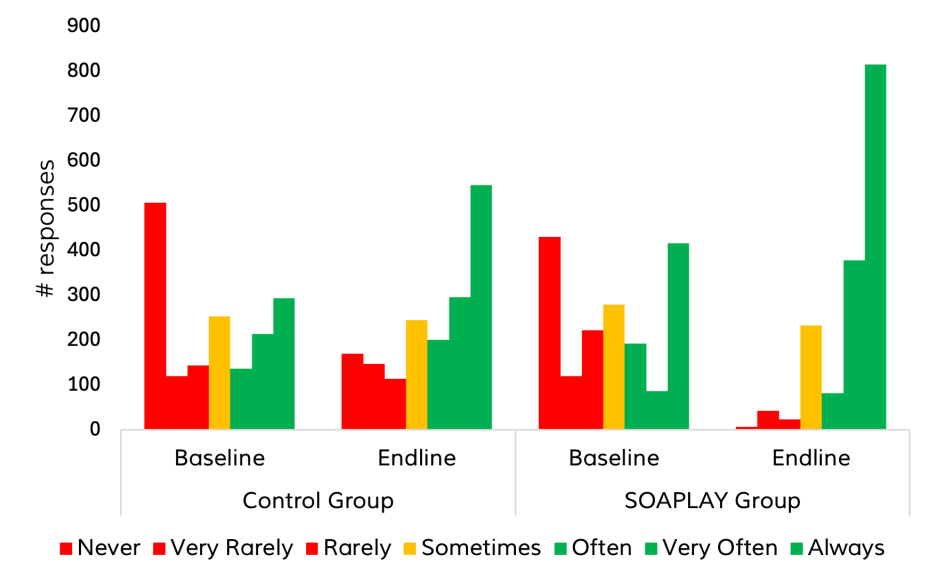
Survey results also revealed significant improvements, with 96% of children reporting to have washed their hands after the last time they used the toilet in school - representing a 33% increase compared to the baseline. Children reporting no handwashing occasions during a school day decreased by 91% overall.

Table 2. Handwashing Survey Results

	Baseline			Endline			Difference			
	n	x	%	n	x	%	x	%	p	Effect
Did you wash your hands with soap the last time you used the toilet in school?										
Control	**1653**			**1718**					**< 0.001**	**ϕ = 0.340**
Yes		1222	**74%**		1649	**96%**	**427**	**30%**		
No		431	**26%**		69	**4%**	**-362**	**-85%**		
SOAPLAY	**1742**			**1579**					**< 0.001**	**ϕ = 0.310**
Yes		1233	**71%**		1522	**96%**	**289**	**36%**		
No		509	**29%**		57	**4%**	**-452**	**-88%**		
How many times did you wash your hands during your last full day of school?										
Control	**1510**			**1621**					**<0.001**	**ϕc = 0.336**
0 times		263	**17%**		46	**3%**	**-217**	**-83%**		
1 time		367	**24%**		236	**15%**	**-131**	**-36%**		
2 times		397	**26%**		474	**29%**	**77**	**19%**		
3 times		307	**20%**		402	**25%**	**95**	**31%**		
4 times		129	**9%**		215	**13%**	**86**	**67%**		
5 times		39	**3%**		194	**12%**	**155**	**397%**		
6 times		8	**1%**		54	**3%**	**46**	**575%**		
SOAPLAY	**1724**			**1560**					**<0.001**	**ϕc = 0.357**
0 times		361	**21%**		10	**1%**	**-351**	**-97%**		
1 time		271	**16%**		114	**7%**	**-157**	**-58%**		
2 times		528	**31%**		534	**34%**	**6**	**1%**		
3 times		450	**26%**		655	**42%**	**205**	**46%**		
4 times		88	**5%**		162	**10%**	**74**	**84%**		
5 times		23	**1%**		73	**5%**	**50**	**217%**		
6 times		3	**0%**		12	**1%**	**9**	**300%**		
How often do you wash your hands with soap after using the toilet in school?										
Control	**1666**			**1621**					**<0.001**	**ϕc = 0.497**
Always		241	**14%**		861	**53%**	**620**	**257%**		
Very Often		217	**13%**		340	**21%**	**123**	**57%**		
Often		187	**11%**		238	**15%**	**51**	**27%**		
Sometimes		375	**23%**		158	**10%**	**-217**	**-58%**		
Rarely		196	**12%**		39	**2%**	**-157**	**-80%**		
Very Rarely		176	**11%**		64	**4%**	**-112**	**-64%**		
Never		274	**16%**		18	**1%**	**-256**	**-93%**		
SOAPLAY	**1745**			**1578**					**<0.001**	**ϕc = 0.557**
Always		242	**14%**		889	**56%**	**647**	**267%**		
Very Often		146	**8%**		286	**18%**	**140**	**96%**		
Often		299	**17%**		181	**11%**	**-118**	**-39%**		
Sometimes		334	**19%**		172	**11%**	**-162**	**-49%**		
Rarely		255	**15%**		27	**2%**	**-228**	**-89%**		
Very Rarely		140	**8%**		21	**1%**	**-119**	**-85%**		
Never		329	**19%**		2	**0%**	**-327**	**-99%**		
How often do you wash your hands with soap before eating in school?										
Control	**1666**			**1718**					**<0.001**	**ϕc = 0.278**
Always		293	**18%**		546	**32%**	**253**	**86%**		
Very Often		214	**13%**		296	**17%**	**82**	**38%**		
Often		136	**8%**		200	**12%**	**64**	**47%**		
Sometimes		253	**15%**		245	**14%**	**-8**	**-3%**		
Rarely		143	**9%**		114	**7%**	**-29**	**-20%**		
Very Rarely		120	**7%**		147	**9%**	**27**	**23%**		
Never		507	**30%**		170	**10%**	**-337**	**-66%**		
SOAPLAY	**1745**			**1578**					**<0.001**	**ϕc = 0.522**
Always		416	**24%**		815	**52%**	**399**	**96%**		
Very Often		86	**5%**		378	**24%**	**292**	**340%**		
Often		192	**11%**		81	**5%**	**-111**	**-58%**		
Sometimes		279	**16%**		233	**15%**	**-46**	**-16%**		
Rarely		222	**13%**		23	**1%**	**-199**	**-90%**		
Very Rarely		120	**7%**		42	**3%**	**-78**	**-65%**		
Never		430	**25%**		6	**0%**	**-424**	**-99%**		
Do you have soap for handwashing at home?										
Control	**1657**			**1715**					**< 0.001**	**ϕ = 0.189**
Yes		591	**36%**		935	**55%**	**344**	**53%**		
No		1066	**64%**		780	**45%**	**-286**	**-29%**		
SOAPLAY	**1743**			**1576**					**< 0.001**	**ϕ = 0.328**
Yes		427	**24%**		893	**57%**	**466**	**131%**		
No		1316	**76%**		683	**43%**	**-633**	**-43%**		

As reflected in the table above, improvements in self-reported handwashing were largely consistent across both groups, with the exception being handwashing before eating. While both groups displayed a positive change within this indicator, the change was significantly larger in the SOAPLAY group (φ_c= 0.278 in the control group and φ_c= 0.522 in the SOAPLAY group).

Figure 3. Self-reported handwashing before eating



Interestingly, both groups also experienced a strong increase in the number of children having soap for handwashing at home. The availability of soap at home increased by 131% in the SOAPLAY group and 53% in the regular soap group. The results support the notion that children serve as agents of change within the home – sharing new knowledge/habits with the rest of the family.

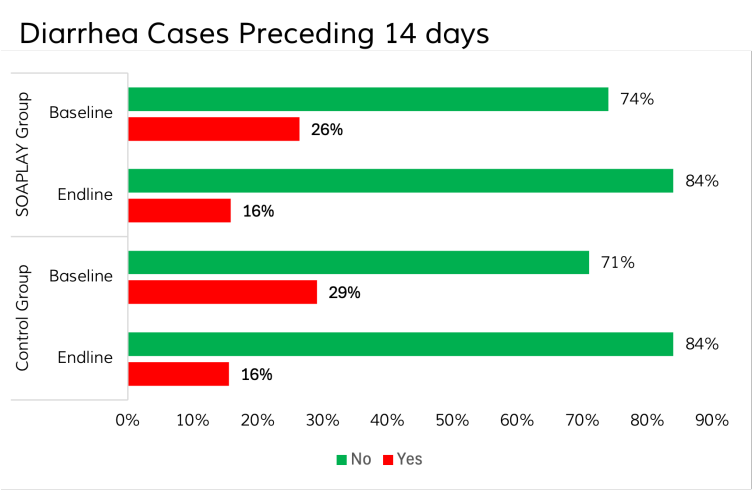
The SOAPLAY group children seemed, however, more inclined to bring these new ideas home. Children given SOAPLAY in school were 2.3 times more likely to have soap for handwashing at home after the intervention compared to before (95% CI: 2.1, 2.5). While children given regular soap were 1.5 times more likely to have soap for handwashing at home after the intervention compared to before (95% CI: 1.4, 1.7).

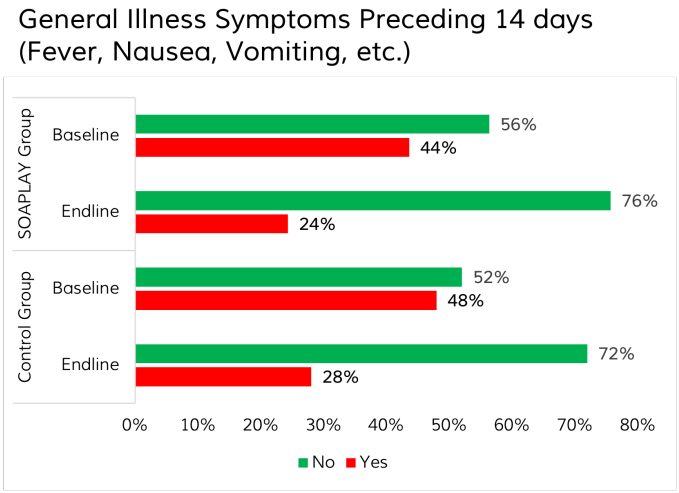
Finally, the illness survey showed that the project helped engender significant improvements within key health indicators. Overall, children missed 701 fewer school days in the two weeks preceding the endline compared to the baseline. The number of children missing school due to illness decreased by 35%. Diarrhea cases, as well as other general illness symptoms, decreased by around 43% across both groups.

Table 3. Illness Prevalence during Preceding 2 weeks

	Baseline			Endline			Difference		
	n	x	%	n	x	%	x	%	p
Illnesses									
Overall									
Children missing school days due to illness	3001	1038	**35%**	2974	664	**22%**	**-374**	**-35%**	**<0.001**
School days missed due to illness	3001	2057		2974	1356		**-701**		
Children experiencing diarrhea symptoms	3350	928	**28%**	3286	515	**16%**	**-413**	**-43%**	**<0.001**
Children experiencing other forms of illness symptoms	3365	1539	**46%**	3286	863	**26%**	**-676**	**-43%**	**<0.001**
Control									
Children missing school days due to illness	1399	576	**41%**	1596	365	**23%**	**-211**	**-44%**	**<0.001**
School days missed due to illness	1399	1196		1596	783		**-413**		
Children experiencing diarrhea symptoms	1612	469	**29%**	1711	266	**16%**	**-203**	**-47%**	**<0.001**
Children experiencing other forms of illness symptoms	1628	781	**48%**	1708	479	**28%**	**-302**	**-42%**	**<0.001**
SOAPLAY									
Children missing school days due to illness	1601	462	**29%**	1381	299	**22%**	**-163**	**-25%**	**<0.001**
School days missed due to illness	1601	861		1381	573		**-288**		
Children experiencing diarrhea symptoms	1738	459	**26%**	1575	249	**16%**	**-210**	**-40%**	**<0.001**
Children experiencing other forms of illness symptoms	1737	758	**44%**	1578	384	**24%**	**-374**	**-44%**	**<0.001**

Figure 4. Illness Prevalence during Preceding 2 weeks

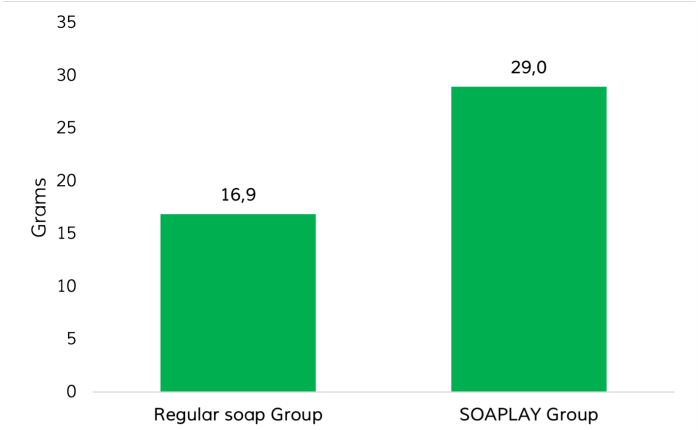




3.3 Soap Usage

Soap usage measurements showed that children in the SOAPLAY group consumed more soap per student during the test period, adding further weight to the differences in handwashing practices reflected in the observations and survey findings. The difference between group was quite large (^{d} = 0.88, p=0.08). In total, children given SOAPLAY in school used 72% more soap per student than children given regular shaped soap.

Figure 5. Average Soap Usage in Grams Per Student



4. Conclusions

Soap remains tragically out of reach for many of those who need it the most, and the overall changes found during this study offer further proof that increased soap access engenders important improvements in handwashing and health among children. The study also offers new evidence, showing that the design of soap bars can have a positive effect on handwashing practices among children. These findings are crucial as it opens new avenues of influence for nudge-based handwashing programming across the world.

The distinctions between the control and SOAPLAY group were subtle in some areas, but there were important differences. While this represented relatively small real-world discrepancies, it should be considered in conjunction with the very strong overall positive change that occurred within both groups. In this context, small differences could represent important advantages.

- Children given SOAPLAY in school were 3.78 times more likely to wash their hands with soap at endline compared to baseline.

- Children in the SOAPLAY group were 7% more likely to be observed washing their hands with soap compared to children in the regular soap group.
- Children in SOAPLAY schools used on average 72% more soap per student than children in the regular soap group, supporting the observation that handwashing rates were higher in the SOAPLAY group.
- Children given SOAPLAY in school were 2.3 times more likely to have soap for handwashing at home after the intervention compared to before, indicating that the children had played a substantial active role in sharing and disseminating their hygiene routines from school within the home.

The nudge-based idea behind SOAPLAY was further supported by the survey feedback section (not included in the main analysis), where a large proportion of children commented that the use of SOAPLAY had made handwashing feel more fun and inspired them to talk more about handwashing with their family and friends. These reports, whilst anecdotal in nature, reinforce the notion that SOAPLAY bars can generate a different level of engagement and enthusiasm for handwashing.

In a world of sustained hygiene paucity and neglect, all these marginal gains can be of utmost importance. Sustainable access to soap and water is the cornerstone of an enabling handwashing environment. SOAPLAY can now offer an easy, highly affordable tool to enhance this basic structure. Either as part of a larger nudge-based handwashing package or on its own, this innovative soap can add an important new dimension to handwashing promotion for children. With the aid of more attractive soap bars, children can engage with handwashing on a level that moves beyond abstract notions of germs and illnesses, and tap into the powerful realm of play in a way that subconsciously nudges them towards improved handwashing practices.

References

Biran et al (2014): Effect of a behaviour-change intervention on handwashing with soap in India (SuperAmma): a cluster-randomised trial, *Lancet Global Health*, Vol. 2, pp. 145-154

Black RE, Morris SS, Bryce J. (2003): Where and why are 10 million children dying every year? The Lancet 361: 2226–34.

Black, R. E., R. Laxminarayan, M. Temmerman, and N. Walker, (eds) (2016): *Reproductive, Maternal, Newborn, and Child Health. Disease Control Priorities*, third edition, volume 2., Washington DC, World Bank

Bulled et al (2017): Assessing the Environmental Context of Hand Washing among School Children in Limpopo, South Africa, *Water International*, Vol. 42, No.5, pp. 568-584

Burns et al. (2018): Washing with hope: evidence of improved handwashing among children in South Africa from a pilot study of a novel soap technology, *BMC Public Health*, Vol. 18, No. 709

Curtis A. Valerie, Lisa O Danquah & Aunger V. Robert (2009), Planned, Motivated and Habitual Hygiene Behaviour: An Eleven Country Review, *Health Education Research*, Vol. 24, No. 4, pp. 655-673

Dreibelbis et al (2016): Behavior Change without Behavior Change Communication: Nudging Handwashing among Primary School Students in Bangladesh, International Journal of Environmental Research and Public Health, Vol. 13, No. 129

Eco-Soap Bank (2024): Using Soap Bars as an Environmental Cue ("nudge") for Handwashing among Children, available at: ecosoapbank.org/impact

GHP, Global Handwashing Partnership (2020): Handwashing Handbook, available at: https://globalhandwashing.org/about-handwashing/

McMichael Celia & Robinson Priscilla (2016): Drivers of Sustained Hygiene Behaviour Change: A Case Study from Mid-Western Nepal, *Social Science and Medicine*, Vol. 163, pp. 28-36

Morris, B. Scott (2009): *Accounting for Covariance Heterogeneity in Estimates of the Standardized Mean Change*, Illinois Institute of Technology

MPI (2024): The Global MPI Country Briefing 2024: Tanzania. (October 2024), The Oxford Poverty and Human Development Initiative, available at https://ophi.org.uk/global-mpi/2024

Rajaraman et al (2014), Implementing Effective Hygiene Promotion: Lessons from the Process Evaluation of an Intervention to Promote Handwashing with Soap in Rural India, *BMC Public Health*, Vol. 14, No. 1179

Watson et al. (2019): Child's play: Harnessing play and curiosity motives to improve child handwashing in a humanitarian setting, *International Journal of Hygiene and Environmental* Health, Vol. 222, pp. 177-182

Watson, Julie & Dreibelbis, Robert (2020): *Using Environmental Nudges to Improve Handwashing With Soap Among Children*, Wash in Schools Network