

Southern Africa Labour and Development Research Unit



Washing with Hope: Evidence from a hand-washing pilot study among children in South Africa

by
Justine Burns, Brendan Maughan-Brown
and
Áurea Mouzinho

About the Author(s)

Justine Burns: School of Economics, University of Cape Town, Private Bag, Rondebosch, 7701, justine.burns@uct.ac.za.

Brendan-Maughan-Brown: Southern Africa Labour and Development Research Unit, University of Cape Town, Private Bag X3, Rondebosch, 7701, brendan.maughanbrown@gmail.com.

Áurea Mouzinho: Abdul Latif Jameel Poverty Action Lab, Africa, University of Cape Town, Private Bag, Rondebosch, 7701, aureamouzinho@gmail.com

Corresponding author: Justine Burns, School of Economics, University of Cape Town, Private Bag, Rondebosch, 7701, Justine.Burns@uct.ac.za, +27-21-650-3506

Funding

This work was supported by the The Abdul Latif Jameel Poverty Action Lab (J-PAL) Incubation Fund.

Acknowledgements

We are grateful to Rachel Glennerster and seminar participants at the University of Cape Town for valuable comments on previous version of this manuscript and to Laura Costica and Emmanuel Bakirdjian for valuable suggestions on the research design. We gratefully acknowledge funding provided by the Abdul Latif Jameel Poverty Action Lab (J-PAL) Incubation Fund.

Declaration of interest: The authors have no actual or potential conflict of interest to declare.

Recommended citation

Burns, J., Maughan-Brown, B., Mouzinho, A. (2017). Washing with Hope: Evidence from a hand-washing pilot study among children in South Africa. A Southern Africa Labour and Development Research Unit Working Paper Number 199. Cape Town: SALDRU, University of Cape Town

ISBN: 978-1-928281-60-3

© Southern Africa Labour and Development Research Unit, UCT, 2017

Working Papers can be downloaded in Adobe Acrobat format from www.saldru.uct.ac.za.

Printed copies of Working Papers are available for R25.00 each plus vat and postage charges.

Orders may be directed to:

The Senior Administrative Officer, SALDRU, University of Cape Town, Private Bag, Rondebosch, 7701,
Tel: (021) 650 5696, Fax: (021) 650 5697, Email: tania.hendricks@uct.ac.za



Washing with Hope: Evidence from a hand-washing pilot study among children in South Africa

Justin Burns, Brendan Maughan-Brown and Âurea Mouzinho

Saldru Working Paper 197

University of Cape Town

January 2017

Abstract

This paper reports the results of a randomised-control pilot study in which children in treatment households received a bi-monthly delivery of HOPE SOAP[®], a colourful, translucent bar of soap with a toy embedded in its centre. In contrast, children in control households received a colourful, translucent bar of soap with the toy alongside it. Whilst many of our findings lack statistical power, the pilot certainly suggests that HOPE SOAP[®] has positive effects on child handwashing behaviour. At endline, HOPE SOAP[®] children are directly observed as being more likely to wash their hands unprompted prior to eating a snack. They are also more likely to wash their hands after using the toilet, are significantly more likely to use soap to wash their hands as opposed to just rinsing with water, and enjoy significantly better health outcomes.

JEL classification: I1; I12; I150

Keywords: Hand-washing intervention; childhood health; pilot randomised controlled trial; behavioural economics; development economics; habit formation

Highlights

- An RCT pilot study was run to test HOPE SOAP[®], an innovative, child-friendly soap.
- Treated children received HOPE SOAP[®], a translucent soap with an embedded toy.
- Control children received the translucent soap with a toy alongside.
- HOPE SOAP[®] children are more likely to wash their hands unprompted prior to eating.
- HOPE SOAP[®] children are more likely to use soap to wash their hands.
- HOPE SOAP[®] children are more likely to wash their hands after using the toilet.
- HOPE SOAP[®] children evidence significantly better health outcomes.

Introduction

Preventable disease continues to be a leading cause in child deaths around the world. Approximately 10 million children die each year, with 50% of deaths occurring in 6 countries alone (Black et al., 2003). Diarrhoea and acute respiratory infections are responsible for 35% and 32% of child deaths respectively (Aiello et al., 2008), whilst communicable diseases have been estimated to be responsible for 73% of deaths of children under the age of five years (Van Lerberghe et al., 2005). Furthermore, early childhood disease has been shown to have potential long-term human and economic costs by impacting future school readiness and achievement, outcomes in early adulthood and performance on cognitive tests in old age (Almond and Currie, 2011; Currie et al., 2010; Case and Paxton, 2009; Chay et al., 2009; Lorntz et al., 2006).

Regular hand-washing holds promise as a cheap and effective way to reduce communicable disease incidence and related child mortality in developing countries. Medical evidence has shown that hands are the primary transmitters of disease and therefore should be the major starting point in any attempt to reduce the incidence of diarrheal and respiratory illness (Galiani et al., 2012). However, instilling a habit of regular hand washing in young children continues to be a challenging task, especially in developing country contexts with inadequate sanitation infrastructure, insecure low-quality water supplies, and low levels of hygiene literacy, where it has been estimated in various studies that only 3-35% of individuals wash their hands at critical times (World Bank, 2005).

In this paper, we explore the impact on hand-washing and health outcomes of a pilot study in which 288 children in poor households in Western Cape Province received a bi-monthly supply of soap over the course of three months. Households were randomly selected to receiving either a glycerine bar of soap per child, or a similar-shaped bar of HOPE SOAP[®] that included a child-friendly toy at the centre which could be accessed through regular hand-washing. We test the hypotheses that children who use HOPE SOAP[®] wash their hands more frequently relative to children who use regular soap, and that over time, they have better hand-washing habits and health outcomes. Whilst many of our findings lack statistical power, the pilot certainly suggests that HOPE SOAP[®] has positive effects on child handwashing behaviour. At endline, HOPE SOAP[®] children are directly observed as being more likely to wash their hands unprompted prior to eating a snack. They are also more likely to wash their hands after using the toilet, and are significantly more likely to use soap to wash their hands as opposed to just rinsing with water. Moreover, HOPE SOAP[®] children, in general, have better health outcomes, and those who use the soap as intended, and do not cheat to remove the toy from the soap, evidence significantly better health outcomes.

From Hand-washing to Health

There is a large literature in support of the health benefits of regular hand-washing. Using pooled cross-sectional estimates from a review of 30 studies conducted between 1960 and 2007, Aiello et al. (2008) found that improving hand hygiene can reduce gastrointestinal illness by 31% and respiratory illness by 21%. In a similar meta-analysis, Curtis and Cairncross (2003) argued that washing hands with soap can decrease the incidence of diarrheal disease by up to 47%. Other studies have demonstrated that hand-washing interventions typically improve knowledge about the importance of cleanliness, especially at critical times (Chase and Do, 2010; Stanton and Clemens, 1987; Han and Hlaing, 1989; Luby et al., 2011), and lead to an increase in the incidence of hand-washing, both observed and self-reported (Galiani et al., 2012).

However, the key challenge, especially in relation to the behaviour of children, is to instill a habit¹ of regular hand-washing. The available literature suggests a number of key insights that are important in this regard. The first is that, on its own, the provision of information about the importance of hand-washing may be necessary but is not sufficient to lead to improved health outcomes. For example, mass media campaigns to promote hand-washing appear to be largely ineffective. In Peru, Galiani et al. (2012) found that a provincial mass media campaign to promote positive messages around the importance of hand-washing had no effect on hand-washing behaviour. Similarly, Chase and Do (2010) found that whilst an information campaign increased knowledge about hand washing at critical times, this did not translate into any significant change either in hand-washing with soap behaviour or on child health more generally.

Recent work in behavioural science suggests that the failure of many interventions aimed at changing behaviours that contribute to poor health outcomes, including hand-washing interventions, may stem from too much emphasis being placed on System II thinking, relying on conscious, deliberate thought and assimilation of knowledge to lead to behaviour change, when, in fact, many of these behaviours are automatic, largely unreflective and prompted by contextual cues (Marteau et al., 2012; Neal et al., 2015). In a meta-review of hand-washing studies, Vindigni et al. (2011) argue that this accounts for the lack of success of many interventions in inducing hand-washing habit formation. Thus, interventions that aim to change intentions through information provision alone may be insufficient. In a meta-analysis of 47 experimental tests, Webb and Shearan (2006) found decreasing returns to scale from intention-change to behaviour-change. Hence, whilst engaging System II thinking may be an important part of a successful hand-washing intervention, if the goal is to induce habit formation greater attention must be paid to System I thinking, which is far more automatic, unconscious and cue-driven (Neal et al., 2015).

Indeed, habits are environmentally triggered, which suggests the need for a supporting environment that provides critical behavioural cues, such as having the tools required for the behaviour consistently and readily available (Neal et al., 2015; Neal et al., 2011a, 2011b; Wood et al., 2005). For example, when soap and water are readily available, hand-washing behaviour and health outcomes tend to improve. Luby et al. (2005) found that the provision of soap and linked promotional activities can reduce the incidence of pneumonia by 50% in children younger than 5 years old. Children younger than 15 experienced a decrease in diarrheal incidence of 53% and a decrease in impetigo of 34%. In a programme in China in which the treatment included a hand washing program, the provision of soap and the appointment of peer hygiene monitors, children in treated schools missed 1.9 days of school per 100 student weeks on average compared to an absenteeism rate of 2.6 days in control schools (Bowen et al., 2007). Galiani et al. (2012) evaluated a district-level programme in Peru which included activities to promote hand-washing in programme communities and the provision of soap and safe water.² The intervention was successful in improving caregivers' knowledge of the importance of hand-washing, and there was an increase in self-reported and observed hand-washing with soap. However, no improvements in health outcomes were observed amongst children, a sober reminder of just how difficult it is to engender change in this domain.

¹ A habit is described as a process consisting of a loop composed of three elements: a cue, a routine and a reward (Duhigg, 2012). The *cue* is as a trigger; the *routine* is the action itself; whilst the *reward* helps the brain understand that this loop is worthwhile remembering. Research in psychology has shown that repetition of an action in a particular context leads to a cognitive association between the action and the contextual cue. In the presence of the cue, the action is triggered, and alternative responses are ignored (Neal, Labrecque, Wood, & Lally, 2011). Well-practiced behaviours in constant contexts recur because the processing that initiates and controls their performance becomes automatic (Ouellette and Wood, 1998).

² Elements of the district-level community treatment included training community agents, conducting capacity building amongst mothers, caregivers and children and incorporating hand washing as part of primary school curricula in primary schools.

Habit formation is also more likely when context is leveraged to good effect, either through significant contextual change (such as becoming a first time mother) or by leveraging old behaviours in new ways to provide a teachable moment (Neal et al., 2015; Greenland et al., 2013). Examples of the latter include targeted interventions that teach proper hand-washing technique and promote the importance of hand washing at key times, namely prior to food preparation and after toilet use. Evidence suggests these kinds of intervention are more effective than those that do not leverage context in this way (Han and Hlaing, 1989; Luby et al., 2011). In an intervention where mothers and children were supplied with soap and asked to wash their hands after defecation and before preparing food, diarrheal incidence decreased and dysentery amongst children aged 0 to 2 decreased by 40% (Han and Hlaing, 1989). Similar results in relation to hand-washing before preparing food were found in rural Bangladesh (Luby et al., 2011). An educational intervention to improve three aspects of water-sanitation behaviour in Bangladesh³ resulted in a decrease in the rate of diarrhoea of 26% in treatment communities as well as an improvement in hand washing practices before preparing food (Stanton and Clemens, 1987).

The difficulty in translating interventions into behavioural change and ultimately improved health outcomes among children stems from the multiple factors that need to be aligned for success. For example, in studies where child and health outcomes improved and where the intervention occurred at the household or district level, it is unclear whether the positive impact resulted from children being more likely to adopt good hand-washing practices, or from better caregiver health practices. Poor health outcomes amongst children may occur when caregivers fail to wash their hands regularly and at critical times, even though the hand-washing behaviour of children may improve. Moreover, caregivers may fail to effectively transfer information from education campaigns to children. All of these difficulties raise the possibility that targeting children directly may be more effective to achieve behavioural change.

Secondly, many hand-washing studies rely on self-reported measures of hand-washing behaviour which may, arguably, be subject to bias. Obtaining objectively verified observational measures of hand-washing is a challenge for any study of hand-washing behaviour, with proposed solutions ranging from the use of costly acceleration sensors to direct observation. However, Ram (2010) estimates that direct observation may lead to an overestimate of hand-washing incidence by as much as 20%. In this study, we try to minimize this sort of bias by adding a snack break – what we'll refer to as a snack test – to a pre-existing program and using the program implementers already familiar to children to collect a directly observable measures of hand-washing. Thus, by relying on a randomized control trial in conjunction with a minimally-intrusive directly observable measure of hand-washing behaviour, this study hopes to overcome some of the difficulties that have plagued previous studies. In addition, there is little available experimental evidence in an African context on the extent to which such interventions might prove effective. It is in each of these domains that this study aims to make a contribution.

Piloting HOPE SOAP[®]

HOPE SOAP^{®4} is a colourful, translucent bar of soap with a toy embedded in its centre. The aim of this innovative yet simple soap technology is to encourage hand-washing practice amongst children by making it fun and goal-oriented. Importantly, this is an intervention targeted directly at children. Using a randomised trial, a pilot study was designed to test whether HOPE SOAP[®], in comparison to

³ These three aspects included aiming to reduce a lack of hand washing when preparing food, defecation by children in the family compound area and a lack of attention paid to the proper disposal of garbage and faeces.

⁴ HOPE SOAP[®] was created through a partnership between advertising agency Young & Rubicam (Y&R) and Safety Lab, a non-profit behavioural innovation lab.

regular soap, increases hand-washing amongst young children, both in the short-term and in the long-term (i.e. habit formation), and results in a lower incidence of communicable disease. Because assignment to treatment is random, receipt of the intervention is exogenous, and therefore unrelated to any other observable and unobservable factors (Duflo et al., 2007). This solves problems of selection bias and unobserved heterogeneity. Since intra-household spillovers in soap usage would be difficult to prevent and measure, we randomized at the household level. We stratified the randomisation by: household size; the gender ratio among eligible children (i.e. number of eligible girls relative to total number of eligible children); the age ratio among eligible children (i.e. number of eligible children above mean age relative to the total number of eligible children); and the number of caregivers in the household.

The pilot ran over four months between September and December of 2014 in the impoverished community of Delft in the Western Cape, South Africa, and was implemented in partnership with the Foundation for Community Work (FCW), an early childhood development and resource organization. FCW runs an in-home education programme called Family-in-Focus, which involves fortnightly home-visits conducted by trained community workers, during which they engage with caregivers and their children, sharing knowledge on child development and facilitating activities to promote caregiver-child interaction. The community of Delft was selected as the pilot site based on ease of access as well as the number of households and children enrolled in the Family-in-Focus program. At the start of the implementation period, 220 families were enrolled in the Family-in-Focus program, and these were served by 13 community workers. Eligibility for inclusion in the pilot was based on the following criteria⁵: (1) the caregiver was still interested in participating in the FCW Family-in-Focus program; (2) the caregiver had at least one child between the ages of three and nine years old⁶; (3) the age-eligible children were not involved in any other sort of ECD program (e.g. crèche or other day-care).

Since the Family-in-Focus program formally addresses issues of child health and hand-washing in its content, it provided an ideal platform to roll out the HOPE SOAP[®] pilot intervention. Delivery of soap into households was tailored to match the program schedule, so that children received their first bar of soap at the end of the designated lesson on health and hygiene. Thereafter, the intervention consisted of fortnightly provision of HOPE SOAP[®] bars to children in treatment households and normal soap with a toy alongside to children⁷ in control households over an 8-week period. The clear bars of soap and the accompanying toys shared the same specifications and were delivered with the same frequency as the HOPE SOAP[®] bars. Although a third group of comparison households in which eligible children received nothing would have been ideal, binding budget constraints for the pilot made this impossible. Accordingly, our estimates show the impact of HOPE SOAP[®] on behaviour and health relative to the impact of the receipt of regular soap that had the same size and colour specifications as the HOPE SOAP[®] bars.

There are a number of reasons to be optimistic about the potential success of HOPE SOAP[®] in promoting hand-washing habit formation, since it satisfies a number of the principles required for

⁵ Note that eligibility was based on caregivers and not households, since a single household could contain more than one caregiver.

⁶ The child age-bracket was based on the fact that FCW do not work with children older than nine, they only start targeting children with hygiene and hand-washing messages once they turn three.

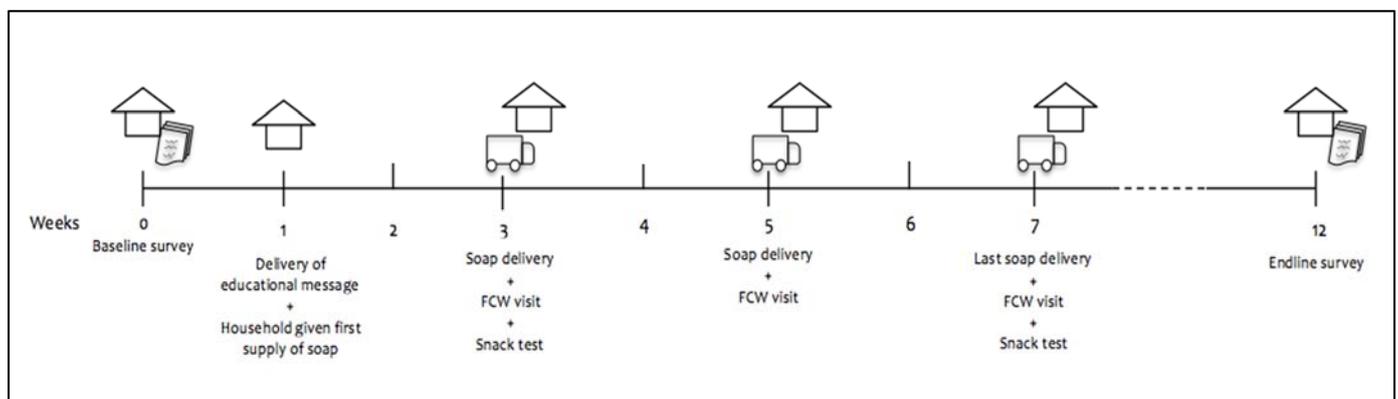
⁷ Children in control households received a colourful translucent bar of soap that was identical in size to HOPE SOAP[®]. Since randomisation was done at the household level and not at the community worker level, a single community worker would have had both treatment and control households amongst the households she served. Since these households typically live close to one another, this raised the possibility that children in control households would learn about HOPE SOAP[®] and possibly become disgruntled and thus less inclined to use their soap, or conversely, might try to assist children in treatment households in getting the toy out of the soap by also using it. To avoid these potential confounds on our treatment effect, we chose to give the children in control households the same toys that were placed inside HOPE SOAP[®] to minimise this kind of behaviour.

habit formation to occur set out by Neal et al. (2015). Firstly, all households were provided with soap, enabling a supporting environment, which in the case of treatment households was re-enforced by the cue given by the visible presence of the toy in the middle of the soap bar. Secondly, HOPE SOAP® was introduced in conjunction with a pre-existing home-visitors programme which included a module on health and hygiene. This context was leveraged to provide a ‘teachable moment’ for children participating in the programme. Since the toy is embedded within the soap, children must expend effort to get the toy. Thus, the act of hand-washing becomes goal-oriented. Goals can direct habits by motivating repetition that leads to habit formation. Once a habit is formed, perception of contexts triggers the associated response without a mediating goal (Wood and Neal, 2007). Moreover, in the case of HOPE SOAP®, the visual cue given by the toy makes hand-washing fun, thereby reducing frictions that might impede the desired behaviour (Wood and Neal, 2007). Finally, in this instance, reward is directly tied to hand-washing performance, and children may be particularly responsive in this regard. Nicholson et al. (2014) report that children who received cues to wash their hands and who were then rewarded by their mothers for doing so enjoyed improved health benefits compared to control group children.

Data Collection

Figure 1 describes the intervention timeline and data collection strategy. A baseline survey was conducted in September 2014 to collect household characteristics (i.e. composition, infrastructures, assets, health), knowledge about health and hygiene practices, as well as attitudes and behaviour towards hand-washing. Additional observational data on soap availability and household cleanliness were also collected. An endline survey was conducted shortly after the intervention period ended in December 2014. The baseline survey was repeated with additional data being collected on usage of and attitude towards HOPE SOAP®.

Figure 1. Timeline of intervention and data collection



In the baseline and endline surveys, frequency of hand-washing by children at two critical times (after the toilet and before meals) was measured by asking caregivers ‘On a scale of 1 to 10, where 1 means never and 10 means always, how regularly does [...] wash his or her hands without being prompted after using the toilet?’ and ‘On a scale of 1 to 10, where 1 means never and 10 means always, how regularly does [...] wash his or her hands without being prompted before a main meal?’ In addition, caregivers used the same scale to report how often the child used soap when he or she washes his or her hands.

The health of children was measured by asking caregivers whether each child had experienced any of the following in the two weeks prior to each survey: blocked nose, runny nose, persistent

sneezing, sore or scratchy throat, painful swallowing, cough, fever, headache, shortness of breath, itchy and watery eyes, nausea, vomiting, rash, diarrhoea.

Baseline Characteristics

Our baseline sample was recruited from 203 houses (i.e. physical structures). In 22 cases, multiple caregivers with children enrolled in the FCW program resided in the same house. These caregivers defined their family unit as a separate household. Accordingly, we defined households as separate family units rather than physical structures. Tables 1 and 2 presents baseline characteristics of the households (n=229), caregivers (n=229) and children (n=288) in our sample.

Of the 229 households/family units that were surveyed at baseline, 123 households were randomly assigned to treatment. The vast majority of household heads had not completed high school (86%). Most households (89%) reported a member who was receiving a government social welfare grant, indicating low levels of income. Despite generally low monthly household income, basic hygiene-related infrastructure was good: 79% of households had piped water in the house and 87% reported a flush toilet within the dwelling. In terms of household hygiene (Table 1), almost all households were using bar soap. The provision of bar soap to households during our study would therefore not have introduced an unfamiliar soap product. Just over a quarter of households (28%) reported not having soap always available and in more than a third (39%) of households the fieldworker did not observed soap for hand-washing on the day of the baseline survey. Reports of illness within the household were common with 65% of households reporting that at least one household member had diarrhoea, flu or nausea in the 2 weeks preceding the baseline, and 42% reporting the same for children.

The caregivers (Table 1) of the children in our sample had, on average, been involved with the FCW programme for a relatively short time with a mean of 5 months and 38% having enrolled in the three months prior to the baseline. Self-reported knowledge of how to effectively wash hands was high among caregivers, with an average score of 32 out of a maximum of 40 based on knowledge of four components of hand-washing (the importance of soap, warm water, rubbing hands and lathering). However, 39% did not mention hand-washing as a means to prevent diarrhoea and over a fifth reported that they did not always wash hands before cooking and eating (22%) and did not always use soap when washing hands (20%). Health was relatively poor among this sample of caregivers: 43% reported that their health sometimes affects their ability to carry out normal activities, and 44% reported that they had been depressed or anxious during 3 or more days in the week before the survey.

Table 1. Baseline summary statistics: households and caregivers

	Full sample		Treatment		Control		Treatment- Control		
	Obs	Mean	SD	Obs	Mean	Obs	Mean	Mean	p-value
<i>Household Characteristics</i>									
Number of members	229	6.47	2.64	123	6.42	106	6.52	-0.10	0.799
Number of children	229	2.27	1.22	123	2.19	106	2.36	-0.17	0.324
Head: Coloured	219	0.82	0.38	120	0.83	99	0.82	0.01	0.900
Head: completed grade 12	189	0.14	0.35	105	0.13	84	0.14	-0.01	0.855
Member received govt. grant	229	0.89	0.31	123	0.92	106	0.86	0.06	0.151
Asset index (0-20)	223	9.16	3.15	121	9.13	102	9.19	-0.05	0.906
Monthly hh income <R2000	214	0.41	0.49	113	0.42	101	0.40	0.02	0.779
Piped water in house	228	0.79	0.41	123	0.73	105	0.85	-0.12	0.041
Toilet in house	226	0.87	0.34	122	0.84	104	0.90	-0.06	0.196
Household limits water use	214	0.44	0.50	110	0.50	104	0.39	0.12	0.096
<i>Hygiene & health</i>									
Use bar soap	226	0.93	0.26	121	0.93	105	0.92	0.00	0.962
Soap always available	226	0.72	0.45	121	0.73	105	0.71	0.02	0.716
Soap observed by fieldworker	198	0.61	0.49	104	0.56	94	0.66	-0.10	0.156
Household limits hand-washing	228	0.18	0.38	123	0.17	105	0.19	-0.02	0.701
Household member ill past 2 weeks	229	0.65	0.48	123	0.62	106	0.68	-0.06	0.354
Child ill past 2 weeks	229	0.42	0.49	123	0.38	106	0.46	-0.08	0.248
<i>Caregiver characteristics</i>									
Programme participant >3 months	222	0.62	0.49	120	0.58	102	0.67	-0.08	0.215
Hygiene training past 3 months	220	0.61	0.49	119	0.56	101	0.65	-0.09	0.183
Hand-washing prevents diarrhoea	229	0.61	0.49	123	0.60	106	0.61	-0.01	0.862
Hand-washing technique knowledge (0-40)	226	32.40	7.33	121	32.11	105	32.73	-0.63	0.517
Washes hands before cooking & eating	229	0.78	0.42	123	0.79	106	0.76	0.02	0.659
Always uses soap to wash hands	228	0.80	0.40	123	0.80	105	0.80	0.00	0.950
Health never affects activities	228	0.57	0.50	122	0.53	106	0.60	-0.07	0.278
Depressed/anxious 3+ days last week	229	0.56	0.50	123	0.60	106	0.51	0.09	0.155

Our sample of children (Table 2) comprised similar numbers of girls and boys, with an average age of four and a half. Several factors were identified to affect the child's willingness to wash his/her hands, with factors relating to the child's physique the most common barriers. For approximately a third of children, being too short to reach the tap, having difficulty opening the tap and having hands too small to hold the soap were reported to affect hand-washing most or all of the time. Factors relating to the water supply (temperature, cleanliness and smell) were also potential barriers to hand-washing for between 16-19% of children. It is also worth noting that just under a fifth of households in the sample reported that they limited hand-washing activities in some way due to water scarcity (Table 1). In terms of hand-washing behaviour, unprompted hand washing was relatively infrequent at baseline with an average hand-washing score (1-10:1=never, 10=always) of less than six for both scenarios of hand-washing after the toilet and before meals. Fewer than a third scored an 8 or more on either hand-washing score. In cases when children did wash their hands, the average score for the regularity of soap use during hand-washing was 6.9, with 49% of the children scoring an 8 or above. Health among our sample of children was relatively poor with three quarters having had a symptom of illness during the two weeks before the survey and caregivers reporting an average of 2.5 symptoms per child.

Table 2. Baseline summary statistics: children

	Full sample			Treatment		Control		Treatment-Control	
	Obs.	Mean	SD	Obs.	Mean	Obs.	Mean	Mean	p-value
Female	287	0.49	0.50	153	0.49	134	0.49	0.00	0.970
Age	287	4.48	1.36	153	4.46	134	4.51	-0.04	0.798
<i>Hand-washing barriers</i>									
Too short	284	0.35	0.48	151	0.39	132	0.30	0.10	0.152
Can't open tap	284	0.38	0.49	150	0.45	133	0.30	0.15	0.026
Hands too small for soap	284	0.32	0.47	150	0.37	133	0.26	0.11	0.077
Water too hot/cold	288	0.19	0.39	153	0.20	134	0.16	0.04	0.502
Dirty water	288	0.18	0.38	153	0.18	134	0.16	0.02	0.739
Water smells bad	288	0.16	0.37	153	0.16	134	0.16	0.00	0.998
Household water saving	284	0.15	0.36	150	0.14	133	0.16	-0.02	0.751
Sounds from water tap	284	0.06	0.24	150	0.09	133	0.04	0.05	0.204
<i>Hand-washing</i>									
After toilet (1-10)	282	5.73	3.00	151	5.62	130	5.89	-0.28	0.501
Before meal (1-10)	283	5.35	2.95	150	5.16	132	5.60	-0.44	0.299
Uses soap (1-10)	275	6.93	2.79	144	6.95	130	6.89	0.07	0.870
<i>Health</i>									
Illness score (0-13)	249	2.55	2.59	137	2.51	112	2.59	-0.08	0.835
Any symptoms	249	0.74	0.44	137	0.77	112	0.71	0.07	0.270
2+ symptoms	249	0.57	0.50	137	0.55	112	0.59	-0.04	0.580

The key feature to note in Tables 1 and 2 is that in almost all cases, sample attributes are balanced between the treatment and control group. Exceptions are that treatment households are significantly less likely to have piped water in the household and more likely to limit water use. In addition, children in treatment households are significantly more likely to be reported as having difficulty opening a tap and as having hands that are too small to hold regular soap. Since our samples are not balanced on these variables, we include them as additional controls in our regression specifications. These pre-existing differences may work to undermine any potential treatment effect that might exist.

Estimation Strategy

Ordinary least squares regression models were used to estimate the effect of assignment to HOPE SOAP[®] on observed hand-washing during the snack tests, as well as endline measures of 1) frequency of hand washing after the toilet and before meals; 2) frequency of soap usage when washing hands; 3) and number of symptoms of illness experienced. For each dependent variable we present results from models with and without control variables for basic demographic and socioeconomic characteristics (gender and age of child, number of household members, number of children in the household, household assets) and relevant factors they were unbalanced (using $p < 0.2$) at baseline. In addition, for the self-reported measures of hand-washing and health, we created a model that includes the equivalent baseline measure. Finally, we assess whether the effect of HOPE SOAP[®] varied according to baseline hand-washing behaviour.

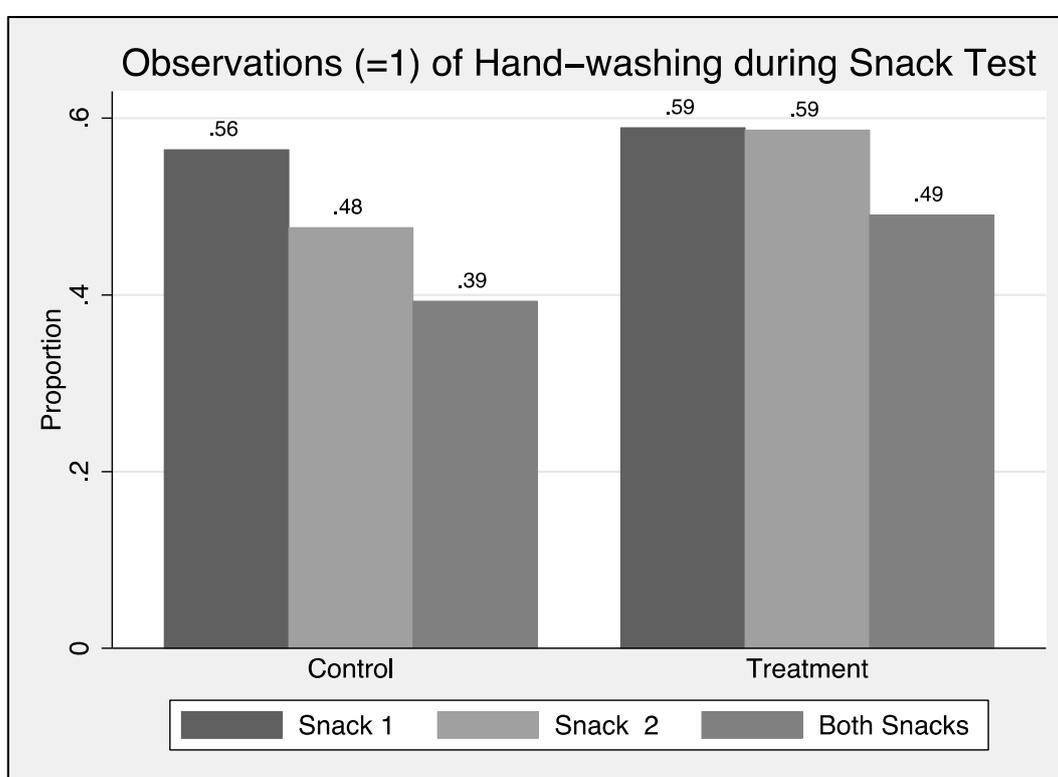
All standard errors are clustered by FCW worker. By accounting for clustering at this level, we control for all potential error correlation between families served by the same FCW worker. This includes potential correlation between family units living within the same physical structure.

Results

Result 1: At endline, HOPE SOAP® children are directly observed as being more likely to wash their hands unprompted prior to eating a snack.

Figure 2 displays the proportion of children in treatment and control groups respectively who, without being prompted, washed their hands before eating at the first and second snack test. Similar proportions of children in both groups were observed to wash their hands prior to the first snack test. However, differences were evident by the second snack test. The proportion of children washing their hands in the HOPE SOAP® group at snack test one and two remained consistent (59%), while there was an 8% point decrease in hand-washing at snack test two among children in the control group.

Figure 2. Observations of hand-washing by children during the snack tests



After controlling for demographic characteristics and factors that were unbalanced between treatment and control groups at baseline, treatment children are 6% points ($p=0.485$) more likely to wash their hands before eating the snack (Table 3, Model 4). Moreover, children in the HOPE SOAP® group were 10% points ($p=0.264$) more likely to wash their hands before both snack tests compared to control group children (Table 3, Model 6).

Table 3. Effect of treatment on hand-washing during the Snack Tests

	(1)	(2)	(3)	(4)	(5)	(6)
	Wash at Snack 1	Wash at Snack 1	Wash at Snack 2	Wash at Snack 2	Wash at Snack 1&2	Wash at Snack 1&2
Treatment:						
HOPE SOAP	0.02 (-0.13 - 0.18)	0.04 (-0.12 - 0.20)	0.11 (-0.06 - 0.29)	0.06 (-0.11 - 0.23)	0.10 (-0.08 - 0.27)	0.10 (-0.07 - 0.27)
Controls	No	Yes	No	Yes	No	Yes
Observations	230	228	188	187	188	187
R-squared	0.00	0.12	0.01	0.17	0.01	0.13

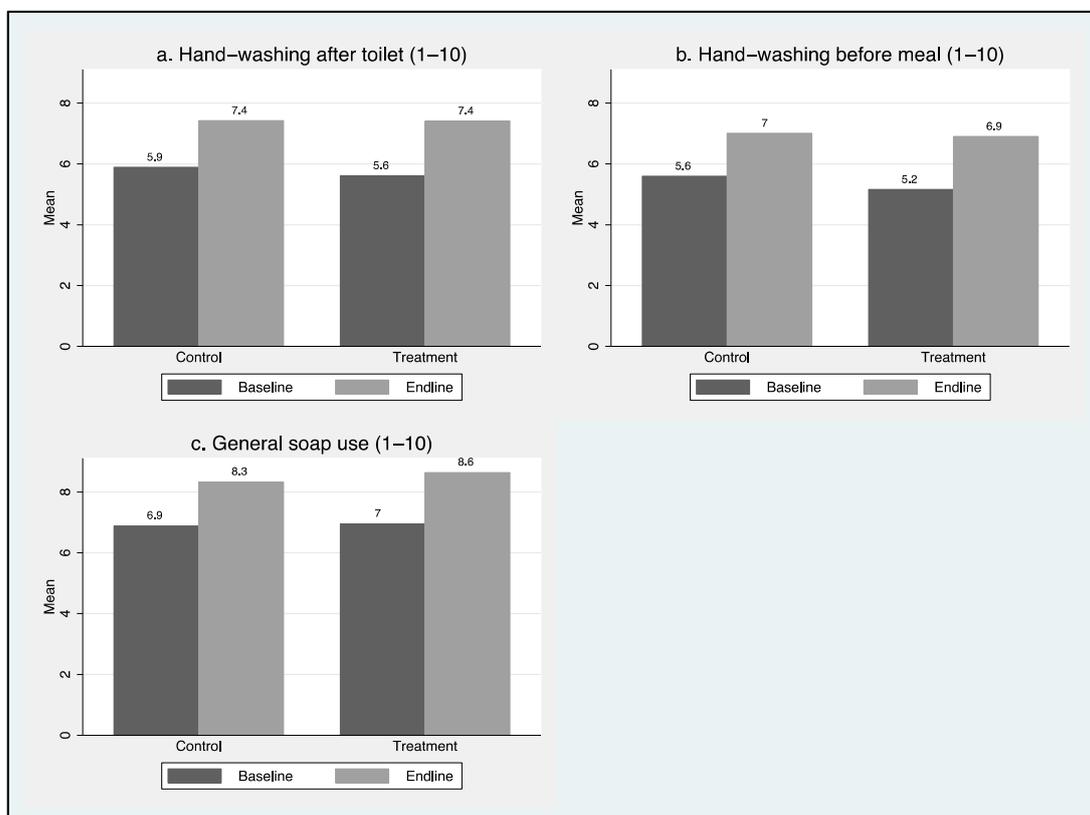
Notes: 95%CI in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Additional controls included but not reported: Female, age, household size, number of children in HH, asset ownership, piped water available in HH, HH limits water use; Soap observed in HH; HH received hygiene training; Caregiver depressed/anxious; child had difficulty opening tap; Child cannot reach taps; Child's hands too small for soap. The full model, with coefficients for all control variables, is presented in the appendix Table A1.

Result 2: Reported incidence of hand-washing improves for all with no significant treatment effect

The remaining results are from data self-reported by children's caregivers. Figure 3 displays the change between baseline and endline in the average score for three different hand-washing measures. Overall, in both groups, substantial improvements in hand-washing were found for both the frequency of hand-washing at critical times and the use of soap when hands were washed. At endline, there were no significant differences in these measures among control and treatment children.

Figure 3. Child hand-washing behaviour as reported by caregivers



Result 3: Conditional on poor baseline hand-washing behaviour, HOPE SOAP® children are more likely to wash their hands after using the toilet

The results for the effect of HOPE SOAP® on hand-washing after going to the toilet are presented in Table 4, Panel A. A weak positive treatment effect was found after controlling for baseline factors (Models A2 & A3). However, Model A4 indicates that the treatment effect varied according to baseline hand-washing score with a larger effect among children who were initially relatively poorer hand-washers (treatment coefficient: 1.29, $p=0.117$), and a weakening treatment effect among initially better hand-washers (interaction term: -0.19, $p=0.093$). Models A5-A7 show small positive associations between receipt of HOPE SOAP® and the proportion at the top end of the hand-washing score. Similar results are found in relation to the effect of HOPE SOAP® on hand-washing before meals as reported in Table 4, Panel B, although the results lack statistical power.

Result 4: HOPE SOAP® children are significantly more likely to use soap when washing their hands

A more positive treatment effect was found on general soap use when children did wash their hands (Table 4, Panel C). The average soap use score was 0.42 higher ($p=0.094$) among children in the HOPE SOAP® group than control children after including control variables (Model C2). At the top end of the scale (Model C7), the proportion scoring higher than eight was 14% points greater ($p=0.011$) in the treatment group.

Table 4. Effect of treatment on hand-washing outcomes

Panel A: Hand-washing after toilet	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)	(A7)
	Score 1-10	Score 1-10	Score 1-10	Score 1-10	Score = 10	Score = 9+	Score = 8+
Treatment: HOPE SOAP	-0.01 (-0.69 - 0.67)	0.11 (-0.62 - 0.84)	0.20 (-0.49 - 0.88)	1.29 (-0.33 - 2.91)	0.02 (-0.11 - 0.15)	0.02 (-0.11 - 0.15)	0.08 (-0.06 - 0.23)
^Baseline measure			0.22*** (0.10 - 0.34)	0.32*** (0.15 - 0.50)	0.14 (-0.05 - 0.33)	0.13 (-0.05 - 0.31)	0.29*** (0.15 - 0.43)
Treatment*Baseline measure				-0.19* (-0.41 - 0.03)			
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	249	247	242	242	242	242	242
R-squared	0.00	0.08	0.16	0.17	0.09	0.08	0.16
Panel B: Hand-washing before meal	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B7)
	Score 1-10	Score 1-10	Score 1-10	Score 1-10	Score = 10	Score = 9+	Score = 8+
Treatment: HOPE SOAP	-0.10 (-0.86 - 0.65)	0.27 (-0.49 - 1.03)	0.28 (-0.46 - 1.02)	1.14 (-0.46 - 2.73)	0.05 (-0.06 - 0.16)	0.07 (-0.06 - 0.21)	0.05 (-0.08 - 0.19)
^Baseline measure			0.13** (0.01 - 0.25)	0.22** (0.04 - 0.39)	-0.03 (-0.21 - 0.14)	0.05 (-0.13 - 0.22)	0.10 (-0.05 - 0.26)
Treatment*Baseline measure				-0.16 (-0.40 - 0.09)			
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	249	247	244	244	244	244	244
R-squared	0.00	0.09	0.11	0.11	0.12	0.12	0.12
Panel C: General soap usage when hand-washing	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)	(C7)
	Score 1-10	Score 1-10	Score 1-10	Score 1-10	Score = 10	Score = 9+	Score = 8+
Treatment: HOPE SOAP	0.31 (-0.27 - 0.89)	0.42* (-0.07 - 0.91)	0.41 (-0.09 - 0.90)	0.91 (-0.89 - 2.70)	0.02 (-0.12 - 0.16)	0.13* (-0.01 - 0.27)	0.14** (0.03 - 0.24)
^Baseline measure			0.13** (0.01 - 0.26)	0.17* (-0.02 - 0.36)	0.15* (-0.01 - 0.31)	0.12 (-0.03 - 0.27)	0.15** (0.02 - 0.28)
Treatment*Baseline measure				-0.07 (-0.31 - 0.17)			
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	249	247	236	236	236	236	236
R-squared	0.01	0.07	0.10	0.10	0.09	0.07	0.13

Notes: 95%CI in parentheses; *** p<0.01, ** p<0.05, * p<0.1; ^ Baseline equivalent of dependent variable

Additional controls included but not reported: Female, age, household size, number of children in HH, asset ownership, piped water available in HH, HH limits water use; Soap observed in HH; HH received hygiene training; Caregiver depressed/anxious; child had difficulty opening tap; Child cannot reach taps; Child's hands too small for soap. The full models, with coefficients for all control variables, are presented in the appendix Tables A2, A3 and A4..

Result 5: HOPE SOAP® children exhibit better health outcomes on average, although the differences are not statistically significant.

Figure 4 shows a reduction in symptoms of illness experienced over the study period for both treatment and control children, with the average illness score marginally lower among treatment children at endline. Results presented in Table 5 shown that a small treatment effect on health remained after controlling for baseline characteristics. The average illness score was -0.35 lower among HOPE SOAP® children (Model 3, $p=0.256$) and the proportion of HOPE SOAP® children who experienced any symptom of illness in the two weeks prior to the endline survey was 9% points lower (Model 7, $p = 0.204$).

Figure 4. Symptoms of illness experienced by child. Data reported by caregivers.

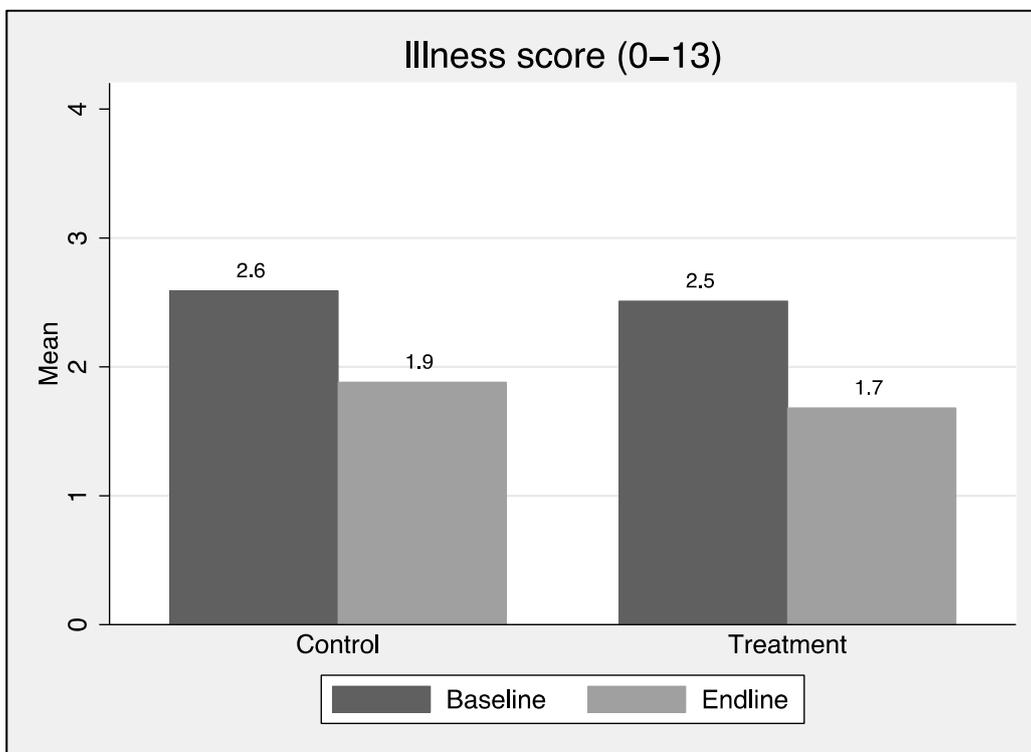


Table 5. Effect of treatment on health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Score 1-13	Score 1-13	Score 1-13	Score 1-13	Any illness	Any illness	Any illness
Treatment: HOPE SOAP	-0.20	-0.28	-0.35	-0.10	-0.06	-0.06	-0.09
	(-0.79 -	(-0.86 -	(-0.96 -	(-0.82 -	(-0.19 -	(-0.18 -	(-0.22 -
	0.39)	0.31)	0.26)	0.62)	0.08)	0.07)	0.05)
Baseline equivalent of dependent variable: hand washing measure			0.19**	0.24**			0.16**
			(0.04 -	(0.02 -			(0.01 -
			0.34)	0.47)			0.31)
Treatment*Baseline measure				-0.10			
				(-0.39 -			
				0.18)			
Controls	No	Yes	Yes	Yes	No	Yes	Yes
Observations	249	247	236	236	236	236	236
R-squared	0.01	0.07	0.10	0.10	0.09	0.07	0.13

Notes: 95%CI in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Additional controls included but not reported: Female, age, household size, number of children in HH, asset ownership, piped water available in HH, HH limits water use; Soap observed in HH; HH received hygiene training; Caregiver depressed/anxious; child had difficulty opening tap; Child cannot reach taps; Child's hands too small for soap. The full model, with coefficients for all control variables, is presented in the appendix Table A5.

Result 6: HOPE SOAP® children who use the soap as intended exhibit significantly better health outcomes compared to the control group

The intention of HOPE SOAP® was to encourage children to wash their hands more frequently in the process of retrieving the toy. However, children may have used other strategies to obtain the toy such as dissolving the soap in water or cutting the soap. In such cases children who received HOPE SOAP® could end up worse off than control children because of decreased access to soap. We create an indicator ('toy cheat') using responses from caregivers about whether the child ever retrieved the toy by (1) dissolving the soap in water, (2) cutting the bar of soap, or (3) destroying the soap in another manner. Notably, this is a blunt indicator as caregivers would have had to both observe and report this behaviour, and they could have reported this behaviour even if it only happened on one occasion. According to this measure, 42% of the treatment children were classified as toy cheats. There was no evidence that toy cheats had less access to soap than other children who received HOPE SOAP®. Caregivers of toy cheats and non-toy cheats reported a similar average for the number of days that a bar of soap lasted (8.4 vs 8.3). Households of toy cheats were slightly less likely to have run out of soap at anytime during the study (38% vs 41%). Furthermore, acceptability among caregivers of these two groups towards the soap was similar with 90% of toy cheat caregivers and 87% of non-toy cheat caregivers reporting that they'd buy HOPE SOAP® if it was available at the same price as other soaps.

Table 6 presents multiple regression models for each of our main dependent variables, with treatment effects shown separately for toy cheats and other children in the treatment group (non-toy cheats). In all cases, the control group is the omitted group. Whilst there are no significant differences between toy cheats and non-toy cheats compared separately to control group children in terms of their observed and caregiver-reported hand-washing behaviour, there is evidence of significantly positive treatment effects on child health for those children who used the soap as intended (Models 5 and 6). For example, Model 6 indicates that compared to children in the control group, those who received HOPE SOAP® and used it correctly (non-toy cheat) were 15% points less likely to experience a symptom of illness in the two weeks prior to the endline survey.

Table 6. Effect of treatment on hand-washing and health by correct use of HOPE SOAP

	(1) Wash hands at both snack tests 0/1	(2) Wash hands after toilet Score:1-10	(3) Wash hands before meals Score:1-10	(4) Uses soap to wash hands Score:1-10	(5) Illness Score:1-13	(6) Any illness 0/1
Intervention (vs Control)						
HOPE SOAP – Not a Toy Cheat	0.07	0.17	0.22	0.40	-0.61*	-0.15** (-0.31 - -
HOPE SOAP –Toy Cheat	(-0.11 - 0.26) 0.13	(-0.57 - 0.91) 0.24	(-0.60 - 1.05) 0.38	(-0.19 - 0.99) 0.41	(-1.31 - 0.09) 0.07	0.00 0.02
Controls	(-0.09 - 0.35) Yes	(-0.65 - 1.13) Yes	(-0.57 - 1.33) Yes	(-0.25 - 1.06) Yes	(-0.65 - 0.79) Yes	(-0.14 - 0.18) Yes
Observations	187	242	244	236	209	209
R-squared	0.13	0.16	0.11	0.10	0.23	0.23

Notes: 95%CI in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Additional controls included but not reported: Female, age, household size, number of children in HH, asset ownership, piped water available in HH, HH limits water use; Soap observed in HH; HH received hygiene training; Caregiver depressed/anxious; child had difficulty opening tap; Child cannot reach taps; Child's hands too small for soap. The full model, with coefficients for all control variables, is presented in the appendix Table A6.

Discussion

There are a number of positive results that emerge from the HOPE SOAP[®] pilot which suggest real potential for this innovative soap product to increase and sustain hand-washing (Result 1) amongst young children. Conditional on poor baseline hand-washing behaviour, HOPE SOAP[®] children are more likely to wash their hands after using the toilet, albeit insignificantly so, (Result 3) and are also significantly more likely to use soap to wash their hands as opposed to just rinsing with water (Result 4). Moreover, HOPE SOAP[®] children, in general, have better health outcomes (Result 5) and those who use the soap as intended, and do not cheat to remove the toy from the soap, evidence significantly better health outcomes (Result 6).

Whilst there are a number of other positive results on reported hand-washing behaviour, our results lack statistical power. This could be due to a number of factors, the most obvious being small sample size which is an inevitable feature of most pilot studies. Attrition between baseline and endline further reduced the sample, although the attrition rate for households from our baseline sample was only 13.5%. Importantly, attrition was marginally higher (4%) in the control group than the treatment group, but these differences are not significant.

Spillover effects, both between and within households, may also serve to dampen estimated treatment effects. Whilst we stratify on the basis of household size and the adult:child ratio within the household when conducting the randomization, it still remains the case that if the novelty of HOPE SOAP[®] induces other household members within the household to wash their hands more regularly than household members in the control group, the soap may be depleted more quickly, thereby undermining potential health benefits for treated children. This could contribute to reduced treatment effects. In contrast, we do not think that between household spillovers constitute a serious problem in this study. Fewer than

2% of treated children were reported to have shared their soap with children outside the household, suggesting that these kinds of spill over effects are minimal.

The magnitude of our treatment effect is also undermined by substantial increases in hand-washing among children in control households during the study period. Control group children also received child-sized, bright, translucent bars of soap. This soap was different than the usual household soap, and may itself have induced children in control households to wash their hands more frequently. Our data shows that the proportion of children whose caregivers reported “small hands” as a barrier to hand-washing halved between baseline and endline (32% to 15%). This effect was similar in both treatment and control groups suggesting that delivery of child-sized soap may itself be an important (and even sufficient) intervention to induce hand-washing amongst children. Had control group children received normal household soap (typically larger in size and not as colourful), one might have anticipated larger treatment effects.

The health impacts associated with HOPE SOAP[®] are not particularly strong. Rather, children in both treatment and control groups appear to have enjoyed improved health between baseline and endline. This could be due to the increased hand washing induced by the availability of soap, which our data certainly suggests⁸, but it could also reflect seasonal changes that may be associated with improved health, since the baseline was conducted in Spring and the endline was conducted during the summer months. However, despite this confound, the fact that HOPE SOAP[®] children who used the soap as intended (i.e. did not cut or dissolve the soap to get the toy) enjoyed significantly better health outcomes compared to the control group is certainly encouraging. Furthermore, the health outcomes of children who were categorised as toy cheats were similar to those in the control group, indicating that there were no unintended negative effects of the intervention on health.

Our analysis of the outcomes of the HOPE SOAP[®] pilot project has shown that it does, indeed, give cause for hope. There is evidence that it improves hand-washing behaviour and induces sustained hand-washing behaviour amongst young children when compared to our control soap. Our research suggests that if HOPE SOAP[®] can be produced and sold at the same price as regular soap there is a sound argument for making it a preferred intervention option.

⁸ Between baseline and endline, there was an almost 12% point increase in the proportion who reported always having soap available within the previous week, whilst the mean number of days that a household had gone without soap in the preceding two weeks dropped from 1.42 at baseline to 0.53 at endline.

References

- Aiello, A., Coulborn, R., Perez, V. & Larson, E. 2008. Effect of Hand Hygiene on Infectious Disease Risk in the Community Setting: A Meta-Analysis. *American Journal of Public Health*. 98(8): 1372-1381.
- Almond, D., & Currie, J. 2011. *Human Capital Development Before Age Five*. National Bureau of Economic Research, 15827.
- Black, R., Morris, S., & Bryce, J. 2003. Where and why are 10 million children dying every year? *The Lancet*. 361(9376), 2226-2234.
- Bowen, A., Ma, H., Ou, J., Billhimer, W., Long, T., Mintz, E., & Luby, S. 2007. A cluster-randomized controlled trial evaluating the effect of a hand-washing-promotion program in Chinese primary schools. *The American journal of tropical medicine and hygiene*, 76(6), 1166-1173.
- Case, A., & Paxson, C. 2009. Early Life Health and Cognitive Function in Old Age. *American Economic Review Papers and Proceedings*, 99(2), 104-109.
- Chase, C., & Do, Q-T. 2010. Scaling Up Handwashing Behavior: Findings from the Impact Evaluation Baseline Survey in Vietnam. *The Water and Sanitation Program*. Available at https://www.wsp.org/sites/wsp.org/files/publications/WSP_VietnamBaselineReport_HWWS.pdf
- Chay, K., Guryan, J., & Mazumder, B. 2009. Birth cohort and the black-white achievement gap: The roles of access and health soon after birth. *National Bureau of Economic Research*, 15078.
- Currie, J., Stabile, M., Manivong, P., & Roos, L. 2010. Child Health and Young Adult Outcomes. *Journal of Human Resources*, 45(3), 517-548.
- Curtis, V., & Cairncross, S. 2003. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *The Lancet infectious diseases*. 3(5), 275-281.
- Duflo, E., Glennerster, R., & Kremer, M. 2007. Using Randomization in Development Economics Research: A Toolkit. CEPR Discussion Paper No. 6059. Available at SSRN: <https://ssrn.com/abstract=997109>
- Duhigg. C. 2012. *The Power of Habit*. New York: Random House
- Galiani, S., Gertler, P., & Orsola-Vidal, A. 2012. Promoting hand-washing behavior in Peru: The effect of large-scale mass-media and community level interventions. *World Bank Policy Research Working Paper*, 6257.
- Greenland, K., Iradati, E., Ati, A., Maskoen, Y., & Aunger, R. 2013. The context and practice of hand-washing among new mothers in Serang, Indonesia: a formative research study. *BMC Public Health*, 13:830
- Han, A., & Hlaing, T. 1989. Prevention of diarrhoea and dysentery by hand washing. *Transactions of the Royal Society of Tropical Medicine and Hygiene*. 83(1), 128-131.
- Lorntz, B., Soares, A., Moore, S., Pinkerton, R., Gansneder, B., Bovbjerg, V., et al. 2006. Early Childhood Diarrhea Predicts Impaired School Performance. *The Pediatric Infectious Disease Journal*, 25(6), 513-520.
- Luby, S., Agboatwalla, M., Feikin, D., Painter, J., Billhimer, W., Altaf, A., & Hoekstra, R. 2005. Effect of hand-washing on child health: a randomised controlled trial. *The Lancet*. 366(9481), 225-233.
- Luby, S., Halder, A. K., Huda, T., Unicomb, L., & Johnston, R. 2011. The effect of hand-washing at recommended times with water alone and with soap on child diarrhea in rural Bangladesh: an observational study. *PLoS medicine*, 8(6), e1001052.
- Marteau, T., Hollands, G., & Fletcher, P. 2012. Changing Human Behavior to Prevent Disease: The Importance of Targeting Automatic Processes. *Science*, 337 (6101), 1492-1495
- Neal D., Vujcic, J., Hernandez, O., & Wood, W. 2015. The Science of Habit: Creating Disruptive and Sticky Behavior Change in Handwashing Behavior. Washington D.C., USA. USAID/WASHplus Project.
- Neal, D., Wood, W., Labrecque, J., & Lally, P. 2011a. How do habits guide behavior? Perceived and actual triggers of habits in daily life. *Journal of Experimental Social Psychology*, 48(2), 492-498.
- Neal, D., Wood, W., Wu, M., & Kurlander, D. 2011b. The pull of the past: When do habits persist despite conflict with motives? *Personality and Social Psychology Bulletin*, 37(11), 1428-1437.
- Nicholson, J., Naeni, M., Hoptruff, M., Matheson, J.R., Roberts, A.J., Taylor, D., Sidibe, M., Weir, A., Satyawan, D., & Wright, R.L. 2014. An investigation of the effects of a hand washing intervention on health outcomes and school absence using a randomised trial in Indian urban communities. *Tropical Medicine and International Health*, 19(3), 284-92.
- Ram, P. 2010. Practical guidance for measuring hand-washing behavior. *The Water and Sanitation Program*. Available at https://www.wsp.org/sites/wsp.org/files/PracticalGuidance_HWWS.pdf.

- Stanton, B., & Clemens, J. 1987. An Educational Intervention for altering water-sanitation behaviours to reduce childhood diarrhea in unban Bangladesh: A randomised control trial to assess the impact of the intervention on hygienic behaviour and rates of diarrhea. *American journal of epidemiology*. 125(2): 292-301.
- Van Lerberghe, W., Manuel, A., Matthews, Z., & Cathy, W. 2005. *Make every mother and child count*. World Health Organization. Available at www.who.int/whr/2005/whr2005_en.pdf
- Vindigni, M., Riley, P., & Jhung, M. 2011. Systematic review: hand-washing behaviour in low- to middle-income countries: outcome measures and behaviour maintenance. *Tropical Medicine & International Health*, 16(4), 466–477.
- Webb, T., & Sheeran, P. 2006. Does Changing Behavioral Intentions Engender Behavior Change? A Meta-Analysis of the Experimental Evidence. *Psychological Bulletin*, 132(2), 249–268.
- Wood, W., & Neal, D. 2007. A New Look at Habits and the Habit–Goal Interface. *Psychological Review* , 114(4), 843–863.
- Wood, W., Tam, L., & Witt, M. 2005. Changing Circumstances, Disrupting Habits. *Journal of Personality and Social Psychology*, 88(6), 918–933.
- World Bank. 2005. *The Hand-washing Handbook: A Guide for Developing a Hygiene Promotion Program to Increase Hand-washing with Soap*. Washington DC: The World Bank.

Appendix

Table A1. Effect of treatment on hand-washing during Snack Tests

	(1)	(2)	(3)	(4)	(5)	(6)
	Wash at Snack 1	Wash at Snack 1	Wash at Snack 2	Wash at Snack 2	Wash at Snack 1&2	Wash at Snack 1&2
Treatment: HOPE SOAP	0.02 (-0.13 - 0.18)	0.04 (-0.12 - 0.20)	0.11 (-0.06 - 0.29)	0.06 (-0.11 - 0.23)	0.10 (-0.08 - 0.27)	0.10 (-0.07 - 0.27)
Female		0.06 (-0.07 - 0.19)		0.01 (-0.13 - 0.14)		0.10 (-0.04 - 0.25)
Age		0.01 (-0.04 - 0.06)		0.04 (-0.01 - 0.09)		0.01 (-0.04 - 0.07)
Household size		-0.03 (-0.06 - 0.01)		0.00 (-0.04 - 0.05)		-0.02 (-0.06 - 0.02)
Number of children in hh		0.04 (-0.03 - 0.11)		0.02 (-0.06 - 0.10)		0.06* (-0.01 - 0.13)
Assets (% ownership)		0.45* (-0.01 - 0.92)		0.54** (0.04 - 1.03)		0.45* (-0.07 - 0.97)
Piped water in house		0.25** (0.05 - 0.45)		-0.12 (-0.33 - 0.09)		0.07 (-0.15 - 0.29)
HH limits water use: Yes		0.02 (-0.14 - 0.17)		0.12 (-0.05 - 0.29)		0.14 (-0.04 - 0.31)
HH limits water use: No data		0.09 (-0.15 - 0.33)		0.38*** (0.15 - 0.60)		0.21 (-0.08 - 0.50)
Soap observed in HH: Yes		0.00 (-0.15 - 0.16)		-0.00 (-0.17 - 0.17)		0.03 (-0.14 - 0.21)
Soap observed in HH: No data		0.12 (-0.08 - 0.33)		-0.11 (-0.38 - 0.16)		-0.01 (-0.27 - 0.24)
HH received hygiene training: Yes		0.17** (0.02 - 0.33)		0.24*** (0.07 - 0.41)		0.19** (0.02 - 0.36)
HH received hygiene training: No data		-0.22 (-0.57 - 0.13)		-0.19 (-0.62 - 0.24)		-0.14 (-0.51 - 0.23)
Caregiver depressed/anxious: Yes		-0.02 (-0.17 - 0.13)		0.13 (-0.05 - 0.30)		0.03 (-0.14 - 0.21)
Difficulty opening tap: Yes		-0.03 (-0.20 - 0.14)		0.06 (-0.13 - 0.25)		-0.04 (-0.22 - 0.13)

Difficulty opening tap: No data		-0.26 (-0.67 - 0.15)		-0.39** (-0.69 - -0.09)		-0.10 (-0.40 - 0.19)
Hands too small for soap: Yes		0.12 (-0.05 - 0.28)		-0.02 (-0.20 - 0.15)		0.06 (-0.12 - 0.23)
Hands too small for soap: No data		0.22 (-0.17 - 0.61)		-0.78*** (-1.01 - -0.55)		-0.62*** (-0.86 - -0.38)
Can't reach taps: Yes		0.06 (-0.10 - 0.22)		-0.03 (-0.21 - 0.15)		-0.00 (-0.18 - 0.18)
Can't reach taps: No data		0.05 (-0.36 - 0.47)		1.02*** (0.41 - 1.63)		0.70*** (0.19 - 1.21)
Constant	0.56*** (0.46 - 0.67)	-0.00 (-0.46 - 0.46)	0.48*** (0.36 - 0.60)	-0.14 (-0.64 - 0.36)	0.39*** (0.28 - 0.51)	-0.24 (-0.76 - 0.28)
Observations	230	228	188	187	188	187
R-squared	0.00	0.12	0.01	0.17	0.01	0.13

Notes: 95%CI in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A2. Effect of treatment on hand-washing after going to the toilet

	(1) Score 1-10	(2) Score 1-10	(3) Score 1-10	(4) Score 1-10	(5) Score = 10	(6) Score = 9+	(7) Score = 8+
Treatment: HOPE SOAP	-0.01 (-0.69 - 0.67)	0.11 (-0.62 - 0.84)	0.20 (-0.49 - 0.88)	1.29 (-0.33 - 2.91)	0.02 (-0.11 - 0.15)	0.02 (-0.11 - 0.15)	0.08 (-0.06 - 0.23)
Baseline equivalent of dependent variable: hand washing measure			0.22*** (0.10 - 0.34)	0.32*** (0.15 - 0.50)	0.14 (-0.05 - 0.33)	0.13 (-0.05 - 0.31)	0.29*** (0.15 - 0.43)
Treatment*Baseline measure				-0.19* (-0.41 - 0.03)			
Female		0.29 (-0.27 - 0.84)	0.16 (-0.37 - 0.70)	0.13 (-0.40 - 0.66)	0.02 (-0.09 - 0.13)	0.05 (-0.06 - 0.17)	0.07 (-0.05 - 0.18)
Age		-0.04 (-0.34 - 0.26)	-0.15 (-0.43 - 0.14)	-0.15 (-0.43 - 0.13)	-0.02 (-0.07 - 0.03)	-0.01 (-0.06 - 0.04)	-0.03 (-0.07 - 0.02)
Household size		-0.08 (-0.23 - 0.08)	-0.07 (-0.22 - 0.08)	-0.08 (-0.22 - 0.07)	-0.00 (-0.03 - 0.03)	-0.02 (-0.05 - 0.01)	-0.03 (-0.06 - 0.01)
Number of children in hh		-0.03 (-0.34 - 0.27)	0.01 (-0.26 - 0.27)	0.01 (-0.26 - 0.28)	0.02 (-0.04 - 0.08)	0.01 (-0.05 - 0.07)	0.04 (-0.02 - 0.11)
Assets (% ownership)		-1.00 (-3.21 - 1.22)	-1.67 (-3.70 - 0.36)	-1.65 (-3.70 - 0.40)	-0.29 (-0.70 - 0.13)	-0.25 (-0.67 - 0.17)	-0.10 (-0.56 - 0.35)
Piped water in house		-0.20 (-1.26 - 0.86)	0.25 (-0.69 - 1.18)	0.19 (-0.77 - 1.15)	0.05 (-0.13 - 0.24)	0.07 (-0.12 - 0.25)	0.09 (-0.11 - 0.30)
HH limits water use: Yes		0.14 (-0.55 - 0.84)	0.22 (-0.44 - 0.87)	0.18 (-0.48 - 0.84)	0.08 (-0.05 - 0.22)	0.09 (-0.04 - 0.23)	0.06 (-0.09 - 0.20)
HH limits water use: No data		-0.23 (-1.35 - 0.89)	-0.05 (-1.26 - 1.17)	-0.12 (-1.27 - 1.02)	0.13 (-0.14 - 0.41)	0.11 (-0.15 - 0.37)	0.05 (-0.16 - 0.27)
Soap observed in HH: Yes		0.26 (-0.54 - 1.05)	0.24 (-0.54 - 1.01)	0.17 (-0.59 - 0.93)	0.08 (-0.06 - 0.22)	0.03 (-0.12 - 0.18)	-0.00 (-0.16 - 0.16)
Soap observed in HH: No data		-0.70 (-1.91 - 0.50)	-0.68 (-1.81 - 0.46)	-0.75 (-1.89 - 0.39)	-0.05 (-0.25 - 0.15)	-0.13 (-0.33 - 0.07)	-0.14 (-0.35 - 0.07)
HH received hygiene training: Yes		-0.52 (-1.34 - 0.30)	-0.72* (-1.47 - 0.02)	-0.74** (-1.48 - -0.01)	-0.05 (-0.18 - 0.09)	-0.04 (-0.18 - 0.11)	-0.13 (-0.28 - 0.03)
HH received hygiene training: No data		0.39 (-1.29 - 2.06)	0.37 (-1.29 - 2.03)	0.31 (-1.31 - 1.93)	0.08 (-0.29 - 0.46)	0.10 (-0.25 - 0.44)	0.10 (-0.22 - 0.43)
Caregiver depressed/anxious: Yes		0.12 (-0.56 - 0.80)	0.28 (-0.36 - 0.92)	0.28 (-0.35 - 0.91)	-0.00 (-0.13 - 0.12)	-0.00 (-0.13 - 0.13)	0.07 (-0.07 - 0.21)
Difficulty opening tap: Yes		-0.49	-0.69*	-0.74**	-0.10	-0.13*	-0.16*

		(-1.29 - 0.30)	(-1.42 - 0.04)	(-1.47 - -0.02)	(-0.24 - 0.04)	(-0.28 - 0.02)	(-0.32 - 0.01)
Difficulty opening tap: No data		-0.53	0.38	0.21	0.62***	0.30	0.22
		(-3.76 - 2.70)	(-2.93 - 3.69)	(-2.72 - 3.13)	(0.38 - 0.85)	(-0.27 - 0.88)	(-0.25 - 0.69)
Hands too small for soap: Yes		-0.32	-0.09	-0.10	-0.06	0.03	-0.02
		(-1.08 - 0.44)	(-0.82 - 0.64)	(-0.84 - 0.64)	(-0.20 - 0.08)	(-0.13 - 0.18)	(-0.18 - 0.14)
Hands too small for soap: No data		-2.44	-1.51	-1.65	-0.42***	-0.71**	-0.75***
		(-5.55 - 0.67)	(-4.65 - 1.62)	(-4.41 - 1.11)	(-0.61 - -0.22)	(-1.26 - -0.16)	(-1.18 - -0.31)
Can't reach taps: Yes		-0.07	-0.10	-0.12	0.14*	0.09	-0.01
		(-0.81 - 0.67)	(-0.80 - 0.61)	(-0.83 - 0.58)	(-0.01 - 0.28)	(-0.06 - 0.24)	(-0.16 - 0.13)
Can't reach taps: No data		-0.01	-0.96	-1.14	-0.43***	0.20	0.08
		(-3.20 - 3.19)	(-4.20 - 2.27)	(-3.99 - 1.71)	(-0.68 - -0.18)	(-0.39 - 0.79)	(-0.38 - 0.54)
Constant	7.42***	9.12***	8.13***	7.74***	0.37*	0.51**	0.62***
	(6.90 - 7.95)	(6.50 - 11.73)	(5.63 - 10.64)	(5.12 - 10.36)	(-0.07 - 0.80)	(0.08 - 0.94)	(0.20 - 1.04)
Observations	249	247	242	242	242	242	242
R-squared	0.00	0.08	0.16	0.17	0.09	0.08	0.16

Notes: 95%CI in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A3. Effect of treatment on hand-washing before meals

	(1) Score 1-10	(2) Score 1-10	(3) Score 1-10	(4) Score 1-10	(5) Score = 10	(6) Score = 9+	(7) Score = 8+
Treatment: HOPE SOAP	-0.10 (-0.86 - 0.65)	0.27 (-0.49 - 1.03)	0.28 (-0.46 - 1.02)	1.14 (-0.46 - 2.73)	0.05 (-0.06 - 0.16)	0.07 (-0.06 - 0.21)	0.05 (-0.08 - 0.19)
Baseline equivalent of dependent variable: hand washing measure			0.13** (0.01 - 0.25)	0.22** (0.04 - 0.39)	-0.03 (-0.21 - 0.14)	0.05 (-0.13 - 0.22)	0.10 (-0.05 - 0.26)
Treatment*Baseline measure				-0.16 (-0.40 - 0.09)			
Female		-0.18 (-0.82 - 0.45)	-0.19 (-0.83 - 0.44)	-0.22 (-0.86 - 0.41)	-0.05 (-0.15 - 0.05)	-0.05 (-0.17 - 0.07)	-0.05 (-0.17 - 0.07)
Age		0.13 (-0.17 - 0.43)	0.11 (-0.19 - 0.41)	0.11 (-0.18 - 0.41)	0.04* (-0.00 - 0.08)	0.03 (-0.01 - 0.08)	0.06** (0.00 - 0.11)
Household size		-0.03 (-0.19 - 0.13)	-0.03 (-0.19 - 0.13)	-0.04 (-0.20 - 0.13)	-0.01 (-0.04 - 0.02)	-0.02 (-0.05 - 0.02)	-0.05*** (-0.08 - -0.01)
Number of children in hh		-0.01 (-0.43 - 0.41)	0.04 (-0.36 - 0.43)	0.04 (-0.36 - 0.45)	0.02 (-0.03 - 0.08)	0.05 (-0.02 - 0.11)	0.07* (-0.00 - 0.15)
Assets (% ownership)		-1.48 (-3.90 - 0.94)	-1.60 (-4.01 - 0.81)	-1.67 (-4.04 - 0.70)	-0.18 (-0.50 - 0.13)	-0.33* (-0.71 - 0.04)	-0.09 (-0.50 - 0.32)
Piped water in house		0.60 (-0.54 - 1.74)	0.59 (-0.53 - 1.71)	0.62 (-0.49 - 1.74)	0.04 (-0.11 - 0.20)	0.14* (-0.02 - 0.31)	0.14 (-0.04 - 0.32)
HH limits water use: Yes		0.25 (-0.54 - 1.04)	0.11 (-0.68 - 0.89)	0.12 (-0.66 - 0.91)	0.07 (-0.05 - 0.19)	0.10 (-0.04 - 0.24)	0.08 (-0.07 - 0.22)
HH limits water use: No data		-1.09 (-2.49 - 0.32)	-1.18 (-2.64 - 0.28)	-1.16 (-2.57 - 0.26)	-0.05 (-0.22 - 0.12)	-0.15* (-0.31 - 0.02)	-0.12 (-0.33 - 0.09)
Soap observed in HH: Yes		1.06** (0.22 - 1.90)	1.01** (0.17 - 1.86)	0.97** (0.13 - 1.82)	0.17*** (0.05 - 0.29)	0.16** (0.02 - 0.31)	0.13 (-0.03 - 0.28)
Soap observed in HH: No data		0.77 (-0.71 - 2.24)	0.85 (-0.58 - 2.27)	0.80 (-0.63 - 2.24)	0.23** (0.02 - 0.44)	0.14 (-0.07 - 0.35)	0.12 (-0.09 - 0.33)
HH received hygiene training: Yes		0.16 (-0.71 - 1.04)	0.18 (-0.69 - 1.04)	0.18 (-0.68 - 1.04)	0.02 (-0.09 - 0.14)	0.01 (-0.13 - 0.15)	-0.03 (-0.18 - 0.12)
HH received hygiene training: No data		0.35 (-1.23 - 1.93)	0.37 (-1.21 - 1.95)	0.27 (-1.33 - 1.86)	-0.07 (-0.36 - 0.21)	0.04 (-0.32 - 0.40)	-0.06 (-0.39 - 0.26)
Caregiver depressed/anxious: Yes		-0.43 (-1.18 - 0.31)	-0.34 (-1.10 - 0.41)	-0.38 (-1.13 - 0.37)	-0.16** (-0.27 - -0.04)	-0.12* (-0.26 - 0.02)	-0.07 (-0.21 - 0.07)

Difficulty opening tap: Yes		-0.24	-0.19	-0.25	-0.01	-0.02	-0.03
		(-1.14 - 0.67)	(-1.10 - 0.71)	(-1.16 - 0.66)	(-0.14 - 0.12)	(-0.18 - 0.14)	(-0.21 - 0.15)
Difficulty opening tap: No data		-1.97	-2.17	-1.82	-0.69**	-0.70***	-0.09
		(-6.10 - 2.16)	(-6.28 - 1.95)	(-5.67 - 2.03)	(-1.25 - -0.13)	(-1.18 - -0.23)	(-0.98 - 0.80)
Hands too small for soap: Yes		0.24	0.45	0.47	-0.00	0.01	0.04
		(-0.64 - 1.13)	(-0.44 - 1.34)	(-0.42 - 1.35)	(-0.15 - 0.14)	(-0.15 - 0.17)	(-0.13 - 0.21)
Hands too small for soap: No data		-0.52	0.20	0.07	0.22	0.13	-0.18
		(-4.44 - 3.40)	(-3.71 - 4.11)	(-3.51 - 3.65)	(-0.30 - 0.75)	(-0.31 - 0.57)	(-1.04 - 0.67)
Can't reach taps: Yes		-0.33	-0.39	-0.45	-0.08	-0.09	-0.10
		(-1.12 - 0.47)	(-1.18 - 0.41)	(-1.24 - 0.34)	(-0.21 - 0.04)	(-0.24 - 0.06)	(-0.25 - 0.05)
Can't reach taps: No data		-0.08	-0.81	-0.99	0.37	0.28	-0.10
		(-4.12 - 3.96)	(-4.80 - 3.18)	(-4.64 - 2.65)	(-0.20 - 0.95)	(-0.21 - 0.76)	(-0.99 - 0.79)
Constant	7.01***	6.36***	5.65***	5.32***	0.09	0.19	0.26
	(6.45 - 7.57)	(3.71 - 9.01)	(2.95 - 8.34)	(2.48 - 8.16)	(-0.27 - 0.46)	(-0.23 - 0.61)	(-0.18 - 0.70)
Observations	249	247	244	244	244	244	244
R-squared	0.00	0.09	0.11	0.11	0.12	0.12	0.12

Notes: 95%CI in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A4. Effect of treatment on general soap usage when washing hands

	(1) Score 1-10	(2) Score 1-10	(3) Score 1-10	(4) Score 1-10	(5) Score = 10	(6) Score = 9+	(7) Score = 8+
Treatment: HOPE SOAP	0.31 (-0.27 - 0.89)	0.42* (-0.07 - 0.91)	0.41 (-0.09 - 0.90)	0.91 (-0.89 - 2.70)	0.02 (-0.12 - 0.16)	0.13* (-0.01 - 0.27)	0.14** (0.03 - 0.24)
Baseline equivalent of dependent variable: hand washing measure			0.13** (0.01 - 0.26)	0.17* (-0.02 - 0.36)	0.15* (-0.01 - 0.31)	0.12 (-0.03 - 0.27)	0.15** (0.02 - 0.28)
Treatment*Baseline measure				-0.07 (-0.31 - 0.17)			
Female		0.00 (-0.50 - 0.51)	-0.08 (-0.59 - 0.42)	-0.08 (-0.59 - 0.42)	-0.05 (-0.18 - 0.08)	0.02 (-0.11 - 0.14)	-0.02 (-0.12 - 0.08)
Age		-0.05 (-0.30 - 0.20)	-0.09 (-0.35 - 0.17)	-0.09 (-0.34 - 0.16)	0.01 (-0.03 - 0.06)	0.02 (-0.03 - 0.07)	-0.01 (-0.05 - 0.03)
Household size		-0.05 (-0.19 - 0.08)	-0.07 (-0.21 - 0.07)	-0.06 (-0.21 - 0.08)	-0.01 (-0.05 - 0.02)	-0.02 (-0.05 - 0.02)	-0.03* (-0.06 - 0.00)
Number of children in hh		0.16 (-0.10 - 0.42)	0.23 (-0.05 - 0.51)	0.22 (-0.05 - 0.50)	0.07** (0.00 - 0.15)	0.04 (-0.03 - 0.12)	0.06** (0.00 - 0.12)
Assets (% ownership)		-0.29 (-1.93 - 1.34)	-0.45 (-2.18 - 1.28)	-0.43 (-2.14 - 1.29)	-0.10 (-0.54 - 0.35)	-0.07 (-0.50 - 0.36)	-0.09 (-0.42 - 0.24)
Piped water in house		0.21 (-0.55 - 0.98)	0.02 (-0.72 - 0.76)	0.06 (-0.68 - 0.81)	-0.05 (-0.23 - 0.13)	0.01 (-0.17 - 0.19)	0.10 (-0.06 - 0.27)
HH limits water use: Yes		0.29 (-0.20 - 0.78)	0.38 (-0.13 - 0.89)	0.38 (-0.13 - 0.89)	0.00 (-0.15 - 0.15)	0.00 (-0.14 - 0.15)	0.11** (0.01 - 0.22)
HH limits water use: No data		-0.94 (-2.41 - 0.53)	-1.11 (-2.76 - 0.53)	-1.11 (-2.77 - 0.55)	-0.02 (-0.30 - 0.26)	-0.10 (-0.35 - 0.16)	-0.16 (-0.41 - 0.09)
Soap observed in HH: Yes		0.09 (-0.53 - 0.72)	0.08 (-0.57 - 0.73)	0.06 (-0.60 - 0.73)	-0.04 (-0.19 - 0.10)	-0.01 (-0.16 - 0.14)	-0.10 (-0.23 - 0.03)
Soap observed in HH: No data		0.70* (-0.10 - 1.51)	0.64 (-0.21 - 1.48)	0.62 (-0.25 - 1.49)	0.04 (-0.20 - 0.28)	0.10 (-0.13 - 0.33)	0.09 (-0.07 - 0.25)
HH received hygiene training: Yes		-0.18 (-0.80 - 0.44)	-0.34 (-0.95 - 0.27)	-0.34 (-0.94 - 0.27)	-0.07 (-0.23 - 0.08)	-0.04 (-0.20 - 0.12)	-0.03 (-0.15 - 0.08)
HH received hygiene training: No data		0.19 (-1.24 - 1.62)	0.38 (-1.08 - 1.83)	0.39 (-1.07 - 1.85)	0.03 (-0.27 - 0.34)	-0.00 (-0.34 - 0.33)	0.03 (-0.30 - 0.35)
Caregiver depressed/anxious: Yes		-0.62** (-1.20 - -0.04)	-0.48 (-1.08 - 0.11)	-0.47 (-1.07 - 0.14)	-0.10 (-0.24 - 0.04)	-0.06 (-0.20 - 0.07)	-0.11* (-0.23 - 0.00)
Difficulty opening tap: Yes		-0.32	-0.33	-0.38	-0.17**	-0.12	0.01

Difficulty opening tap: No data			(-0.88 - 0.25)	(-0.92 - 0.25)	(-0.97 - 0.22)	(-0.32 - -0.02)	(-0.29 - 0.04)	(-0.11 - 0.13)
			-0.05	-0.48	-0.36	-0.79***	0.11	0.20
Hands too small for soap: Yes			(-1.48 - 1.38)	(-2.20 - 1.24)	(-1.97 - 1.25)	(-1.31 - -0.27)	(-0.32 - 0.55)	(-0.23 - 0.63)
			-0.11	-0.05	-0.06	0.05	0.01	-0.08
Hands too small for soap: No data			(-0.72 - 0.49)	(-0.65 - 0.55)	(-0.66 - 0.55)	(-0.11 - 0.21)	(-0.16 - 0.18)	(-0.21 - 0.05)
			0.69	1.35	1.20	0.32	0.17	0.06
Can't reach taps: Yes			(-0.70 - 2.09)	(-0.37 - 3.07)	(-0.40 - 2.79)	(-0.15 - 0.79)	(-0.21 - 0.55)	(-0.34 - 0.47)
			0.21	0.16	0.14	0.09	0.04	0.03
Can't reach taps: No data			(-0.36 - 0.78)	(-0.43 - 0.75)	(-0.44 - 0.73)	(-0.07 - 0.24)	(-0.12 - 0.20)	(-0.08 - 0.15)
			0.82	0.44	0.42	0.12	0.14	0.14
Constant			(-0.62 - 2.25)	(-1.26 - 2.14)	(-1.14 - 1.98)	(-0.38 - 0.62)	(-0.27 - 0.55)	(-0.29 - 0.56)
	8.33***		8.77***	8.23***	7.94***	0.54**	0.52**	0.79***
	(7.89 - 8.77)		(6.82 - 10.73)	(5.95 - 10.51)	(5.47 - 10.41)	(0.12 - 0.96)	(0.07 - 0.96)	(0.43 - 1.14)
Observations	249	247	236	236	236	236	236	236
R-squared	0.01	0.07	0.10	0.10	0.09	0.07	0.13	

Notes: 95%CI in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A5. Effect of treatment on child health

	(1) Score 1-13	(2) Score 1-13	(3) Score 1-13	(4) Score 1-13	(5) Any illness	(6) Any illness	(7) Any illness
Treatment: HOPE SOAP	-0.20 (-0.79 - 0.39)	-0.28 (-0.86 - 0.31)	-0.35 (-0.96 - 0.26)	-0.10 (-0.82 - 0.62)	-0.06 (-0.19 - 0.08)	-0.06 (-0.18 - 0.07)	-0.09 (-0.22 - 0.05)
Baseline equivalent of dependent variable: hand washing measure			0.19** (0.04 - 0.34)	0.24** (0.02 - 0.47)			0.16** (0.01 - 0.31)
Treatment*Baseline measure				-0.10 (-0.39 - 0.18)			
Female		0.29 (-0.21 - 0.78)	0.19 (-0.33 - 0.70)	0.19 (-0.32 - 0.71)		0.01 (-0.11 - 0.12)	-0.01 (-0.13 - 0.12)
Age		-0.11 (-0.31 - 0.09)	-0.19* (-0.41 - 0.02)	-0.21* (-0.42 - 0.01)		-0.03 (-0.07 - 0.01)	-0.03 (-0.07 - 0.02)
Household size		-0.09 (-0.21 - 0.02)	-0.10 (-0.23 - 0.03)	-0.10 (-0.23 - 0.02)		-0.03** (-0.06 - -0.00)	-0.04** (-0.07 - -0.00)
Number of children in hh		-0.16 (-0.37 - 0.06)	-0.10 (-0.31 - 0.11)	-0.09 (-0.30 - 0.11)		-0.02 (-0.08 - 0.04)	-0.01 (-0.07 - 0.05)
Assets (% ownership)		0.56 (-1.12 - 2.24)	-0.08 (-1.79 - 1.62)	-0.08 (-1.79 - 1.62)		0.35 (-0.08 - 0.77)	0.32 (-0.11 - 0.75)
Piped water in house		-0.78* (-1.61 - 0.05)	-0.75* (-1.59 - 0.10)	-0.74* (-1.58 - 0.10)		-0.11 (-0.28 - 0.06)	-0.09 (-0.26 - 0.08)
HH limits water use: Yes		0.60* (-0.01 - 1.22)	0.76** (0.13 - 1.38)	0.75** (0.13 - 1.38)		0.11 (-0.03 - 0.25)	0.12 (-0.03 - 0.27)
HH limits water use: No data		-0.28 (-1.09 - 0.52)	0.12 (-0.80 - 1.03)	0.07 (-0.86 - 1.01)		0.01 (-0.25 - 0.27)	0.10 (-0.14 - 0.33)
Soap observed in HH: Yes		-0.01 (-0.64 - 0.62)	-0.27 (-0.93 - 0.39)	-0.25 (-0.90 - 0.39)		0.06 (-0.07 - 0.19)	0.02 (-0.13 - 0.16)
Soap observed in HH: No data		0.01 (-1.06 - 1.08)	-0.11 (-1.15 - 0.93)	-0.12 (-1.15 - 0.92)		0.16 (-0.06 - 0.37)	0.17 (-0.04 - 0.38)
HH received hygiene training: Yes		0.56** (0.05 - 1.06)	0.59** (0.11 - 1.07)	0.58** (0.10 - 1.06)		0.12* (-0.01 - 0.24)	0.13* (-0.00 - 0.26)
HH received hygiene training: No data		0.83 (-1.25 - 2.92)	0.62 (-2.42 - 3.66)	0.83 (-2.15 - 3.81)		0.01 (-0.38 - 0.39)	0.02 (-0.41 - 0.45)
Caregiver depressed/anxious: Yes		0.48 (-0.10 - 1.05)	0.54* (-0.03 - 1.11)	0.55* (-0.02 - 1.11)		-0.01 (-0.15 - 0.13)	-0.02 (-0.16 - 0.12)
Difficulty opening tap: Yes		-0.05	-0.12	-0.11		0.04	0.03

Difficulty opening tap: No data		(-0.67 - 0.57)	(-0.80 - 0.55)	(-0.78 - 0.55)		(-0.11 - 0.19)	(-0.12 - 0.18)
		-3.47**	-1.14*	-1.23**		-0.49***	-0.30**
Hands too small for soap: Yes		(-6.46 - -0.47)	(-2.29 - 0.02)	(-2.43 - -0.02)		(-0.71 - -0.27)	(-0.57 - -0.02)
		-0.36	-0.59*	-0.55*		-0.14*	-0.16*
Hands too small for soap: No data		(-1.05 - 0.33)	(-1.22 - 0.05)	(-1.19 - 0.08)		(-0.31 - 0.02)	(-0.34 - 0.01)
		-3.55**	-2.07***	-1.96***		-0.58***	-0.58***
Can't reach taps: Yes		(-6.47 - -0.64)	(-2.93 - -1.22)	(-2.92 - -1.00)		(-0.77 - -0.39)	(-0.79 - -0.38)
		-0.07	-0.07	-0.06		-0.03	-0.03
Can't reach taps: No data		(-0.65 - 0.51)	(-0.72 - 0.57)	(-0.71 - 0.59)		(-0.18 - 0.12)	(-0.19 - 0.13)
		6.05***	1.25	1.33		0.51***	0.29
Constant		(3.08 - 9.02)	(-0.94 - 3.44)	(-0.83 - 3.49)		(0.28 - 0.74)	(-0.17 - 0.75)
	1.88***	2.98***	3.18***	3.08***	0.63***	0.82***	0.74***
	(1.43 - 2.33)	(0.90 - 5.07)	(0.93 - 5.43)	(0.89 - 5.28)	(0.53 - 0.72)	(0.42 - 1.21)	(0.31 - 1.17)
Observations	245	243	209	209	245	243	209
R-squared	0.00	0.18	0.22	0.22	0.00	0.16	0.21

Notes: 95%CI in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A6. Effect of treatment on hand-washing and health by correct use of HOPE SOAP

	(1) Wash hands at both snack tests 0/1	(2) Wash hands after toilet Score:1-10	(3) Wash hands before meals Score:1-10	(4) Uses soap to wash hands Score:1-10	(5) Illness Score:1-13	(6) Any illness 0/1
Intervention (vs Control)						
HOPE SOAP – Not a Toy Cheat	0.07 (-0.11 - 0.26)	0.17 (-0.57 - 0.91)	0.22 (-0.60 - 1.05)	0.40 (-0.19 - 0.99)	-0.61* (-1.31 - 0.09)	-0.15** (-0.31 - -0.00)
HOPE SOAP –Toy Cheat	0.13 (-0.09 - 0.35)	0.24 (-0.65 - 1.13)	0.38 (-0.57 - 1.33)	0.41 (-0.25 - 1.06)	0.07 (-0.65 - 0.79)	0.02 (-0.14 - 0.18)
Baseline equivalent of dependent variable: hand washing measure	N/A	0.22*** (0.10 - 0.34)	0.13** (0.01 - 0.25)	0.13** (0.01 - 0.26)	0.19** (0.04 - 0.34)	0.16** (0.01 - 0.31)
Female	0.10 (-0.04 - 0.25)	0.16 (-0.37 - 0.70)	-0.20 (-0.83 - 0.44)	-0.08 (-0.59 - 0.42)	0.19 (-0.32 - 0.70)	-0.01 (-0.13 - 0.12)
Age	0.01 (-0.04 - 0.07)	-0.15 (-0.43 - 0.13)	0.11 (-0.19 - 0.41)	-0.09 (-0.35 - 0.17)	-0.21* (-0.42 - 0.01)	-0.03 (-0.07 - 0.01)
Household size	-0.02 (-0.06 - 0.02)	-0.07 (-0.22 - 0.08)	-0.03 (-0.19 - 0.14)	-0.07 (-0.21 - 0.07)	-0.09 (-0.22 - 0.04)	-0.03* (-0.07 - 0.00)
Number of children in hh	0.06 (-0.01 - 0.14)	0.01 (-0.26 - 0.27)	0.03 (-0.36 - 0.43)	0.23 (-0.05 - 0.51)	-0.11 (-0.32 - 0.11)	-0.01 (-0.08 - 0.05)
Assets (% ownership)	0.45* (-0.07 - 0.97)	-1.66 (-3.67 - 0.35)	-1.58 (-3.97 - 0.81)	-0.45 (-2.16 - 1.27)	0.05 (-1.70 - 1.80)	0.35 (-0.08 - 0.79)
Piped water in house	0.06 (-0.16 - 0.28)	0.24 (-0.68 - 1.15)	0.57 (-0.55 - 1.69)	0.02 (-0.69 - 0.73)	-0.82* (-1.66 - 0.03)	-0.10 (-0.27 - 0.07)
HH limits water use: Yes	0.13 (-0.04 - 0.31)	0.21 (-0.43 - 0.85)	0.09 (-0.70 - 0.88)	0.38 (-0.14 - 0.89)	0.71** (0.10 - 1.31)	0.11 (-0.04 - 0.25)
HH limits water use: No data	0.21 (-0.07 - 0.50)	-0.04 (-1.26 - 1.17)	-1.18 (-2.63 - 0.27)	-1.11 (-2.76 - 0.53)	0.12 (-0.85 - 1.10)	0.10 (-0.12 - 0.32)
Soap observed in HH: Yes	0.04 (-0.14 - 0.22)	0.24 (-0.55 - 1.04)	1.03** (0.18 - 1.89)	0.08 (-0.57 - 0.74)	-0.20 (-0.83 - 0.44)	0.04 (-0.11 - 0.18)
Soap observed in HH: No data	-0.01 (-0.27 - 0.25)	-0.67 (-1.80 - 0.46)	0.87 (-0.53 - 2.27)	0.64 (-0.21 - 1.49)	-0.02 (-1.03 - 0.99)	0.19* (-0.02 - 0.40)
HH received hygiene training: Yes	0.19** (0.02 - 0.35)	-0.73* (-1.48 - 0.02)	0.17 (-0.70 - 1.03)	-0.34 (-0.96 - 0.28)	0.57** (0.09 - 1.06)	0.13* (-0.01 - 0.26)
HH received hygiene training: No data	-0.15 (-0.53 - 0.23)	0.37 (-1.28 - 2.02)	0.37 (-1.19 - 1.93)	0.38 (-1.08 - 1.83)	0.68 (-2.28 - 3.65)	0.04 (-0.37 - 0.44)

Caregiver depressed/anxious: Yes	0.03 (-0.15 - 0.21)	0.28 (-0.35 - 0.92)	-0.34 (-1.09 - 0.40)	-0.48 (-1.08 - 0.12)	0.50* (-0.08 - 1.08)	-0.03 (-0.17 - 0.11)
Difficulty opening tap: Yes	-0.05 (-0.23 - 0.13)	-0.70* (-1.43 - 0.03)	-0.21 (-1.11 - 0.69)	-0.34 (-0.93 - 0.26)	-0.21 (-0.93 - 0.50)	0.01 (-0.15 - 0.16)
Difficulty opening tap: No data	-0.09 (-0.38 - 0.21)	0.38 (-2.97 - 3.72)	-2.18 (-6.38 - 2.01)	-0.48 (-2.20 - 1.24)	-0.92 (-2.14 - 0.31)	-0.24* (-0.53 - 0.04)
Hands too small for soap: Yes	0.05 (-0.12 - 0.23)	-0.09 (-0.82 - 0.64)	0.45 (-0.44 - 1.34)	-0.05 (-0.65 - 0.55)	-0.60* (-1.22 - 0.03)	-0.17* (-0.34 - 0.00)
Hands too small for soap: No data	-0.59*** (-0.83 - -0.35)	-1.50 (-4.65 - 1.65)	0.23 (-3.75 - 4.20)	1.35 (-0.37 - 3.07)	-1.78*** (-2.80 - -0.76)	-0.51*** (-0.74 - -0.27)
Can't reach taps: Yes	0.00 (-0.17 - 0.18)	-0.09 (-0.81 - 0.62)	-0.38 (-1.16 - 0.40)	0.16 (-0.43 - 0.74)	-0.06 (-0.71 - 0.59)	-0.02 (-0.18 - 0.13)
Can't reach taps: No data	0.62** (0.06 - 1.18)	-1.00 (-4.28 - 2.29)	-0.88 (-4.95 - 3.18)	0.44 (-1.28 - 2.15)	0.35 (-2.21 - 2.91)	0.06 (-0.45 - 0.57)
Constant	-0.23 (-0.75 - 0.29)	8.13*** (5.64 - 10.63)	5.65*** (2.97 - 8.33)	8.23*** (5.91 - 10.55)	3.21*** (0.97 - 5.45)	0.75*** (0.32 - 1.17)
Observations	187	242	244	236	209	209
R-squared	0.13	0.16	0.11	0.10	0.23	0.23

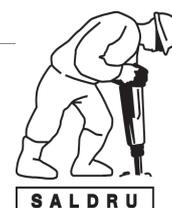
Notes: 95%CI in parentheses

*** p<0.01, ** p<0.05, * p<0.1

southern africa labour and development research unit

The Southern Africa Labour and Development Research Unit (SALDRU) conducts research directed at improving the well-being of South Africa's poor. It was established in 1975. Over the next two decades the unit's research played a central role in documenting the human costs of apartheid. Key projects from this period included the Farm Labour Conference (1976), the Economics of Health Care Conference (1978), and the Second Carnegie Enquiry into Poverty and Development in South Africa (1983-86). At the urging of the African National Congress, from 1992-1994 SALDRU and the World Bank coordinated the Project for Statistics on Living Standards and Development (PSLSD). This project provide baseline data for the implementation of post-apartheid socio-economic policies through South Africa's first non-racial national sample survey.

In the post-apartheid period, SALDRU has continued to gather data and conduct research directed at informing and assessing anti-poverty policy. In line with its historical contribution, SALDRU's researchers continue to conduct research detailing changing patterns of well-being in South Africa and assessing the impact of government policy on the poor. Current research work falls into the following research themes: post-apartheid poverty; employment and migration dynamics; family support structures in an era of rapid social change; public works and public infrastructure programmes, financial strategies of the poor; common property resources and the poor. Key survey projects include the Langeberg Integrated Family Survey (1999), the Khayelitsha/Mitchell's Plain Survey (2000), the ongoing Cape Area Panel Study (2001-) and the Financial Diaries Project.



www.saldru.uct.ac.za

Level 3, School of Economics Building, Middle Campus, University of Cape Town

Private Bag, Rondebosch 7701, Cape Town, South Africa

Tel: +27 (0)21 650 5696

Fax: +27 (0) 21 650 5797

Web: www.saldru.uct.ac.za

