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Three kinds of psychological determinants for hand-washing behaviour in Kenya

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ABSTRACT

Washing hands with soap at the right times – primarily after contact with faeces, but also before handling food or feeding an infant – can significantly reduce the incidence of childhood infectious disease. Here, we present empirical results which substantiate a recent claim that washing hands can be the consequence of different kinds of psychological causes. Such causes can be divided into three kinds of control over behaviour: automatic or habitual responses, motivated or goal-driven behaviour to satisfy needs, and cognitive causes which reflect conscious concerns. Empirical results are based on 3-h-long structured observations of hand-washing behaviour in 802 nationally representative Kenyan households with children under five, and structured interviews with the primary female caretaker in these households, collected in March 2007. Factor analysis of questionnaire responses identified three psychological factors which are also significant predictors of observed hand-washing behaviour: having the habit of hand-washing at particular junctures during the day, the motivated need for personal or household cleanliness, and a lack of cognitive concern about the cost of soap use. These factors each represent a different kind of psychological cause. A perceived link between clean hands and sexual attractiveness also appeared in the factor analysis, but was not a determinant of actual behaviour. We also report evidence that those who express concern about the cost of soap use are those with relatively few economic resources. We suggest that those developing hygiene promotion programmes should consider the possible existence of multiple types of strategies for increasing hand-washing behaviour.

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Introduction

Washing hands with soap at times of public health significance – primarily after contact with faeces, but also before handling food or feeding an infant – has been shown to be effective in reducing the occurrence of diarrhoea, trachoma and skin infections in poor settings, (Curtis & Cairncross, 2003; Ejemot, Ehiri, Meremikwu, & Critchley, 2008) and also plays a role in reducing acute respiratory infections. (Luby, Agboatwalla, Feikin, Painter, Billhimer, Altaf, et al., 2005; Rabie & Curtis, 2006) Getting people to wash their hands with soap is therefore a promising strategy for promoting health. It is also one of the most cost-effective means of reducing the burden of infectious disease and child deaths in the developing world. (Jamison, 2006)

Hand-washing has been studied in a variety of contexts: food service (Green et al., 2006), hospitals (Kuzu, Ozer, Aydenir, Yalcin, &

Zencir, 2005; O'Boyle, Henly, & Larson, 2001; Snow, White, Alder, & Stanford, 2006; Whitby, McLaws, & Ross, 2006), schools (Drankiewicz & Dundes, 2003; Guinan, McGuckin-Guinan, & Severeid, 1997), in public restrooms (Johnson, Sholcosky, Gabello, Ragni, & Ogonosky, 2003; Judah, Aunger, Curtis, Schmidt, & Michie, in press), However, all of these studies occur in specialised organisational situations in developed countries – not the context in which the major public health impact is felt. Several studies have sought, with some success, to increase hand-washing practice in developing countries (Curtis, Cousens, Mertens, Traoré, Kanki, et al., 1993; Luby et al., 2005; Luby, Agboatwalla, Painter, Altaf, Billhimer, & Hoekstra, 2004; Luby, Agboatwalla, Painter, Altaf, Billhimer, Keswick et al., 2006; Peterson, Roberts, Toole, & Peterson, 1998; Scott, Lawson, & Curtis, 2007; Shahid, Greenough, Samadi, Huq, & Rahman, 1996). However, it remains difficult to know how best to induce this important behaviour at scale. This may be due, at least in part, to the fact that we still do not know what kinds of psychological mechanisms produce this behaviour, and therefore need to be manipulated.

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Prior research suggests that behaviour can be determined by three different kinds psychological processes: reactive, motivated or cognitive. (Dennett, 1983; Ortony, Norman, & Revelle, 2004; Rolls, 1999; Sloman, 2001) Reactive behaviours are those which are triggered automatically by particular kinds of stimuli. In humans, most reactive behaviours are acquired (i.e., learned habits). Habitual behaviours are automatic responses to the presence of a specific cue, such as an object, a person, a message or a time of day. (Verplanken, 2006; Wood, Quinn, & Kashy, 2002) Habitual behaviours are typically enacted quite regularly in similar circumstances. (Verplanken & Wood, 2006; Wood, Tam, & Guerrero Witt, 2005) Because hand-washing is a daily behaviour, it can occur frequently enough to become habitual.

Motivated behaviour, on the other hand, occurs in response to a need, or perceived discrepancy between an aspect of a person's current state and an ideal state. (Deci & Ryan, 2000; Franken, 2001; Hull, 1943) Motivated behaviour is thus different from reactive behaviour in being directed at the goal of satisfying a need (i.e., it is 'forward-looking', whereas habitual behaviour is 'backward-looking', being driven by a trigger). A variety of motivations can spur behaviour. In particular, a number of motivations for hand-washing have been suggested by previous studies, such as a desire to nurture one's family, to increase social status, or reduce the disgust of dirty hands, while concerns with overt disease avoidance are less strong. (Curtis, in press).

Finally, some behaviours are cognitive – guided by often consciously determined plans to achieve a long-term objective or culturally determined goal (for example, to be consistent with religious practices, or to protect the health of an infant by removing germs from the hands). Choice among potential objectives to pursue requires evaluation of the likely returns from action. Such evaluations can involve the psychological reward system associated with motivation, but also require sophisticated mental representations of imagined states of affairs, which typically underlie the formulation of plans and objectives. (Koechlin, Ody, & Kouneiher, 2003; Wood & Grafman, 2003) It is the ability to form these complex, symbolic representations of unexperienced states which distinguish cognitive processes from motivational ones. (Johnson-Laird, 2006; Perner, 1991; Sperber, 2000)

This three-level model fit well the results from formative research on hand-washing (Curtis, in press) However, which of these potential causes can most effectively be stimulated with a public health programme, or even be correlated with actual behaviour, has yet to be demonstrated. Our hypothesis is that hand-washing can be caused by psychological mechanisms at each of these levels.

Prior field-based research on the psychological determinants of hand-washing has either been qualitative, or been based on reported rather than observed behaviour. Here, we seek to isolate the specific kinds of psychological mechanisms which are most important in determining actual hand-washing behaviour in the developing country context important to public health. To achieve this aim, we examine the types of reported processes which correlate with hand-washing behaviour observed in households in Kenya. The study took place in the context of the design of a national hand-washing promotion campaign. This national programme to promote hand-washing with soap is currently being designed in Kenya through a public-private partnership, the Global Hand-washing Partnership, under the supervision of a national coordinator responsible for implementing the programme. The partnership approach is described elsewhere. (Curtis, Garbrah-Aidoo, & Scott, 2007) The preparatory work for this campaign involved formative research into the explanatory factors for current hand-washing practices, and the barriers to change. This formative research was funded by the World Bank's Water and Sanitation

Programme, and executed by a private research firm based in Nairobi (Steadman International). Ethical approval was obtained from the Kenyan Ministry of Health. This paper reports on the psychological factors which contribute to hand-washing behaviour in Kenya; a companion paper focuses on the environmental correlates of this behaviour (Schmidt et al., in press). The intervention campaign is being designed on the basis of insights generated through this process. Such interventions are necessary because, according to the Kenya Demographic Healthy Survey of 2003, under-five mortality is 115 per 1000 live births. Much of this burden is due to diseases which can be reduced by hand-washing: diarrhoea and respiratory infections. Diarrhoeal diseases, for example, caused 16% of deaths among Kenyan children under five years in 2002–2003. (WHO, 2006)

Methods

First, we outline the strategy that was used to obtain a national sample of Kenyan households, then set out the methods that were used to collect and analyse the data on those households.

All data collection was conducted by independent Kenyan researchers experienced in social scientific research who had been hired contractually by the Kenyan research consultancy Steadman International, which managed data collection in the field and prepared an initial report. All subjects provided written consent to participate in the study during an initial household visit. Fieldwork was completed in four weeks in March 2007. Data records were translated into English for computer-based analysis by Steadman International personnel. Analyses reported here were conducted by the authors, supplemented by the report written in English by Steadman International (Steadman-Group, 2006).

Sampling strategy

First, one district was randomly chosen from each of eight provinces (all provinces in Kenya, except the North Eastern province, which was left out because of logistic problems associated with the very low population density of this area). Within a district, two sub-locations (the smallest administrative unit in Kenya) were selected using the probability proportion to size (PPS) method, in which the size of individual units was considered when performing random selection. (Levy & Lemeshow, 1991) The interviews were spread across villages in the same sub-location by choosing every 4th household on the list of those families with children under five years of age until 100 households per district had been selected. Twenty households dropped out on the day of observation, after confirming their availability the previous day, so the sample was extended to replace these households by following the household selection method (i.e., every 4th household on list with children under 5). Structured observations were undertaken with all these households, as were structured interviews, with no missing data. A total sample of 802 households was achieved.

Data collection methods

A variety of methods were used to investigate hand-washing behaviour and its determinants including structured observations of behaviour, formal interviews and focus group discussions. Each will be described in turn.

Structured observations

An observer/interviewer visited the participating house one day before planned observation to seek consent from the head of household and the primary caregiver and to book an appointment for the following day. The specific objectives of the study were kept

discreet to avoid biasing behaviour, although the household was told that the study concerned family life. During the recruitment the primary caregiver and index child (i.e., the child under five whose presence was required for household selection) were identified (the demographic characteristics of this sample are reported in Table 1). All participating households had at least one child below five years of age.

Interviewers arrived at the household a few minutes before 6:00am and strategically positioned themselves to observe hand-washing behaviour at key junctures: after toilet use, before handling food, and before feeding the index child. All observations started at 6.00am unless the household woke up late. The objective was to observe all occasions in which the following events occurred during the period of observation by the primary caregiver of the index child: carer's own toilet use, cleaning up index child following child's toileting, feeding index child, and handling of foods by carers. Information was recorded in a structured format and included: what type of event took place, whether hands were washed with water, and whether soap was used. Observation continued for 3 h within each household, or until the index carer left the home. Observers were instructed to interact as little as possible with household members during observation periods in order to minimize reactivity of those being observed. Local individuals were also used as fieldworkers to reduce the discomfort and unusual nature of having someone outside the family in the compound. (Cousens, Kanki, Toure, Diallo, & Curtis, 1996)

Household interviews

Formal interviews were carried out with the primary female caregivers in households where the observations took place in order to determine their socio-economic as well as psychological characteristics. Household interviews followed immediately after the period of observation, and were also conducted in the caretaker's primary language by the contracted employees of Steadman International. Interview topics included demographic, educational and socio-economic qualities of the household, environmental factors such as source of water, as well as a psychological profile.

The psychological questions were developed to address all three levels of control over behaviour: habitual, motivated and planned. (Aunger & Curtis, 2008) The habit questions were based on a validated self-report habit behaviour scale (Verplanken & Orbell, 2003). Questions in this scale address both the influence of past behaviour and measure the degree to which respondents feel their behaviour was an automatic response to their local surroundings. Only a subsample of the full set of questions were used, given time constraints of the interview.

The motivational questions were based on a recent review of research on the psychology of hand-washing (Curtis, in press), which suggests that four motivations are most likely to be closely associated with such hygiene behaviour: disgust (an avoidance

motivation which evolved to protect individuals from exposure to pathogens (Curtis, Aunger, & Rabie, 2004)), nurture (which causes individuals to care for the wellbeing of their offspring), social norms (which causes people to want to behave in ways that will increase their likelihood of being welcomed by others into social groups) and comfort (the desire to have hands free of pain, heat, oiliness, etc). Other potential motivations included in the questionnaire were sexual attraction (others might find dirty people less attractive), and hygiene (a concern with tidiness or orderliness).

Cognitive-level questions concerned a variety of beliefs which might influence planned hand-washing behaviour – primarily concerning health education-based factual information (e.g., the relationship between germs and disease), and economic constraints on use of soap and water – the kinds of cognitive factors found to be influential in the qualitative review of previous hand-washing studies. (Curtis, in press) All psychological questions (except those for habit) were formulated at the London School of Hygiene and Tropical Medicine and have been developed through previous use in research projects on hand-washing behaviour in other developing countries. Possible responses were given on a four point Likert scale (strongly agree, agree, disagree, strongly disagree). (See Table 4 for a listing of all items in the questionnaire.)

Focus group discussions

One focus group discussion was organized per district with a sample of female caregivers with children under five, recruited via random household selection procedures. Each of the eight discussions included eight to ten adult female respondents from the local area who had not participated in household observations or interviews. Discussions sought to establish existing behaviour with respect to hand-washing at critical junctures, as well as women's motivations, and barriers at the functional and emotive levels. Discussions employed picture interpretation and ranking exercises, lasted about 1.5 h, and were transcribed from a tape recording after its conclusion.

Data analysis

We used exploratory factor analysis to investigate whether the three kinds of psychological processes postulated to account for hand-washing behaviour emerged from use of this data reduction technique. Although we had some ideas about which questions should cluster together, based on our prior experience with hand-washing studies, we had not previously subjected this list of questions to any sort of quantitative data reduction techniques, and so had not confirmed these expectations through previous analyses, nor developed a list of questions known to be robust to such statistical manipulation. As a result, confirmatory factor analysis was not appropriate. We used the Kaiser–Meyer–Olkin (KMO) statistics to assess which variables to drop from the model due to multicollinearity with other variables. (Kaiser, 1974) Only questions with KMO values of 0.6 and above were retained for factor analysis (using stepwise elimination). The number of latent factors under consideration was determined using a combination of variance explained and visual inspection of the scree plot. Factors were identified using Varimax rotation. To interpret the resulting factors, we used those questionnaire items with factor loadings above 0.4 to construct composite index scores for each factor. For some analyses, the factor scores were collapsed into quintiles, with higher quintiles indicating a pro-hygiene bias.

The association between the factors from the factor analysis and hand-washing practices was analysed at the level of the observed event (faecal contact, eating, feeding or cleaning child). We used a binomial regression model in which the outcome variable (hand-washing with soap) was measured as a binary variable and the

Table 1

Description of persons observed at different junctures during the day for hand-washing behaviour.

Juncture	Person observed	
	Primary caregiver	Secondary caregiver
After using the toilet	✓	X
After cleaning up the bottom of index child	✓	✓
Other contact with stool	✓	✓
Before feeding the index child	✓	✓
Before handling food (taken raw)	✓	X
Before eating	X	X

✓, Juncture was observed.

X, juncture was not observed.

predictive variable (factor score) was quantitatively measured. We were interested in the absolute percentage differences between groups, and therefore decided to calculate the prevalence differences instead of ratios or odds ratios which would result from a log-risk or log-odds (logistic) model. Accordingly, we used the identity link (instead of the log link) to calculate risk (prevalence) differences and specified the binomial distribution as the distribution for the regression analysis. The clustering at the level of the household was taken into account by using generalised estimating equations (GEE) with robust standard errors. This approach was suitable to account for within-cluster correlation of a binary outcome variable (due to multiple measures being taken with respect to the same household and on the same person). As all the explanatory variables were at household level, this method provides confidence intervals and *p*-values that account both for within-household and within-person correlation.

Finally, for analytical purposes, we constructed an index of household 'material lifestyle' as the number of the following characteristics found in a household: ownership of television, radio, mobile phone, fixed line phone, email address, and postal address. Education was computed as a categorical variable with the values of primary school not completed, primary school completed, secondary school completed, or specialised training. Similarly, water supply was categorised as access to tap or bore hole, street vendor or truck, or other source (surface water, open well, rain water). All analyses were performed in Stata 10.

Results

This section describes the findings from descriptive and factor analysis of the data on Kenyan households. The meaning of these results is illuminated by insights from qualitative data on the same population.

Descriptive analysis

The age, marital status, and education levels of the primary caregivers in sampled households are reported in Table 2. Most of these women were relatively young and married; a few had

Table 2
Demographic characteristics of primary caregivers.

Age	%
Less than 18	1
18–24	30
25–30	29
31–35	23
36–40	8
41 and above	6
No response	2
Highest education level attained	
Never attended school	3
Did not complete primary school	16
Completed primary	29
Did not complete secondary	13
Completed secondary	23
Beyond secondary school	13
No response	2
Marital status	
Married	80
Single	13
Widowed	2
Cohabiting	2
Divorced or separated	1
No response	2

Note: based on household interviews (*n* = 802).

completed secondary schooling. This profile thus reflects the sampling constraint that study participants must be a female caregiver with a young child.

During the structured observations, a total of 3178 potential hand-washing events were recorded (see Table 3). Roughly four opportunities for caregivers to wash hands were observed during the 3-h-morning session in each household; on average, one of these involved hand-washing with soap. Hand-washing with soap was most frequent after potential contact with faeces, but only 14% of food-related events were preceded by hand-washing with soap.

Overall, 97% of Kenyan households have soap present in the household, so access to soap was not a problem. However, one reason that the proportion of hand-washing with soap was not higher was that hand-washing as a use of soap takes low priority, being ranked fourth in importance by women – after bathing, laundry and washing dishes – in focus groups discussions. Household chores (washing clothes and utensils) and personal care (bathing) are considered more important uses for soap.

Factor analysis

Following the procedures outlined in the Methods section, we retained four factors based on the scree plot from factor analysis of the entire questionnaire. Given that this was an exploratory analysis, statements whose factor loadings exceeded 0.4 in a rotated analysis were used to interpret the latent variables (Table 4). Based on this examination of loadings, we named the latent variables 'habit', 'cleanliness', 'attractiveness' and 'economic concern'. The overall KMO value for the set of variables retained was 0.86, suggesting the data are suitable for factor analysis. The four factors explained 24% of the variance in the data (after rotation).

The most significant factor concerned habit, both in the sense of automatic responses to cues such as seeing soap after toilet or a feeling of compulsion to wash, and the influence of long-term past behaviour being repeated. This factor explained 9% of the variance in the data. Statements which neared a loading of 0.4 (see Table 4) reinforce this interpretation of the first factor as representing habitual behaviour: 'Seeing dirt on my hands makes me wash them automatically', and 'I sometimes start washing my hands without even realizing it'.

The second factor (which explained 8% of the variance in the data) concerns a need to be clean or hygienic. Five statements loaded on this factor, suggesting it is quite robust. Two of the statements are beliefs related to a fear of contracting disease ('Diarrhoea can kill' and 'Hidden germs cause diarrhoea'); one can be considered to be about nurture ('Its important to teach children to wash hands with soap'), and another about disgust ('Bad smell on my hands make me want to wash them with soap'). It is possible that items related to several different motivations loaded on

Table 3
Sample sizes for hand-washing behaviours observed at particular junctures.

Type of occasion	% Of occasions hands washed with water ^a	% Of occasions hands washed with soap	# Of occasions
After cleaning child's bottom	69	34	652
After self-defecation	62	31	888
Before serving or handling food	49	15	772
Before feeding or serving index child	49	13	866

Note: based on household behaviour observations (*n* = 802).

^a The figures in this column include occasions of washing with water only, or with soap.

Table 4

Factor loadings (after rotation) for each questionnaire statement

Construct category	Statement	Statistics.	Habit factor	Cleanliness factor	Sexual attraction factor	Economic concern factor
<i>Reactive</i>		<i>Mean score (SD) 1 = strongly disagree 5 = strongly agree</i>				
Habit/past behaviour	I took up the practice of washing my hands with soap after the toilet many years ago	2.54 (1.61)	0.63	0.10	0.03	0.06
Habit/automaticity	I feel strange when I do not wash my hands with soap	2.48 (1.48)	0.62	−0.01	0.10	0.04
Habit/past behaviour	My parents taught me to wash my hands with soap	2.19 (1.23)	0.53	0.15	0.22	0.10
Habit/automaticity	Once you take up the practice of hand-wash with soap you cannot stop doing it	2.14 (1.38)	0.46	0.17	−0.02	0.03
Habit/automaticity	Seeing soap after having been to toilet makes me hand-wash with soap	2.39 (1.51)	0.44	0.15	0.13	−0.19
Habit/automaticity	Seeing dirt on my hands makes me wash them automatically	1.63 (1.08)	0.39	0.34	−0.13	−0.08
Habit/automaticity	I sometimes start washing my hands even without realizing I'm doing it	3.54 (1.52)	0.37	0.02	0.05	−0.18
<i>Motivational</i>						
Disgust	After the toilet I am compelled to wash my hands with soap because they feel disgusting	2.23 (1.27)	0.51	0.24	0.17	0.05
Nurture	Its important to teach children to wash hands with soap	1.48 (0.73)	0.19	0.57	0.14	0.12
Social norms	I feel good when people comment that I am clean	1.25 (0.69)	0.15	0.50	0.03	0.11
Disgust	Bad smell on my hands make me want to wash them with soap	1.67 (0.88)	0.19	0.47	0.07	−0.11
Sexual attraction	Washing hands with perfumed soap makes me attractive to my husband	2.48 (1.48)	0.16	0.08	0.59	−0.07
Sexual attraction	If you want your husband to stay around, you should make sure you smell good for him	2.07 (1.39)	0.13	0.11	0.55	0.03
Social norms	I would be ashamed if someone saw me not washing my hands after the toilet	2.38 (1.36)	0.39	0.27	0.29	−0.13
Social norms	I am more likely to wash my hands with soap if someone is watching	3.63 (1.32)	0.04	−0.01	0.10	−0.34
Social norms	I would say that hand-washing with soap is not a habit we practice much round here	2.67 (1.32)	−0.34	0.00	−0.01	−0.09
Social norms	People will notice/comment if you do not have clean hands and finger nails	2.02 (1.10)	0.19	0.28	0.25	−0.11
Social norms	Visitors will respect me if they find a place to hand-wash in my home	2.03 (1.18)	0.28	0.17	0.31	−0.03
Comfort	I hate it when my hands feel sticky	1.65 (1.11)	0.14	0.36	−0.01	−0.01
Comfort	If you wash your hands with soap before eating, it spoils the taste of food	1.73 (0.98)	−0.01	0.17	−0.00	0.32
Disgust	I feel my hands are disgusting after cleaning up my child's faeces	2.21 (1.24)	0.26	0.30	0.09	−0.11
Nurture	Being a mother is the most important thing in my life	1.34 (0.87)	0.16	0.30	0.08	0.034
Nurture	I believe my family would be healthier if I washed hands with soap all the time	2.00 (1.14)	0.29	0.35	0.29	0.054
Hygiene	I always keep my house tidy	1.55 (1.04)	0.17	0.37	0.01	0.05
Hygiene	Hygiene is not a priority to me	2.01 (1.46)	0.10	0.11	−0.10	0.20
Hygiene	I find hand-washing very boring	1.82 (1.27)	0.20	0.16	−0.09	0.29
Hygiene	I despise people who won't keep their house tidy	2.06 (1.39)	0.15	0.24	0.18	−0.12
<i>Cognitive</i>						
Economic constraint	I always make sure that my family has soap for hand-washing	2.30 (1.47)	0.60	0.11	0.08	0.10
Health education	Diarrhoea can kill	1.36 (0.78)	0.03	0.50	0.11	0.08
Health education	Hidden germs cause diarrhoea	1.56 (0.87)	0.03	0.44	0.08	0.12
Economic constraint	I don't want my children to wash their hands because they waste water	1.92 (0.34)	0.13	0.16	0.00	0.43
Economic constraint	Soap is too expensive for everyday use of washing hands	2.28 (1.30)	0.31	0.06	−0.02	0.42
Economic constraint	I am poorer than most people around here	2.06 (1.30)	0.05	0.12	−0.08	0.26
Economic constraint	It takes too much time to wash my hands with soap each time I prepare food	2.25 (1.13)	0.16	0.09	0.02	0.28
Health education	I can tell if my hands are free of germs just by looking at them	2.24 (1.32)	−0.11	0.09	−0.07	0.27
Health education	After the toilet there may be unseen contamination on my hands	1.79 (1.00)	0.06	0.35	0.14	0.15

Note: based on household interview responses ($n = 802$).

a single factor because insufficient questions were included in the questionnaire to identify these motivations as separate factors (i.e., there were in some cases only two questions per motivation – e.g., see the next factor). This factor also includes items which we

believed a priori to be both cognitive and motivational in nature – that is, items of belief and items about drivers of behaviour. However, it is nevertheless clear that all of the items linked to this factor indicate a general need to be hygienic. In particular, a general

concern with hygiene is indicated by the final statement loading on this factor: 'I feel good when people comment that I am clean'. (A second statement which was almost significant – 'I always keep my house tidy' – supports this interpretation). Responses thus indicate that a specific construct with motivational components centering around the issue of hygiene is significant in the minds of our respondents – a concern which is crucially related to disease avoidance via hand-washing.

The third factor concerns sexual attraction as a motivation for hand-washing separate from the motivation to be clean. This factor explained 4% of the variance in the data. The two statements loading on this factor suggest that women find it important to be clean in order to attract their spouse or to feel attractive.

Finally, the fourth factor was about economic constraints on soap use – in particular, the problem of having children waste soap or water and the economic cost of these resources. This factor explained 3% of the variance in the data.

Association of psychological factors with behaviour

While these factors discriminate between different psychological categories of attitudes and beliefs related to hand-washing, they might not be associated with hand-washing behaviour. We seek here to learn whether different kinds of hand-washing behaviours exist, with different kinds of psychological causes. Since different causes might come into play in different contexts of washing hands, we sought to isolate which kinds of contexts of practice might be associated with different combinations of psychological factors. We therefore conducted exploratory analyses of several possible break-downs of the types of hand-washing events, including by time of day, or estimating a separate model for each event type – that is, after using the toilet, after cleaning up the bottom of the index child, other kinds of contact with stools, before

feeding the index child, before handling food and before eating oneself. The only division which showed significantly different results by type of context or occasion combines the first three types of event into one (stool-related) category, and the second three into a second (food-related) category.

Comparison of scores on the four factors with observations of the same sample of women with regard to their hand-washing behaviour shows that the most significant psychological discriminator between subjects – reported habit – is also a significant correlate of observed use of soap when washing hands (see Table 5 for results of the binomial regression models). That is, people who report washing their hands with soap habitually are significantly more likely to be observed engaging in this behaviour. This is true whether the event concerned contact with stools or was food-related. Each quintile of the population, based on reported strength of habit, is significantly more likely to wash their hands with soap than the quintile with the next lowest average factor loading, for both stool-related and food-related occasions (Table 5). This statement is true for analyses both unadjusted and adjusted for education, water supply, and number of household appliances.

Table 5 also shows that a concern with cleanliness (the second factor) is strongly associated with observations of soap use after contact with faeces (crude and adjusted), but not before contact with food. Thus, hygienic Kenyans appear to think that it is important to clean their hands after coming into contact with their own faeces, or that of their child, but not before preparing, serving or eating food. The fourth factor, economic concern, is also correlated with being observed washing hands with soap after contact with faeces – that is, those who are concerned about the economic cost of soap are significantly less likely to be observed using soap after contact with faeces. However, in the adjusted analysis this association is no longer found. Sexual attraction does not predict hand-washing with soap for either type of contact. It remains

Table 5
Relationships between factor scores and probability of observed hand-washing behaviour.

Quintile	Hand-washing occasion					
	After stool contact			Before food preparation/eating/feeding		
	% Hand-washing with soap	Difference	<i>P</i> crude (adjusted)	% Hand-washing with soap	Difference	<i>P</i> crude (adjusted)
Habit factor			<0.001 (<0.001)	0.001 (0.01)		
Quintile 1	23	0 (ref)		7	0 (ref)	
Quintile 2	31	+8		14	+7	
Quintile 3	35	+12		17	+10	
Quintile 4	39	+16		12	+5	
Quintile 5	41	+18		18	+11	
Cleanliness factor			0.007 (0.012)	0.61 (0.53)		
Quintile 1	27	0 (ref)		11	0 (ref)	
Quintile 2	31	+4		13	+2	
Quintile 3	37	+10		16	+5	
Quintile 4	38	+11		15	+4	
Quintile 5	35	+8		15	+4	
Sexual attraction factor			0.42 (0.057)	0.53 (0.27)		
Quintile 1	30	0 (ref)		13	0 (ref)	
Quintile 2	33	+3		13	0	
Quintile 3	37	+7		17	+4	
Quintile 4	33	+3		13	0	
Quintile 5	35	+5		13	0	
Economic concern factor			0.06 (0.699)	0.27 (0.99)		
Quintile 1	30	0 (ref)		10	0 (ref)	
Quintile 2	32	+2		14	+4	
Quintile 3	33	+3		17	+7	
Quintile 4	40	+10		16	+6	
Quintile 5	33	+3		11	+1	

Binomial regression analysis (identity link, binomial family); *p*-values indicate test for linear association; *p*-values without brackets indicate crude analysis; *p*-values in brackets indicate analysis adjusted for water supply, education and number of household appliances.

Note: based on household observations and interview responses (*n* = 802).

a purely psychological phenomenon: some Kenyans have a belief that hand-washing can be linked to attractiveness, but do not engage in significantly different patterns of hand-washing behaviour as a result.

Association of psychological factors with caregiver characteristics

When we investigate which kinds of personal and household qualities are associated with the psychological factors, we find that these qualities cluster in such a way that richer Kenyans are separated from poorer ones. In particular, the habit ($p = 0.016$) and cleanliness ($p = 0.035$) factors are associated with an index of household material lifestyle (as measured by the number of electric or electronic appliances in the household). Habit ($p < 0.001$), cleanliness ($p = 0.004$) and economic concern ($p = 0.014$) are also significantly associated with latrines that were observed to be cleaner on the day of interview. A concern for being sexually attractive was also positively correlated with education ($p = 0.0001$) and the material lifestyle index ($p < 0.001$). A greater awareness of the importance of personal and sexual attractiveness – or at least the willingness to report such a concern – may therefore be concentrated in the relatively well-off segments of Kenyan society. This set of results, taken together, suggests that this group is more likely to express concern about, and to be, hygienic.

On the other hand, those who were likely to report economic concerns over the use of soap and water suffered from a number of social and economic disadvantages. They engaged in fewer social activities ($p = 0.06$), had less education ($p < 0.0001$), and were less likely to be able to read ($p = 0.038$). They also had fewer modern appliances ($p < 0.001$) and were less likely to have improved or costly types of sanitation (e.g., private pits or flush toilets) ($p = 0.047$), but were more likely to have an uncertain water supply (measured as number of months with scarce water) ($p = 0.008$). However, no factor, including economic concern, was associated with a household's quality of water supply facilities, such as household tap, communal tap, bore hole or water truck. The problem associated with hand-washing thus seems to be whether water was actually delivered, not how.

Discussion and conclusion

This study reports results from a nationally representative survey investigating the determinants of hand-washing behaviour in Kenya. We found that hand-washing with soap was more widely practiced than in similar countries. Certainly the levels of soap use observed in Kenya are higher than those in other sub-Saharan African countries in which hand-washing with soap has been observed, where frequencies are in the range of 3–23% after defecation. (Curtis, in press) (These other studies also involved structured observation, so the rates in these various countries can be compared.) The higher levels in Kenya may reflect a long history of hygiene promotion in the country or may have been a temporary response to a cholera epidemic that was ongoing in Kenya at the time of the study. (Steadman-Group, 2006) Another reason may be that focus group discussions suggest that adult Kenyans have a strong tendency to wash their face first thing in the morning. Defecation was also found by structured observations to often be the first action taken after waking up. Therefore hand-washing after going to the toilet may have been driven more by the need to wash the face than the hands.

Why adults should wash their hands more often after defecation than before eating is unknown, but may reflect a heightened sense of disgust at that time. Hand-washing before eating was reported as customary in Kenya.

Nevertheless, rates are generally still very low and public health in Kenya would be improved by increasing them. The question is how to most effectively achieve this goal. Factor analysis suggests that there are several kinds of tendencies people can feel with respect to hand-washing. The strongest correlate of observed hand-washing behaviour was habit, and for all kinds of occasions, suggesting that one segment of the Kenyan population practice this hygiene behaviour routinely, and largely as a response to environmental cues or psychological conditions such as knowing they have just left a toilet or are about to eat a meal.

A study conducted in Kenyan schools simultaneously with, and as a secondary part of, the programme reported on here, also corroborates the claims that hand-washing can be a habit of long practice, and particularly that it is learned when young in a household context. School children, especially in urban areas, claimed to have picked up the habit of washing hands from parents or elder siblings at home. This is mainly a driver to washing hands before eating food and not after using the toilet. Many of these children indicated that parents continue to remind them to wash hands with soap. (Steadman-Group, 2006)

A second group of items are associated with a need for personal or household cleanliness – that is, the desire for bodies or family environments to be clean. Those expressing greater concern for their cleanliness were significantly more likely to be seen washing their hands after contact with faeces. In focus group discussions, the cleanliness concept was seen to also include personal grooming (having short nails, clean clothes, bathing), and a clean physical environment (i.e., daily observation of sanitation issues, especially cleanliness in the compound and cooking and dining areas). Hence, the statement 'I always keep my house tidy' also loaded heavily on this factor, extending the cleanliness concept to the household itself.

A third factor some Kenyans worried about was their sexual attractiveness if they are seen by their spouse to be unclean. In focus group discussions, women expressed this relation as follows.

'The baby you have, it is the husband who gave it to you. It is good to look clean to your husband so that both of you can get children.'

'You cannot caress your husband when your hands are dirty.'

However, Kenyan women tend to see attraction as related more to personal care – for example, bathing, or changing clothes after a hard day's work. Thus, opinion seemed to be divided on whether or not cleanliness – at least of hands – was relevant to this important kind of social relation. This ambivalence was reflected in the rankings of various motivations for hand-washing in focus group discussions: attraction came seventh (on average), after nurture, comfort, disgust, conformity, social status, and purity as reasons to hand-wash. Those who believe that good hand hygiene can be sexually attractive were not observed to wash their hands at significantly different rates from the population in general – so this remains a psychological, not behavioural, distinction.

Finally, another fraction of Kenyans thinks the costs of soap and water outweigh the benefits of hand-washing. They experience a 'rational' or cognitive concern for the 'wastefulness' of using soap for this purpose. As might be expected, this consideration was stronger among poorer Kenyans. Across the country, soap was seen as a valued commodity. However, for some households, this economic concern was so great that they feel compelled to protect soap from being 'wasted', damaged (excessive heat from fire or sun) or used by children. Many end up hiding the soap or keeping it on top of a cupboard, to make access difficult for children.

Although the poorest segments of the Kenyan population have the greatest need of improved hygiene (based on their higher child mortality rates), it is clear from this work that those facing the greatest economic constraints are those least likely to have positive

attitudes about using soap for hand-washing. The attitude that hand-washing leads to 'wasteful' use of soap by children, prevalent among the poor, is an obvious target for any health promotion effort, as it is likely to be a barrier to success in the most needy communities. This finding is similar to that found in an urban community in Burkina Faso where an urban mentality seemed to be the best predictor of hand-washing behaviour. (Curtis, Kanki, Mertens, Traore, Diallo, Tall et al., 1995) Thus, those most in need of increasing their hand-washing are least likely to have attitudes which lead to such practices.

Each of the factors identified here reflects one of the levels of control included in recent models of behaviour determination (Aunger & Curtis, 2008; Rols, 1999; Sloman, 2001). The fourth factor, economic concern, is a reflection of cognitive worries about household economics. However, the other factors (and those which are most closely associated with behaviour) are those reflecting more ancient types of processes. The first factor, habit, is behaviour controlled at the reactive or automatic level. The second factor, cleanliness, is a general motivation which reflects more recent developments in behavioural control: the ability to pursue goals in order to satisfy fundamental needs. It has several components – disgust, nurture, and social status – all of which are human universals. The third factor is similar: sexual attraction is another ancient and universal human motivation. These results suggest that hygiene promotion efforts should target the more fundamental aspects of human psychology, rather than trying to appeal to weaker rational arguments. In particular, hygiene promotion should probably rely on incentives (to spur motivation), and decision-making (to form the intention to learn new habits) or repeated practice (to induce habits directly).

A recent study in Australia proposed two different kinds of hand-washing by nurses in hospitals which are related, but not identical to, these different levels of control: 'inherent' and 'elective' hand-washing. (Whitby et al., 2006) 'Inherent' hand-washing occurs when hands are physically dirty or feel sticky, or when hands come into contact with things considered to be 'emotionally dirty' (e.g., groins or genitals). 'Inherent' hand-washing seem to be practiced automatically by nurses, or to be motivated by a desire to clean visibly soiled hands, and thus combines the habitual and motivated levels of control. 'Elective' hand-washing occurred in any other situation when it was a matter of choice. Nurses reported modelling their elective behaviour on that of their superiors, and on their own behaviour outside hospitals. Others have reported that hand-washing was influenced by social factors: it increases in the presence of others (Drankiewicz & Dundes, 2003) or if respected people (in hospitals) practice hand-washing. (Lankford et al., 2003; Pittet et al., 2004) The Whitby study thus suggests that there are at least two kinds of hand-washing behaviour, each reflecting a different complex of factors. We believe the evidence presented here justifies an expansion of this earlier distinction to three kinds of hand-washing behaviour.

The factor analysis accounts only for a relatively small proportion of total variance (24%), and many of the questionnaire items do not cluster into factors. Further, two of the four factors (sexual attraction and economic concern) load on only two items, which means they are not statistically robust (although these are the only questions in the questionnaire which reflect these concerns, and so are the only questions on which such factors could load). In the past, many qualitative studies have used 'motivational' items that are unrelated to a psychological typology of determinants of hand-washing and possibly unrelated to hand-washing. Overall, the differences between different factor quintiles are at times significant but small in absolute terms, suggesting that there are other factors causing hand-washing behaviour which are not captured by the questionnaire. Purely methodological problems may be partly

responsible. Both the questionnaire administration and observation of hygiene behaviour were conducted by multiple researchers, which can lead to interviewer and observer effects, for example. (Foddy, 1994)

Another possibility is that a purely psychological explanation of hand-washing behaviour is incomplete. While we can address some social factors influencing hygiene behaviours (e.g., a concern for social status), our psychological framework does not explicitly address influences related to an individual's position in social, economic or political structures. We did, however, adjust the analysis for type of water supply (four categories), level of education (four categories) and number of household appliances, which had little effect on the analysis. Only the economic factor was no longer associated with hand-washing after faecal contact when adjusted for these covariates. However, socio-economic factors and perceived economic constraint share a similar causal pathway towards hand-washing (as may be the case for the other factors hygiene and habit as well). It is therefore debatable whether the analysis should be adjusted for socio-economic markers since variables that share a common causal pathway cannot be regarded as confounders (Rothman, Greenland, & Lash, 2008). Our psychological factors continue to be strongly associated with hand-washing behaviour even after controlling for these potential socio-economic confounders. On the other hand, our measures of wealth and westernization may be poor proxies for access to hand-washing facilities, which obviously have an impact on whether people are observed to hand-wash. As they are complex, these issues will be addressed in a companion paper. (Schmidt et al., in press)

It is also the case that we report here on *correlations* between psychological variables and behaviour, which do not represent *causal* relationships. (Weinstein, 2007) These results must therefore be taken as preliminary.

Nevertheless, to our knowledge, this is the first time that people have been asked about the habitualness of their hand-washing behaviour. We suspect that other hygiene behaviours, such as tooth brushing, are often performed automatically, often as part of daily routines. (Aunger, 2007) More health promotion campaigns should investigate this issue since inducing habits can involve different tactics than trying to change behaviour by increasing motivation or conscious self-regulation. (Cairncross, Shordt, Zacharia, & Govindan, 2005) We hope that the interest of these results will inspire additional studies.

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