







Barrier Analysis on handwashing with soap in Madagascar







BushProof



Background

In 2021, RANOWASH is a national programme to promote hygiene, safe water source provision, and sanitation in rural areas of Madagascar. Handwashing with soap is associated with significant reductions in child diarrhoea and is an important part of infection prevention and control practices. The community-based approach implemented by the RANOWASH programme has the potential to engage traditionally marginalised populations in rural, isolated communities in Madagascar through a novel arrangement of community health volunteers, local utility and service providers, and village «champions». In order to inform modifications/future adaptations to the programme, RANOWASH collected data for a Barrier Analysis for handwashing with soap.

This Barrier Analysis involved an adopter / non-adopter sample of individuals residing in RANO WASH programme areas. Adopters were selected from those households that had successfully completed the RANOWASH community-based education modules on Handwashing with Soap and who had verified by programme staff as having constructed a handwashing station in the home. Non-adopters were households form the same region who had enrolled in the RANO WASH programme but had not successfully completed modules related to hygiene and handwashing.

A telephone survey was completed with 90 sampled households - 45 adopters; 45 non-adopters. A survey with pre-coded responses and semi-structured qualitative responses was completed with all households. Data were collected on 13 pre-selected behavioural determinants known to influence individual handwashing behaviours.

Details of the overall research and data collection process can be found in the RANOWASH protocol and data collection report.

Aims and objectives

The aim of the study is to understand the differences in determinants of handwashing with soap among adopter and non-adopter households of improved handwashing facilities in rural Madagascar. Specific objectives are:

- I. Explore the differences in self-reported handwashing behaviors among households that completed the RANO WASH hand hygiene modules
- 2 Explore differences in self-reported behavioral determinants of handwashing with soap among adopter and non-adopter households in rural Madagascar.

Methods

This study applied the standardized Barrier Analysis approach for assessing the determinants of handwashing behavior (Appendix I). Barrier Analysis is a standardized rapid assessment tool which compares the perspective of people who practice a behavior with those who do not practice the same behavior. The definition of the behavior and related critical times of interest, priority groups and determinants drawn from the barrier analysis guidelines are detailed in **Table I**.



| Key term | Definition |
|---------------------------------|--|
| Target behavior | Handwashing with soap |
| Priority groups | Primary caretakers of children under the age of five |
| Details of behavior | Handwashing with water and soap at the three critical times; critical times defined as: I. After defecation/cleaning a baby following defecation, 2. Before food preparation 3. Before eating/feeding a child |
| Adopter | Priority group from household that had successfully completed the RANOWASH community-based education modules on Handwashing with Soap and who had verified by program staff as having constructed a handwashing station in the home. |
| Non-adopter | Priority group from households from the same region who had enrolled in the RANO WASH program but had not successfully completed modules related to hygiene and handwashing. |
| Perceived self-efficacy | An individual's belief that they can wash their hands with soap give their current knowledge and skills |
| Perceived social norms | The perception that people important to an individual think that they should wash their hands with soap |
| Perceived positive consequences | The positive things a person thinks will happen as a result of HWWS |
| Perceived negative consequences | The negative things a person thinks will happen as a result of HWWS |
| Access | The availability of the needed products or services (e.g. soap, water, handwas- hing facilities) required for handwashing with soap. This includes barriers related to the cost, distance and cultural acceptability of these products and services. |
| Cues to action/reminders | The presence of reminders that help a person remember to wash their hands with soap |

| Key term | Definition |
|---------------------------|---|
| Perceived susceptibility | A person's perception of how vulnerable or at risk they are to getting diarrhea |
| Perceived vulnerability | The extent to which a person believes that the diarrhea is a serious illness |
| Perceived action efficacy | The extent to which a person believes that by practicing handwashing with soap they will be able to avoid getting diarrhea |
| Perceived divine will | The extent to which a person believes that it is the gods' will them to get diarrhea and/or to overcome it |
| Policy | The presence of laws and regulations that may affect whether people wash their hands with soap or which affect their access to relevant products and services |
| Culture | The extent to which local history, customs, lifestyles, values and practices may affect whether people wash their hands with soap. |

The Barrier Analysis approach recommends a sample size of 45 adopters and 45 non-adopters. This relatively small sample size is argued to be sufficient because the Barrier Analysis method is designed to identify significant differences in behavioral determinants (defined as results with statistical significance of p < 0.05 using the chi-square test). Participants continued to be screened and sampled until these figures were met.

For this analysis, all responses were tallied in each category, and by their adopter and no-adopter classification. These figures were then entered into the standardized Barrier Analysis tabulation sheet to draw conclusions from the data (Appendix 1). This allowed for closed-answer, quantitative data to be easily summarized and compared using the standard Barrier Analysis approach involving Chi-square tests and the generation of an estimated relative risk. Any qualitative text entries were reviewed and where applicable, classified thematically, recoded quantitatively and entered into the tabulation sheet. The Barrier Analysis tabulation sheet highlights differences between adopters and non-adopters based on P values of >0.05.

Results

For this study, 46 adopters and 46 non-adopters were selected from six regions resulting in a total sample of 92 respondents (Table 2). All primary caretakers were women and the average age of the respondents' youngest children was similar among the adopters (Mean: 2.5 yrs.; Range: 0.5 - 5) and non-adopters (Mean: 2.6 yrs.; Range 0.75 - 5).

Table 2: Geographical distribution of respondents

| Region | Commune (N) | Adopters N (%) | Commune (N) | Non –adopters N (%) |
|---------------------|-------------|----------------|-------------|---------------------|
| Amoron'i Mania | 5 | 7 (15%) | 6 | 7 (15%) |
| Alaotra Mangoro | 7 | 7 (15%) | 4 | 5 (11%) |
| Atsinanana | 9 | 12 (26%) | 5 | 7 (15%) |
| Haute Matsiatra | 7 | 7 (15%) | 8 | 10 (22%) |
| Vakinankaratra | 8 | 8 (17%) | 5 | 7 (15%) |
| Vatovavy Fitovinany | 4 | 5 (11%) | 7 | 10 (22% |
| Total | 40 | 46 | 35 | 46 |



Reported behaviors

All adopters and non-adopters reported to washing their hands with soap the day before (Table 3). 100% of the adopters and non-adopters reported having washed their hands the day before. Adopters were more likely to report having washed their hands at all three critical moments (p = 0.00) than the non-adopters.

Conversely, none of the non-adopters reported having washed their hands at all three critical times. The majority of the non-adopters (72%) reported having washed their hands after toileting activities and before eating/feeding the child yesterday. The rest of the non-adopters reported washing their hands only at one critical time; 24% before eating/feeding the child and 4% before meal preparation.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | | |
|--|-----------|--------------|------------|-------------------------|---------|--|--|--|--|
| Yesterday did you wash your hands? | | | | | | | | | |
| Yes | 46 (100%) | 46 (100%) | 0% | | 1.00 | | | | |
| What are all the moments that you washed your hands? | | | | | | | | | |
| a. After defecation/after wiping -changing child | 0 (0%) | 0 (0%) | 0% | | 1.00 | | | | |
| b. before cooking meals /preparing meals | 0 (0%) | 2 (4%) | -4% | 0.00 | 0.15 | | | | |
| c. before eating/feeding child | 0 (0%) | (24%) | -24% | 0.00 | 0.00 | | | | |
| a & c | 0 (0%) | 33 (72%) | -72% | 0.00 | 0.00 | | | | |
| a & b | 0 (0%) | 0 (0%) | 0% | - | 1.15 | | | | |
| b & c | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |
| a, b and c | 46 (100%) | 0 (0%) | 0% | - | 0.00 | | | | |

Table 3: Comparison of the adopters and non-adopters regarding reported handwashing behaviors

Handwashing facility type and location

The adopters and non-adopters reported using various types of handwashing facility (HWF) (Table 4). The most common type of infrastructure used in both groups (adopters; 46% non-adopters 54%) was a bucket with tap. Adopters were more likely than non-adopters to mention using a tippy tap as their main HWF (P = 0.03). There were no significant differences between the adopters and non-adopters for any other reported HWF types.

The HWF were located in various places around the household. The HWF location for the majority of the adopters (48%) and non-adopters (59%) in the yard. Adopters were more 7 times more likely (p = 0.04) to report having a HWF located at the toilets and 11.4 times more likely (p = 0.01) to report having a HWF located in the kitchen.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | |
|---|----------|--------------|------------|-------------------------|---------|--|--|--|
| What HWF do you or other household members most often use to wash your hands? | | | | | | | | |
| Bucket with tap | 21 (46%) | 25 (54%) | -9% | 0.73 | 0.40 | | | |
| Тірру Тар | 15 (33%) | 6 (13%) | 20% | 2.74 | 0.03 | | | |
| Bucket/Jug/Kettle/Basin | 10 (22%) | 13 (28%) | -7% | 0.73 | 0.47 | | | |
| Anything else | 0 (0%) | 2 (4%) | -4% | 0.00 | 0.15 | | | |
| Where is the HWF lo | cated? | | · | | | | | |
| Yard | 22 (48%) | 27 (59%) | -11% | 0.66 | 0.30 | | | |
| Toilets | 6 (13%) | I (2%) | 11% | 4.45 | 0.04 | | | |
| In the kitchen | 6 (13%) | 0 (0%) | 13% | 11.4 | 0.01 | | | |
| Balcony | 6 (13%) | 8 (17%) | -4% | 0.74 | 0.56 | | | |
| Bathroom | 6 (13%) | 4 (9%) | 4% | 1.49 | 0.50 | | | |
| In the house | 5 (11%) | 4 (9%) | 2% | 1.25 | 0.73 | | | |
| Dishwashing station | 3 (7%) | I (2%) | 4% | 2.61 | 0.31 | | | |
| At the shop | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 | | | |
| Undefined | I (2%) | 2 (4%) | -2% | 0.52 | 0.56 | | | |

Table 4: Comparison of the adopters and non-adopters regarding handwashing facility type & location.

Main handwashing water source and location

The main water sources that were used for handwashing varied (Table 5). In both groups, the main location of water used for the HWF was located away from the home. Among the adopters, the most commonly reported source was the public/communal piped water taps (33%), while among the non-adopters this was the borehole (28%) and surface water (28%). There were no significant differences between the two groups on their reported main sources or location of water used for handwashing.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | | |
|---|-------------------|----------------|------------|-------------------------|---------|--|--|--|--|
| What is the main source of water you use for the HWF? | | | | | | | | | |
| Public/communal piped water tap | 15 (33%) | (24%) | 9% | 1.47 | 0.35 | | | | |
| Dug well | (24%) | 8 (17%) | 7% | 1.43 | 0.44 | | | | |
| Borehole | 9 (20%) | 13 (28%) | -9% | 0.65 | 0.32 | | | | |
| Surface water | 7 (15%) | 13 (28%) | -13% | 0.49 | 0.14 | | | | |
| Private piped water tap | 3 (7%) | I (2%) | 4% | 2.61 | 0.31 | | | | |
| Rainwater | I (2%) | 0 (0%) | 2% | 10.2 | 0.32 | | | | |
| Anything else | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |
| Where is the main so | urce of water you | use for the HW | F located? | | | | | | |
| Away from home | 25 (54%) | 20 (43%) | 11% | 1.48 | 0.30 | | | | |
| Undefined | 16 (35%) | 17 (37%) | -2% | 0.92 | 0.83 | | | | |
| On the home property | 5 (11%) | 9 (20%) | -9% | 0.53 | 0.25 | | | | |
| In the house | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |

Table 5: Comparison of the adopters & non-adopters regarding main HWF water source & location

Soap use, purpose and preference

The majority of adopters (98%) and non-adopters (93%) reported keeping the soap they use for handwashing at a HWF or near the toilet and/or kitchen. All adopters (100%) and most of the non-adopters (96%) reported using bar soap as the type of soap to wash their hands.

Half (50%) of the adopters and 20% of the non-adopters did not use the soap designated for handwashing for anything other purposes (Table 6). Adopters were 3 times more likely to mention using the soap exclusively for handwashing (p = 0.002). Other uses of soap included washing clothes, bathing and cleaning kitchen utensils. Non-adopters were 7.3 times more times likely to have additional uses for the soap (p = 0.026) however the data did not provide details around what these other purposes where.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | |
|--|----------|--------------|------------|-------------------------|---------|--|--|
| For what other purposes do you use the soap mentioned? | | | | | | | |
| Nothing else - Just handwashing | 23 (50%) | 9 (20%) | 30% | 3.42 | 0.002 | | |
| Cleaning cooking and eating utensils | 9 (20%) | 5 (11%) | 9% | 1.83 | 0.24 | | |
| Washing clothes | 8 (17%) | 15 (33%) | -15% | 0.47 | 0.09 | | |
| Body bathing | 5 (11%) | 10 (22%) | -11% | 0.47 | 0.16 | | |
| Anything else | I (2%) | 7 (15%) | -13% | 0.14 | 0.026 | | |

Table 6: Comparison of the adopters and non-adopters regarding other purposes for soap



Reported Determinants

Perceived efficacy

The majority of adopters (91%) and non-adopters (98%) felt that they were able to wash their hands with soap at the three critical times given their current knowledge, skills and their available resources (Table 7).

| Table | 7. Con | nbarison | of the | adopters | and | non-ado | bters re | ording | , perceived | efficacy |
|--------|--------|----------|--------|----------|-----|-----------|----------|----------|-------------|----------|
| I UDIE | 7. Con | ipunson | of the | udupters | unu | 11011-000 | piers id | zgurunig | perceiveu | efficucy |

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | |
|--|----------------|-------------------|----------------|----------------------------|--------------|--|--|--|
| With your current knowledge and skills do you think you can wash your hands with soap at the three critical times? | | | | | | | | |
| Yes | 42 (91%) | 45 (98%) | -7% | 0.31 | 0.17 | | | |
| No | 2 (4%) | I (2%) | 2% | 1.86 | 0.56 | | | |
| Maybe | I (2%) | 0 (0%) | 2% | 10.2 | 0.32 | | | |
| With your current re | sources do you | think you can was | h your hands w | ith soap at the three crit | tical times? | | | |
| Yes | 42 (91%) | 44 (96%) | -4% | 0.53 | 0.40 | | | |
| No | 3 (7%) | 2 (4%) | 2% | 1.46 | 0.65 | | | |
| Maybe | I (2%) | 0 (0%) | 2% | 10.2 | 0.32 | | | |

When asked about the factors that made it easy to wash their hands at the critical moments, there was ahigh level of consistency with no significant differences between the adopters' and non-adopters' responses (Table 8). The common factors mentioned by participants were related to availability/inaccessibility of HW infrastructure and materials, the type of handwashing infrastructure (e.g. having a tap) and handwashing being a habit/routine.

Table 8: Comparison of the adopters and non-adopters regarding factors that promote and hinder them from washing their hands.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value |
|--|-------------------|--------------------|-----------------|----------------------------|---------|
| What makes it easier | for you to wash | n your hands with | soap at the thr | ee critical times each da | y? |
| Availability/accessibility of HW infrastructure and materials | 34 (74%) | 38 (83%) | -9% | 0.63 | 0.31 |
| Type of handwashing infrastructure | 20 (43%) | 24 (52%) | -9% | 0.73 | 0.40 |
| Habit | 8 (17%) | 12 (26%) | -9% | 0.62 | 0.31 |
| Exposure to promotion programs | 3 (7%) | 2 (4%) | 2% | 1.46 | 0.65 |
| No answer | 2 (4%) | l (2%) | 2% | 1.86 | 0.56 |
| What makes it difficu | Ilt for you to wa | sh your hands with | h soap at the t | hree critical times each d | lay? |
| Not difficult at all | 20 (43%) | 20 (43%) | 0% | 1.00 | 1.00 |
| Unavailability or inaccessibility of infrastructure and materials | 20 (43%) | 33 (72%) | -28% | 0.35 | 0.006 |
| No time/too busy | 8 (17%) | (24%) | -7% | 0.70 | 0.44 |
| Forget/not a habit | 8 (17%) | 9 (20%) | -2% | 0.88 | 0.79 |
| Type of handwashing infrastructure | 9 (20%) | (24%) | -4% | 0.79 | 0.61 |
| Lack of respect | I (2%) | 2 (4%) | -2% | 0.52 | 0.56 |
| Lazy | 2 (4%) | 4 (9%) | -4% | 0.51 | 0.40 |
| No education/ ignorance | 2 (4%) | 0 (0%) | 4% | 10.4 | 0.15 |
| Time of the day | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 |
| No money | I (2%) | 6 (13%) | -11% | 0.16 | 0.049 |
| No answer | 2 (4%) | 0 (0%) | 4% | 10.4 | 0.15 |

There were a variety of reported difficulties which hindered handwashing for both adopters and nonadopters including the unavailability and access of handwashing infrastructure and materials, the type of handwashing infrastructure (e.g. one without a tap, HWF that needed someone to pour water), lack of time/too busy and forgetting. Compared to the adopters, non-adopters were more likely to mention the unavailability/inaccessibility of handwashing infrastructure and materials (p = 0.006) and prohibitive costs (p = 0.049) as factors that made it difficult to wash their hands at the three critical times. 43% of adopters and non-adopters reported having no difficulty to wash their hands with soap at the three critical moments.

Perceived positive and negative consequences

Participants cited many positive consequences of handwashing with soap. Both adopters and non-adopters cited the main positive consequences of handwashing with soap at the critical times as good general health and wellbeing, avoiding infection of self or their children, general cleanliness (removal of dirt), and having clean hands and food (Table 9).

The majority of adopters (85%) and non-adopters (76%) did not think that there were negative consequences to handwashing with soap.

There were no significant differences between adopters and non-adopters in their reported positive or negative consequences in relation to handwashing.

Table 9: Comparison of the adopters and non-adopters regarding the positive and negative consequences of handwashing.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | | |
|---|----------|--------------|------------|-------------------------|---------|--|--|--|--|
| What are the advantages of washing your hands with soap at the three critical times each day? | | | | | | | | | |
| General health and wellbeing | 32 (70%) | 32 (70%) | 0% | 1.00 | 1.00 | | | | |
| Cleanliness (general) | 25 (54%) | 24 (52%) | 2% | 1.08 | 0.83 | | | | |
| Cleanliness (food) | 31 (67%) | 26 (57%) | 11% | 1.52 | 0.28 | | | | |
| Cleanliness (hands) | 13 (28%) | 16 (35%) | -7% | 0.76 | 0.50 | | | | |
| Kills/Avoid germs/ avoid infection (self) | 23 (50%) | 20 (43%) | 7% | 1.27 | 0.53 | | | | |
| Kills/Avoid germs/ avoid infection (others) | 20 (43%) | 24 (52%) | -9% | 0.73 | 0.40 | | | | |
| Money saved from future treatment | 2 (4%) | I (2%) | 2% | 1.86 | 0.56 | | | | |

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | | |
|--|----------|--------------|------------|-------------------------|---------|--|--|--|--|
| Teach children to be clean | I (2%) | 2 (4%) | -2% | 0.52 | 0.56 | | | | |
| What are the disadvantages of washing your hands with soap at the three critical times each day? | | | | | | | | | |
| No disadvantages | 39 (85%) | 35 (76%) | 9% | 1.67 | 0.29 | | | | |
| Hands smell of soap | I (2%) | 3 (7%) | -4% | 0.34 | 0.31 | | | | |
| Soap goes on food from poor rinsing | I (2%) | 4 (9%) | -7% | 0.25 | 0.17 | | | | |
| Hands always wet | I (2%) | 0 (0%) | 2% | 10.2 | 0.32 | | | | |
| Consumes water and soap | I (2%) | 0 (0%) | 2% | 10.2 | 0.32 | | | | |
| Poor rinsing | 3 (7%) | 0 (0%) | 7% | 10.6 | 0.08 | | | | |
| Time wasting (to collect water) | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 | | | | |
| Food unhygienic if water is dirty | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 | | | | |
| Diarrhea due to ingesting soap from poor rinsing | 0 (0%) | 2 (4%) | -4% | 0.00 | 0.15 | | | | |

Social norms

Mothers in both adopter (83%) and non-adopter (76%) categories reported that washing their hands with water and soap at the critical times was something that was generally approved of by society around them (Table 10).

Table 10: Comparison of the adopters and non-adopters regarding perceived handwashing social norms.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | |
|--|----------|--------------|------------|-------------------------|---------|--|--|--|
| Would most of the people that you know approve of you washing your hands with soap at the three critical times each day? | | | | | | | | |
| Yes | 38 (83%) | 35 (76%) | 7% | 1.44 | 0.44 | | | |

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value |
|---|------------------|-------------------|----------------|----------------------------|-------------|
| Possibly | 7 (15%) | 8 (17%) | -2% | 0.87 | 0.78 |
| No | I (2%) | I (2%) | 0% | 1.00 | 1.00 |
| Don't know/won't say | 0 (0%) | 2 (4%) | -4% | 0.00 | 0.15 |
| Who are the people a each day? | that/would appro | ove of you washin | g your hands w | ith soap at the three crit | tical times |
| Household members | 37 (80%) | 38 (83%) | -2% | 0.88 | 0.79 |
| Neighbors/Community members | 24 (52%) | 28 (61%) | -9% | 0.73 | 0.40 |
| HCW/Hospital | 8 (17%) | 7 (15%) | 2% | 1.15 | 0.79 |
| Relatives/house guests | 8 (17%) | 3 (28%) | -11% | 0.56 | 0.21 |
| Hygiene promoters | 8 (17%) | 7 (15%) | 2% | 1.15 | 0.79 |
| Government | I (2%) | 4 (9%) | -7% | 0.25 | 0.17 |
| No one | (2%) | 0 (0%) | 2% | 10.2 | 0.32 |
| Which critical time is | /would be appro | oved of the most? | | | |
| a. After defecation/ after wiping -changing child | 17 (37%) | 22 (48%) | -11% | 0.67 | 0.29 |
| a, b and c | 14 (30%) | 7 (15%) | 15% | 2.18 | 0.08 |
| c. before eating/feeding children | 8 (17%) | 9 (20%) | -2% | 0.88 | 0.79 |
| b. before cooking meals/preparing meals | 4 (9%) | 4 (9%) | 0% | 1.00 | 1.00 |
| a & c | I (2%) | (2%) | 0% | 1.00 | 1.00 |
| a & b | 0 (0%) | 2 (4%) | -4% | 0.00 | 0.15 |

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value |
|------------|----------|--------------|------------|-------------------------|---------|
| b & c | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 |
| Don't know | 2 (4%) | 0 (0%) | 4% | 10.4 | 0.15 |

A range of people were cited to approve of this behavior ranging from those at household and community levels up to the government level. When asked which critical time would earn the most approval if conducted, nearly half of the non-adopters (48%) cited after defecation/after wiping –changing child. Among the adopters the response was spread between all three critical times (30%) and after defecation/after wiping-changing a child (37%).

There were no significant differences between the adopters and no-adopters around the reported social approval of handwashing.

Perceived access

The majority of adopters (78%) and non-adopters (67%) said that accessing sufficient soap and water for handwashing was not difficult (Table 11). The proportion of non-adopters reported accessing water to wash hands to be "somewhat difficult" (adopters – 15%; non-adopters – 22%) and "very difficult" was higher than the adopters (adopters – 7%; non-adopters – 11%). The most difficult critical time to get water and soap to wash hands was after toileting activities for the non-adopters (41%) while in the case of adopters it was split between after toileting activities (24%) and before meal preparation (20%).

There were no significant differences in perceived access to water and soap between adopters and non-adopters.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | |
|---|----------|--------------|------------|-------------------------|---------|--|--|--|
| How difficult is it to get the water and soap you need to wash your hands at the three critical times each day? | | | | | | | | |
| Very difficult | 3 (7%) | 5 (11%) | -4% | 0.60 | 0.459 | | | |
| Somewhat difficult | 7 (15%) | 10 (11%) | -7% | 0.67 | 0.420 | | | |
| Not difficult at all | 36 (78%) | 31 (67%) | 11% | 1.66 | 0.241 | | | |
| Which is the most difficult critical time to get the water and soap you need to wash your hands? | | | | | | | | |
| a. After defecation/after wiping -changing child | 11 (24%) | 19 (41%) | -17% | 0.48 | 0.08 | | | |

Table 11: Comparison of the adopters and non-adopters regarding perceived access to soap and water.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value |
|--|----------|--------------|------------|-------------------------|---------|
| b. before cooking meals/preparing meals | 9 (20%) | 6 (13%) | 7% | 1.53 | 0.40 |
| c. before eating/feeding children | 2 (4%) | 3 (7%) | -2% | 0.68 | 0.65 |
| a & b | 0 (0%) | 0 (0%) | 0% | - | 1.00 |
| a & c | 0 (0%) | 0 (0%) | 0% | - | 1.00 |
| b & c | 0 (0%) | 0 (0%) | 0% | - | 1.00 |
| a, b and c | 0 (0%) | (2%) | -2% | 0.00 | 0.32 |
| None | 24 (52%) | 17 (37%) | 15% | 1.74 | 0.14 |

Cues to action/reminders

Adopters were six times more likely than non-adopters (p = 0.049) to report that it was "not difficult at all" to remember to wash hands with soap at the critical times each day (Table 12). Conversely non-adopters were 6 times more likely than adopters (p = 0.049) to respond to washing hands with soap at the critical times each day as being "somewhat difficult" to remember. None of the participants in either groups reported it being very difficult.

Table 12: Comparison of the adopters and non-adopters regarding cues to action/reminders.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | |
|--|----------|--------------|------------|-------------------------|---------|--|--|--|
| How difficult is it to remember to wash your hands with soap at the three critical times each day? | | | | | | | | |
| Very difficult | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | |
| Somewhat difficult | I (2%) | 6 (13%) | -11% | 0.16 | 0.049 | | | |
| Not difficult at all | 45 (98%) | 40 (87%) | 11% | 6.11 | 0.049 | | | |
| Do not know | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | |

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | | |
|---|----------|--------------|------------|-------------------------|---------|--|--|--|--|
| Which is the most difficult critical time to remember to wash your hands with soap? | | | | | | | | | |
| a. After defecation/after wiping -changing child | (24%) | 15 (33%) | -9% | 0.68 | 0.35 | | | | |
| b. before cooking meals/preparing meals | 6 (13%) | 8 (17%) | -4% | 0.74 | 0.56 | | | | |
| c. before eating/feeding children | 3 (7%) | 4 (9%) | -2% | 0.75 | 0.69 | | | | |
| a & b | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |
| a & c | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |
| b & c | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |
| a, b and c | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |
| None | 24 (52%) | 18 (39%) | 13% | 1.61 | 0.21 | | | | |
| Not said | 2 (4%) | 0 (0%) | 4% | 10.4 | 0.15 | | | | |

Over half (52%) of the mothers in the adopter group reported that they do not find any of the critical times difficult to remember to wash their hands with soap compared to 40% of the mothers in the non-adopter group.

Across both groups, after defecation/after changing the child (adopters 24%; non-adopters 33%) was the most reported difficult critical time to remember to wash their hands with soap. This was followed by before meal prep (adopters 13%; non-adopters 17%) and before eating/feeding children (adopters 7%; non-adopters 9%). There were no significant differences in reports of which critical time was most difficult between non-adopters and adopters.

Perceived risk

There was no difference between adopters and non-adopters in the perception of their child's vulnerability to diarrhea (Table 13). The majority of adopters (78%) and non-adopters (76%) did not perceive their children as being susceptible to diarrhea in the coming 3 months. None of the non-adopters felt it was "very likely" that their child would get diarrhea and only 4% of adopters felt this was "very likely".

Table 13: Comparison of the adopters and non-adopters regarding perceived risk.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | | |
|--|--------------------|-------------------|------------------|---------------------------|----------------|--|--|--|--|
| How likely is it that your child will get diarrhea in the coming 3 months? | | | | | | | | | |
| Very likely | 2 (4%) | 0 (0%) | 4% | 10.4 | 0.15 | | | | |
| Somewhat likely | 8 (17%) | (24%) | -7% | 0.70 | 0.44 | | | | |
| Not likely at all | 36 (78%) | 35 (76%) | 2% | 1.12 | 0.8 | | | | |
| How serious would it | be if your child | got diarrhea? | | | | | | | |
| Very serious problem | 25 (54%) | 30 (65%) | -11% | 0.67 | 0.29 | | | | |
| Somewhat serious problem | 12 (26%) | 4 (9%) | 17% | 3.03 | 0.028 | | | | |
| Not serious at all | 8 (17%) | 12 (26%) | -9% | 0.62 | 0.31 | | | | |
| Do not know | I (2%) | 0 (0%) | 2% | 10.2 | 0.32 | | | | |
| How likely is it that y cal times each day? | our child will sut | ffer from diarrhe | a if you wash yo | our hands with soap at th | e three criti- | | | | |
| Very likely | 0 (0%) | 0 (0%) | 0% | - | 1.00 | | | | |
| Somewhat likely | 2 (4%) | 4 (9%) | -4% | 0.51 | 0.40 | | | | |
| Not likely at all | 43 (93%) | 42 (91%) | 2% | 1.33 | 0.70 | | | | |
| Do not know | I (2%) | 0 (0%) | 2% | 10.2 | 0.32 | | | | |

Across groups over half described their children getting diarrhea as "a very serious problem", with the proportion being higher in non-adopters (65%) than in adopters (54%). At the same time, a higher proportion of non-adopters (26%) perceived getting diarrhea as 'not being serious at all" compared to adopters (17%). There was no significant difference between adopters and non-adopters in this perceived severity of diarrhea. However, adopters were more likely (p = 0.028) than non-adopters to say it would be a 'somewhat' serious problem if their child got diarrhea. The perceived action efficacy of handwashing was high in both groups with 93% of adopters and 91% of non-adopters believing that handwashing with soap at critical times can prevent their child from suffering diarrhea.

Religion, culture and policy

No significant difference existed between the adopters and non-adopters regarding religion, culture and policy (Table 14). The majority of participants (adopters; 93%, non-adopters 91%) did not believe that it was God's will that determined when children got diarrhea and said there no cultural rules or taboos that prevented handwashing (adopters and non-adopters; 93%). In both groups, slightly more participants reported the absence of any community rules that promoted handwashing.

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | | |
|--|----------|--------------|------------|-------------------------|---------|--|--|--|--|
| Do you think that it's God will that children get diarrhea? | | | | | | | | | |
| Yes | 2 (4%) | (4%) | 0% | 1.00 | 1.00 | | | | |
| Sometimes/situation dependent | I (2%) | I (2%) | 0% | 1.00 | 1.00 | | | | |
| No | 43 (93%) | 42 (91%) | 2% | 1.33 | 0.70 | | | | |
| Won't say/doesn't know | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 | | | | |
| Are there any cultural rules or taboos against washing your hands with soap at the three critical times each day? | | | | | | | | | |
| Yes | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 | | | | |
| No | 43 (93%) | 43 (93%) | 0% | 1.00 | 1.00 | | | | |
| Don't know/won't say | 3 (7%) | 2 (4%) | 2% | 1.46 | 0.65 | | | | |
| Are there any community laws or rules in place that make it more likely that you wash your hands with soap at the three critical times each day? | | | | | | | | | |
| Yes | 20 (43%) | 22 (48%) | -4% | 0.85 | 0.68 | | | | |
| No | 26 (57%) | 23 (50%) | 7% | 1.27 | 0.53 | | | | |
| Don't know/won't say | 0 (0%) | I (2%) | -2% | 0.00 | 0.32 | | | | |

Table 14: Comparison of the adopters and non-adopters regarding religion, culture and policy

Universal motivators

The motivators for handwashing with soap did not vary between both groups (Table 15).

| If you continue to wash your hands with soap | Adopters agree | Non-adopters agree | Estimated relative risk | P-value |
|--|-------------------|-----------------------|-------------------------|---------|
| your children will grow up healthy | 45 (98%) | 46 (100%) | 0.10 | 0.32 |
| you will feel more comfortable after | 46 (100%) | 46 (100%) | - | 1.00 |
| your spouse will find you more attractive | 45 (98%) | 44 (96%) | 1.94 | 0.56 |
| your neighbors will approve you for doing this | 46 (100%) | 45 (98%) | - | 0.32 |
| your family will feel their best | 44 (96%) | 44 (96%) | 1.00 | 1.00 |
| you will get rid of disgusting things | 46 (100%) | 46 (100%) | - | 1.00 |
| it will be the right thing to do | 46 (100%) | 46 (100%) | - | 1.00 |
| your hands will be beautiful | 43 (93%) | 46 (100%) | 0.09 | 0.08 |
| The important people in the community will regard you as an exemplary community member | 46 (100%) | 46 (100%) | - | 1.00 |

Intervention touchpoints

The two groups reported having similar sources of hygiene information, daily social interactions and movement habits with no significant differences between the adopters and non-adopters (Table 16).

RANO WASH was the most reported common source of hygiene knowledge by adopters (50%) and nonadopters (48%). Other main sources of knowledge included other hygiene promoters (adopters 33%; nonadopters 33%), hospitals (adopters 28%; non-adopters 22%), media (adopters 22%; non-adopters 20%) and the commune/community (adopters 11%; non-adopters 22%).

Table 16: Comparison of the adopters and non-adopters regarding potential intervention touchpoints

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value | | | |
|--|----------|--------------|------------|-------------------------|---------|--|--|--|
| From where would you say you have learned most how to keep your household and household members hygienic and healthy in the last year? | | | | | | | | |
| RANO WASH | 23 (50%) | 22 (48%) | 2% | 1.08 | 0.84 | | | |

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value |
|--|------------------|-------------------|-----------------|-------------------------|---------|
| Hygiene promoters / other projects | 15 (33%) | 15 (33%) | 0% | 1.00 | 1.00 |
| Hospital | 13 (28%) | 10 (22%) | 7% | 1.37 | 0.47 |
| Media (radio, tv, display) | 10 (22%) | 9 (20%) | 2% | 1.13 | 0.80 |
| Commune/Community | 5 (11%) | 10 (22%) | -11% | 0.47 | 0.16 |
| School | 2 (4%) | I (2%) | 2% | 1.86 | 0.56 |
| Home | I (2%) | 4 (9%) | -7% | 0.25 | 0.17 |
| other meeting place | I (2%) | I (2%) | 0% | 1.00 | 1.00 |
| Don't remember/didn't say | 2 (4%) | 2 (4%) | 0% | 1.00 | 1.00 |
| What places in your v | illage do you go | to more than tw | vo times a weel | đ | |
| Market | 14 (30%) | 11 (24%) | 7% | 1.34 | 0.48 |
| Capital/Town/workplace | 13 (28%) | 11 (24%) | 4% | 1.22 | 0.64 |
| Fields/farm | 11 (24%) | 18 (39%) | -15% | 0.52 | 0.12 |
| Church | 7 (15%) | 5 (11%) | 4% | 1.41 | 0.54 |
| Commune/Community | 4 (9%) | 4 (9%) | 0% | 1.00 | 1.00 |
| School | 4 (9%) | 5 (11%) | -2% | 0.80 | 0.73 |
| Hospital | 2 (4%) | 0 | 4% | 10.4 | 0.15 |
| Taxi station | I (2%) | 0 | 2% | 10.2 | 0.32 |
| Nowhere | 5 (11%) | 4 (9%) | 2% | 1.25 | 0.73 |
| Elsewhere (water pump, out of town, funeral) | 0 | 3 (7%) | -7% | 0.00 | 0.08 |
| Other than your house | ehold members | , who do you tall | k to more than | two times a week? | |
| Neighbors/Community members | 21 (46%) | 22 (48%) | -2% | 0.92 | 0.83 |
| Colleagues/Friends/ Church mates | 11 (24%) | 20 (43%) | -20% | 0.44 | 0.047 |
| Relatives | 8 (17%) | (24%) | -7% | 0.70 | 0.44 |
| Hygiene promoters | 8 (17%) | 4 (9%) | 9% | 1.99 | 0.22 |

| Responses | Adopters | Non-adopters | Difference | Estimated relative risk | P-value |
|---|----------|--------------|------------|-------------------------|---------|
| School/school students | 3 (7%) | 5 (11%) | -4% | 0.60 | 0.46 |
| Village association/ Elders | 2 (4%) | 2 (4%) | 0% | 1.00 | 1.00 |
| In the city | 2 (4%) | 0 | 4% | 10.4 | 0.15 |
| Government | 0 | 3 (7%) | -7% | 0.00 | 0.08 |
| Healthcare workers | I (2%) | I (2%) | 0% | 1.00 | 1.00 |
| No one | 2 (4%) | 2 (4%) | 0% | 1.00 | 1.00 |
| What events do you regularly attend (e.g. religious service)? | | | | | |
| Religious services | 24 (52%) | 29 (63%) | -11% | 0.67 | 0.29 |
| Community meetings | 11 (24%) | 11 (24%) | 0% | 1.00 | 1.00 |
| Community health sensitizations | 4 (9%) | 6 (13%) | -4% | 0.66 | 0.50 |
| Market days | 4 (9%) | 4 (9%) | 0% | 1.00 | 1.00 |
| Sport events | 3 (7%) | 4 (9%) | -2% | 0.75 | 0.69 |
| Wedding/Funerals/ Family events | 3 (7%) | 7 (15%) | -9% | 0.42 | 0.18 |
| None | 4 (9%) | I (2%) | 7% | 3.28 | 0.17 |

The market (adopters 30%; non-adopters 24%), capital/town (adopters 28%; non-adopters 24%), and the farm/fields (adopters 24%; non-adopters 39%), were the most commonly reported places that both adopters and non-adopters frequented (> 2 times a week) during the week.

Religious services were the most regularly attended events with over half of the adopters (52%) and non-adopters (63%) reporting attendance. Other commonly attended events were community meetings and sensitizations, market days and sports events. When asked about who they frequently interacted with (> 2 times a week) other than household members, nearly half of the adopters and non-adopters cited community members/neighbors (adopters 46%; non-adopters 48%). Other commonly cited groups included colleagues/friends/church mates, relatives and hygiene promoters with non-adopters being more likely to report interacting with colleagues/friends/church mates (p = 0.047) than adopters.

Suggested recommendation section/next steps

- Accessibility, convenience and type of HWF, cues to remember and cost of HWF are still relevant factors promoting or hindering handwashing practices. These are currently being targeted by the RANO WASH strategy and should continue to be emphasized.
- Hygiene promoters, media, health centre and the community are reported as the main sources of hygiene knowledge by both groups (Table 16). This aligns with the current RANO-WASH multi-level BC strategy. These avenues should be maintained to promote hygiene. The program could also consider adding healthcare centers for hygiene promotion to reinforce/repeat these messages such as media and health centre.
- RANO/WASH program could also explore using additional intervention touchpoints such as religious places and the field/farms in addition to market days to increase coverage.
- Across both adopters and non-adopters, there was a low perceived risk in relation to both vulnerability and severity of diarrhea (Table 13). The program should address ways to improve this perceived risk.
- There is mixed opinion among both the adopters and non-adopters around the existence of community norms that drive handwashing (Table 14). However, the study finds that the social norms for handwashing is strong (Table 10) for both groups and so this could be leveraged to advocate for the creation of explicit community rules/laws in place that encourage handwashing.
- There was a high level of homogeneity between the adopters and non-adopters which could suggest that the existing RANO WASH strategy might not need to be tailored differently between the different groups. However more in depth/qualitative research is needed for further exploration of the various determinants to tease out any subtle differences between the groups.

Limitations

- Large reporting bias (social-desirability) particularly in a population that was highly exposed to hygiene promotion activities due to self-reporting nature of data collection.
- Barrier analysis might not be most appropriate for places with high homogeneity because it is powered to detect large differences in behavioral determinants.
- Some sample sizes are very small so fisher's exact test more appropriate than chi-square test.
- Closed answer (yes/no) approach is not sufficient to explore behavioral determinants or assess handwashing behaviors and a mixture of qualitative and quantitative methods might be more appropriate.

Appendix

1. Barrier analysis approach and guestionnaire