

Effects of Contextualized versus Non-Contextualized Interventions to Improve Hand Washing, Sanitation, and Health in Rural Tanzania: Results from a Cluster-Randomized Controlled Trial

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Introduction and aim of the study

Nearly 90% of diarrhea-related mortalities are the result of unsafe drinking water, poor sanitation, and insufficient hygiene. Although “Water, Sanitation, and Hygiene” (WASH) interventions may significantly reduce the risk of diarrheal disease, it is currently unclear which interventions are the most effective. The aim of this study was to evaluate the effectiveness of supplementing a standard package of ‘Water, Sanitation, and Hygiene’ (WASH) interventions with various behavior change interventions in rural Tanzania. In one group, information was first collected on the factors that trigger behavior change in that particular population, and then the supplementary intervention was adjusted accordingly (‘contextualized supplementary intervention’). A second group received a pre-defined supplementary intervention, only focusing on one specific factor of behavior change (‘non-contextualized supplementary intervention’). A third group received only the standard package of WASH interventions, consisting of infrastructure improvements and a set of standard educational sessions.

For detailed information see protocol paper at [10.3390/ijerph16142529](https://doi.org/10.3390/ijerph16142529) or [Appendix 1](#) (1).

Methods

Registration & protocol paper

This study was registered at Clinicaltrials.gov ([NCT03709368](https://clinicaltrials.gov/ct2/show/study/NCT03709368)) and the protocol was published prior to commencing the study ([10.3390/ijerph16142529](https://doi.org/10.3390/ijerph16142529)) (1).

Ethics

Ethical approval was obtained at the Social and Societal Ethics committee (KU Leuven, Belgium), and at the National Institute for Medical Research (Dar es Salaam, Tanzania). A research permit was obtained at the Tanzania Commission for Science and Technology. The trial progress was overseen by the National Institute for Medical Research and the Commission for Science and Technology. All subjects were required to provide written informed consent (see Table S9 of the protocol paper (1)) or to sign with a thumb stamp.

Design

This study is a prospective, parallel group, single blinded, cluster randomized controlled trial (cRCT) with a 2-year implementation period (April 2018-May 2020) and a 12 month follow-up (May 2021). It was a collaboration between Belgian Red Cross (BRC), Tanzania Red Cross Society (TRCS), and the Environmental and Occupational Health Department of Muhimbili University of Health and Allied Sciences (MUHAS).

Participants and setting

Participants were recruited from 27 sub-villages, embedded in 7 villages and 3 wards, in Buhigwe district, Kigoma region, Tanzania (Fig. 1). Four of the sub-villages had a school. Formative research showed that an estimated 4782 households live in this area. Based on sample size calculations (See protocol paper p. 4) (1), a random sample of 1500 households was planned to be included in the study (i.e. 500 households per cohort, see Table 1 in protocol paper). Cluster randomization was used to assign households to one of the three cohorts. Households from the same

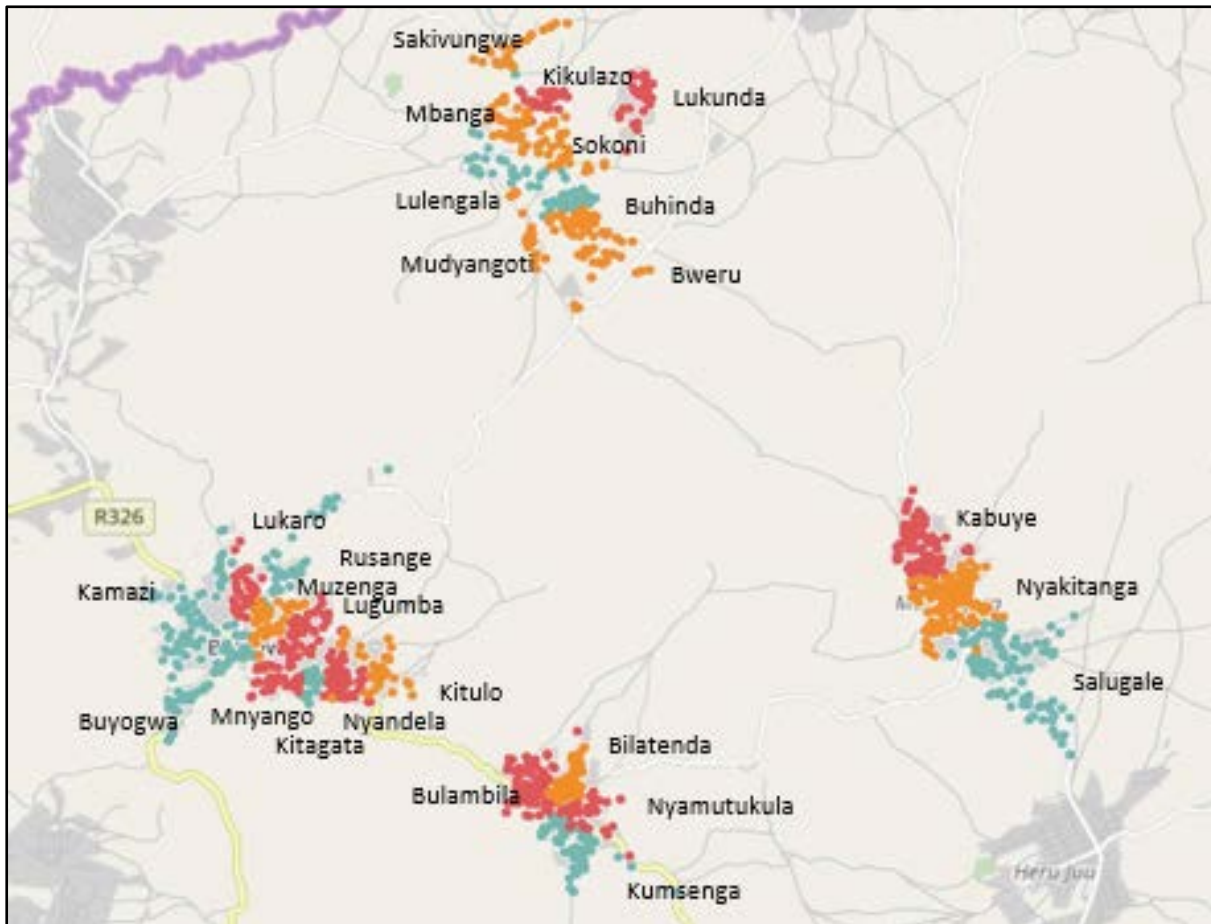


Figure 1. Group allocation. 27 sub-villages from 7 villages were allocated to one of the three cohorts: **Control (orange)**, **Non-contextualized (red)**, or **Contextualized (green)**.

sub-village were assigned to the same treatment arm (Fig. 1). The sub-villages were stratified according to size and whether or not the sub-village had a school. Following allocation, a representative sample was selected in each sub-village. A household was defined as one or more people who occupy a housing unit. Subjects were excluded as a respondent to the questionnaires if they were below the age of 18 years old at the time of the study. There were no other eligibility criteria.

Interventions

The intervention was subdivided into a basic intervention, which provides all cohorts equally, and add-on household visits, which differed from one cohort to another. All interventions were delivered by TRCS volunteers, who received formal training prior to implementation. Participants and TRCS volunteers were not blinded to the intervention status.

Basic intervention

Hardware interventions were aimed at improving the infrastructure: An existing water gravity flow scheme was rehabilitated and extended, 350 tippy taps and 350 pans for pour flush latrines were distributed, and sanitation blocks were built in four schools. In addition, community sessions were provided to each of the sub-villages (n = 27), teaching participants how to build a tippy tap, how to build an improved latrine, and how to make liquid soap.

Software interventions involved the improvement of knowledge, skills, and attitude. In order to reach this goal, Community-Led Total Sanitation (**CLTS**), Participatory Hygiene and Sanitation Transformation (**PHAST**), and School Water, Sanitation and Hygiene (**SWASH**) clubs were used (Table 1). More detailed descriptions of these interventions are available in the protocol paper (1).

Add-on interventions

All cohorts received an add-on intervention on top of the basic intervention package. The content of this add-on intervention differed between the contextualized and the non-contextualized intervention. An overview of when the interventions took place (according to the protocol and in reality) is available in Figure 2.

Contextualized intervention

A contextualized intervention is defined as an intervention that is **adapted to the local context** by collecting data at baseline and using this data to fit the intervention to the specific population's needs, as prescribed by the 'Risks, Attitudes, Norms, Abilities, Self-regulation' (**RANAS**) model (www.ranamosler.com). More information on the contextualized intervention is provided in the protocol paper (1). The contextualized intervention cohort received the basic intervention and 8 household visits of 20–40 min each, at a frequency of around one visit every two months.

Non-contextualized intervention

A non-contextualized intervention is a general 'Water, Sanitation, and Hygiene' (WASH) intervention that is not fine-tuned to meet the specific needs of the context at hand, and is only based on the factor 'Norms', as a trigger of behaviour change. The non-contextualized intervention cohort received the basic intervention and 8 household visits of 20–40 min each, at a frequency of around one visit every two months. The content of these visits involved a general WASH intervention that was

not tailored to the context at hand. More information on the non-contextualized intervention is provided in the protocol paper (1).

Control

The control cohort received the basic intervention and one 'placebo' household visit of 20–40 min. During this visit, a placebo poster was distributed focusing on malaria nets.

	Ctx HH visits (RANAS)	Non-cx HH visits (Norms)	Control
Hardware			
- School sanitation blocks			
- School hygiene clubs	Mulera school	Songambebe & Kabuye school	Nyamugali school
- Menstrual hygiene			
- Building a tippy tap	1 session/CG	1 session/CG	1 session/CG
- Building a sanplat	1 session/CG	1 session/CG	1 session/CG
- Liquid soap making	1 session	1 session	1 session
CLTS			
- CLTS	12 sessions/CG	12 sessions/CG	12 sessions/CG
- CLTS HW	1 session/CG	1 session/CG	1 session/CG
PHAST			
	17 sessions/CG	17 sessions/CG	17 sessions/CG
Contextualized	8 HH visits	-	-
Non-contextualized	-	HH visits	-
Control	-	-	First aid poster

Table 1. Overview of the number of sessions within each cohort. CG = community groups; CLTS = Community-led total sanitation; HW = hand-washing; PHAST = Participatory Hygiene and Sanitation Transformation; HH = household

Outcomes

Demographic data were gathered, including the Global Positioning System (GPS) location of the household, village and sub-village, name, age, gender, and education level of the household head. These demographics were crucial to verify that the correct households—i.e., the households that were randomly selected in R—are targeted at each of the intervention and data collection moments. In addition, socio-economic data were collected, i.e., age and gender of the respondent, main source of income, etc. The questionnaire is available in Table S7 of the protocol (1).

Primary outcome

The primary outcome of interest was the percentage of households **washing hands**, which was obtained by means of a self-developed WASH questionnaire, which involves both **multiple-choice questions** and **spot checks** (see Table S4 of the study protocol (1)). Spot checks were used to determine the hardware situation in the household. Assessors checked whether there is a hand-washing station available, and if so, what type of hand-washing station (i.e., running water or a bucket). Spot checks were also used to determine the presence of water and/or soap at the time of the measurement. By means of the questionnaire, assessors probed when people normally wash their hands (i.e., before eating, after using the latrine, etc.), and what they use for hand-washing (i.e., water and/or soap).

A household was defined to have correct hand-washing behaviour when they: (1) have a hand-washing station available (spot check), (2) have water and soap available at the hand-washing station (spot check), and (3) indicate that they wash their hands with water and soap (questionnaire). All items must be present. The analysis was repeated for each of the critical times: after defecation or using the latrine, before cooking or handling food, before eating, and before feeding a child.

Secondary outcomes

WASH infrastructure was assessed using a self-developed **questionnaire** and **spot checks** (see Tables S4 and S5 of the protocol (1)). Both hand-washing (see above) and latrine infrastructure were judged. The quality of the latrine infrastructure was scored based on the type of facility (i.e., did it have a roof, a door, etc.) (spot check), the cleanliness (spot check), and the number of people who use the latrine (questionnaire). Information about whether or not the pit had ever been emptied, and how was also gathered (questionnaire), allowing for the measurement of Sustainable Development Goal (SDG) 6 according to the WHO/UNICEF JMP (<https://washdata.org>) tools.

Latrine use was assessed by means of a self-developed WASH questionnaire, involving both **spot checks** (see above) and **multiple choice questions** (see Table S5 of the protocol (1)). By means of the questionnaire, behavioural information about the past two weeks was gathered. These questions probe whether people (1) normally use a latrine when defecating at home; (2) normally use a latrine when defecating elsewhere (i.e., when at work in the field); (3) sometimes defecate in the

open when at home; (4) sometimes defecate in the open when they are elsewhere; (5) clean the latrine and how often.

A household was defined to have correct latrine use behaviour when: (1) they have a latrine available (spot check), (2) the latrine minimally includes walls, a roof, a door or curtain, and a slab or concrete floor (spot check), (3) the latrine is clean (spot check), (4) they indicate to normally use the latrine when defecating at home (questionnaire), and (5) they indicate to not defecate in the open when they are at home (questionnaire). A similar analysis was performed for latrine use behaviour when people are elsewhere.

Health was assessed using a self-developed health **questionnaire** (see Table S6 of the protocol (1)). The questionnaire was used to probe the prevalence rates of diarrhea, vomiting, limitations of daily activities, the need for medical care due to diarrheal illness in the past two weeks, and hospitalization due to diarrheal illness in the past three months. The WHO definition was used: 'Diarrhea is defined as the passage of three or more loose or liquid stools per day or more frequent passage than is normal for the individual. Frequent passing of formed stools is not diarrhea, nor is the passing of loose, pasty stools by breastfed babies. Prevalence was subdivided into people below and above 5 years of age.

Quality of Life was assessed using the EQ-5D-3L, a validated **questionnaire** examining 5 dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (see Figure S1 of the protocol (1)). All items were scored on a 3-point Likert scale. Results of the EQ-5D-3L were used to calculate the quality-adjusted life-year (QALY), a generic measure of disease burden. The initially-planned incremental cost per QALY calculation was not performed due to the missing/unavailable (direct) cost data of the set of interventions.

Timeline of interventions and outcome assessments

Outcome assessments were initially planned at baseline (May 2018), after one year of intervention (Midline - May 2019), after two years of intervention (Endline - May 2020), and 1 year after the intervention had been terminated (Follow-up - May 2021). However, due to COVID-19, the third assessment on May 2020 did not take place. Hardware and CLTS interventions were executed according to our protocol, except for the CLTS-handwashing component, which took place after Midline. PHAST interventions were initiated just before Midline and were ended at Endline. Eight

household visits (cfr. (non-) contextualized interventions) were organised. According to the protocol a final visit (visit 9) was planned, however this visit was cancelled due to the COVID-19 pandemic (Fig. 2).

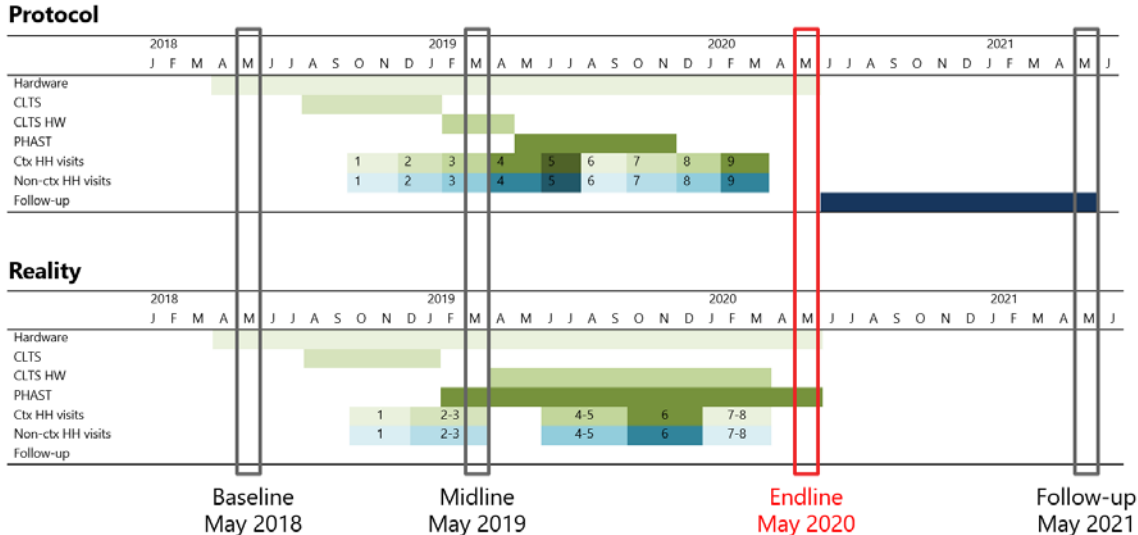


Figure 2. Timeline of interventions and assessments.

Statistical analysis

Baseline demographic characteristics and primary/secondary outcome measures (via generalized linear mixed models) were analysed according to our protocol. The a-priori planned sensitivity analysis to compare effectiveness of the interventions in low compliance versus high compliance households could not be executed due to lack of data. Data were analysed using R studio and R Markdown following the intention-to-treat principle.

Primary and secondary outcomes were analysed using **generalized linear mixed-effects models** including a Time (Baseline (T1) vs Midline (T2) and Baseline (T1) vs Follow-up (T3)) by Group (Model 1: Control vs Non-contextualized, Model 2: Control vs Contextualized, Model 3: Contextualized vs Non-contextualized) interaction, with intercepts varying among sub-villages and households within sub-villages. By introducing sub-village and household as random intercepts, we take into account nesting of data within households (given that households are measured repeatedly over time) and households being nested within sub-villages. The Holm-Bonferroni method was used to adjust for multiple comparisons. Given that there were 3 models per outcome, this implies that the smallest p-value was considered statistically

significant if it was smaller than $0.05/3$, the middle p-value was considered statistically significant if smaller than $0.05/2$, and the largest if smaller than 0.05 .

As opposed to what was described in the study protocol, we did not perform sensitivity analyses comparing the effectiveness of the interventions in low-compliance versus high-compliance households. In addition, investigators who were involved in data analysis were not blinded to group allocation.

Results

Participants

Data were obtained from 1517 households at baseline (509 control, 502 non-contextualized, 506 contextualized), 1451 households at midline, and 1461 households at follow-up. For 1391 households all data points were available, while 110 households were measured at only two time points and 48 households at only one time point. Table 2 illustrates that demographic variables at baseline were equally distributed over the groups, which is important given that these variables could also affect the outcomes in which we are interested and thus need to be similar in all the groups that we wish to compare.

Demographics

	Control HHV (N=509)	Non-ctx HHVs (Norms) (N=502)	Ctx HHVs (RANAS) (N=506)	Overall (N=1517)
Age respondent				
Mean (SD)	43.4 (17.6)	41.7 (16.8)	43.5 (17.6)	42.9 (17.3)
Median [Min, Max]	40.0 [18.0, 102]	39.0 [18.0, 90.0]	40.0 [18.0, 104]	40.0 [18.0, 104]
Sex HHH				
Female	89 (17.5%)	68 (13.5%)	89 (17.6%)	246 (16.2%)
Male	420 (82.5%)	434 (86.5%)	417 (82.4%)	1271 (83.8%)
Education level HHH				
1_none	179 (35.2%)	154 (30.7%)	170 (33.6%)	503 (33.2%)
2_adult	15 (2.9%)	16 (3.2%)	24 (4.7%)	55 (3.6%)
3_primary	297 (58.3%)	311 (62.0%)	290 (57.3%)	898 (59.2%)
4_secon_ord	17 (3.3%)	12 (2.4%)	17 (3.4%)	46 (3.0%)
6_ter_voc	1 (0.2%)	6 (1.2%)	1 (0.2%)	8 (0.5%)
5_secon_adv	0 (0%)	1 (0.2%)	0 (0%)	1 (0.1%)
7_ter_undergra	0 (0%)	2 (0.4%)	4 (0.8%)	6 (0.4%)
Monthly income				
1_<30	321 (63.1%)	299 (59.6%)	311 (61.5%)	931 (61.4%)
2_30-40	90 (17.7%)	87 (17.3%)	68 (13.4%)	245 (16.2%)
3_40-100	22 (4.3%)	39 (7.8%)	24 (4.7%)	85 (5.6%)
4_>100	8 (1.6%)	14 (2.8%)	11 (2.2%)	33 (2.2%)
NA	68 (13.4%)	63 (12.5%)	92 (18.2%)	223 (14.7%)

Table 2. Demographics at baseline. HHH = head household; adult = adult education; secon_ord = secondary – ordinary; secon_adv = secondary – advanced; ter_voc = tertiary – vocational; ter_undergra = tertiary – undergraduate.

Primary outcome

A narrative summary of the results is provided below, and the statistical analyses are available in [Appendix 2](#).

Washing hands

A household should meet the following criteria in order to comply: the presence of proper facilities (hand washing station, water, and soap) and reply "yes" to "Do you normally wash hands after defecation/before cooking/...with water and soap?"

Generally, the following conclusions can be formulated (see Fig. 2-5, and Table 3-6):

- Baseline (prior to the intervention): hand-washing behaviour was rather **low**: around 5% (before cooking or feeding a child) to 30% (after using latrine or before eating) of the households indicated washing their hands.
- Midline (1 year after the start of the intervention): hand-washing behaviour increased at some time points (before cooking or feeding a child) while remaining stable at others (after defecation or before eating), and there were no differences between interventions.
- Follow-up (3 years after the start of the intervention/1 year after termination): the two groups with **add-on interventions** (i.e., basic intervention with 8 contextualized or non-contextualized household visits) **benefited** compared to the control group (i.e., basic intervention with 1 placebo household visit). The **contextualized** and the **non-contextualized** intervention showed no differences in the change in hand-washing behaviour over time. The percentage of households washing their hands meaningfully increased after the add-on interventions (from baseline) (1) after defecation (from 25% to 40%), (2) before cooking (from 10% to 20%), (3) before eating (from 25% to 40%).

	Baseline	Midline	Follow-up
Control	141	134	134
Contextualized	131	152	193
Non-contextualized	116	128	219

Table 3. Number of households washing hands after defecation (see also Figure 2 and Appendix 2).

	Baseline	Midline	Follow-up
Control	39	72	50
Contextualized	46	94	95
Non-contextualized	39	77	108

Table 4. Number of households washing hands before cooking (see also Figure 3 and Appendix 2).

	Baseline	Midline	Follow-up
Control	134	134	130
Contextualized	136	153	189
Non-contextualized	115	126	210

Table 5. Number of households washing hands before eating (see also Figure 4 and Appendix 2).

	Baseline	Midline	Follow-up
Control	13	36	18
Contextualized	27	40	14
Non-contextualized	21	44	32

Table 6. Number of households washing hands before feeding a child (see also Figure 5 and Appendix 2).

Washing hands after defecation/using the latrine

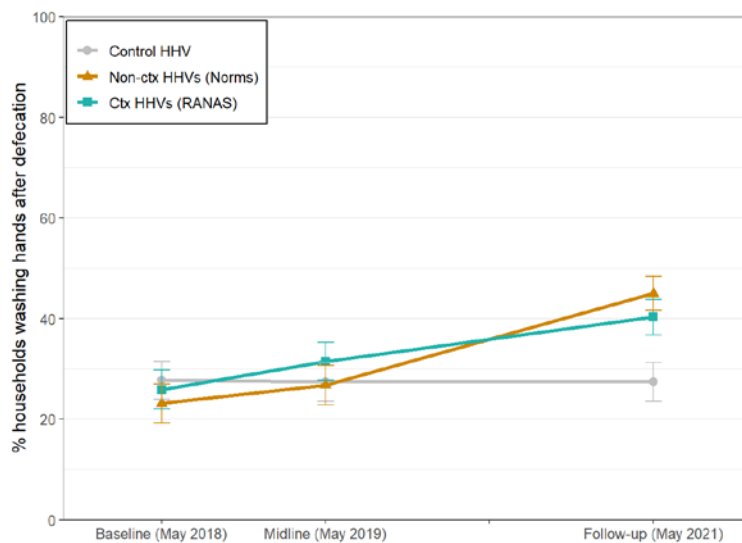


Figure 2. Means \pm SE.

Hand-washing behaviour did not significantly increase from baseline to midline ($p=0.937$). At follow-up, the groups that received an add-on intervention benefited compared to the control group (i.e., basic intervention without add-ons) ($p<0.001$). There was no apparent benefit of the contextualized intervention over the non-contextualized intervention ($p=0.062$).

Washing hands before cooking

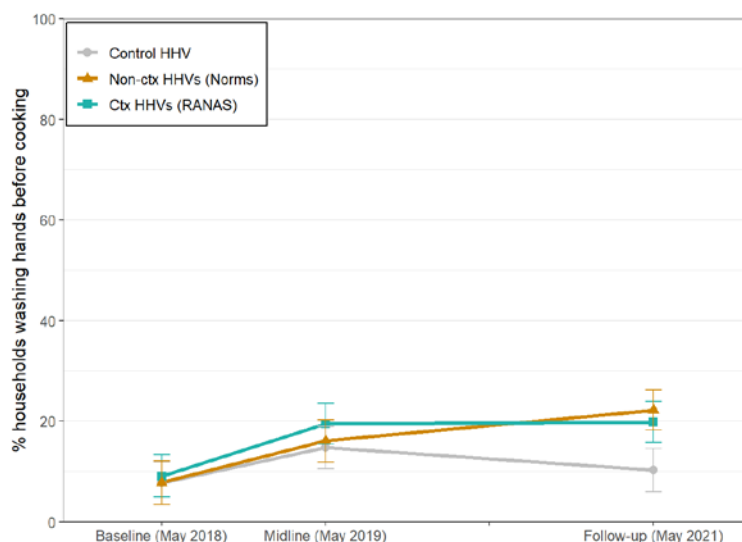


Figure 3. Means \pm SE.

Overall, hand-washing behaviour increased from baseline to midline ($p<0.001$) (without differences between groups). At follow-up, the non-contextualized group showed the largest increase from baseline (statistically different from the control group ($p=0.002$), but not from the contextualized group ($p=0.251$)).

Washing hands before eating

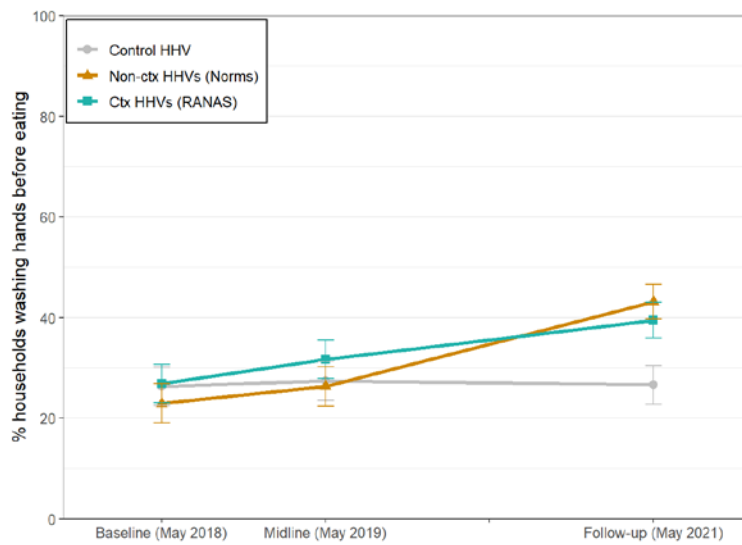


Figure 4. Means \pm SE.

Hand-washing behaviour did not significantly increase from baseline to midline ($p=0.671$). At follow-up, the groups that received the add-on intervention benefited compared to the control group (i.e., basic intervention without add-ons) (contextualized vs. control: $p=0.003$; non-contextualized vs. control: $p<0.001$). The change from baseline to follow-up was (borderline) statistically different between the contextualized and non-contextualized group ($p=0.046$).

Washing hands before feeding a child

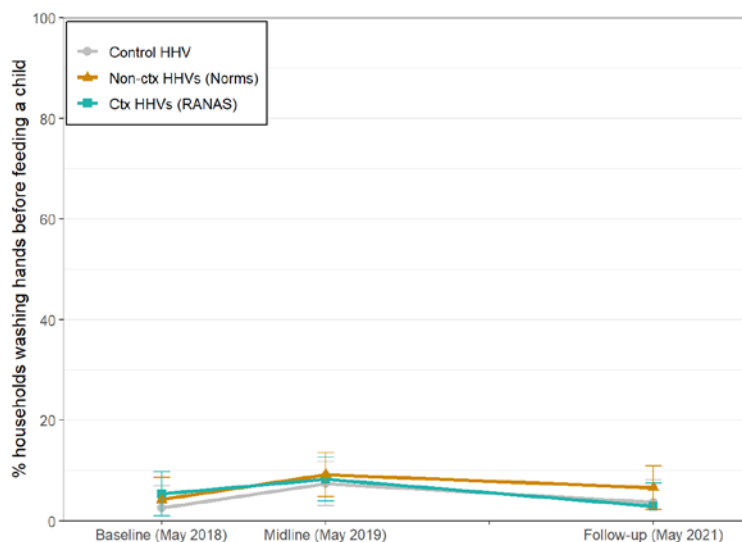


Figure 5. Means \pm SE.

Hand-washing behaviour before feeding a child was generally low ($< 10\%$) and increased from baseline to midline ($p<0.001$), but not from baseline to follow-up ($p=0.295$).

Secondary outcomes

A narrative summary of the results is provided below. Absolute numbers of households performing the assessed behaviour (see 'Overview table') and results of statistical analyses are available in [Appendix 2](#). The overview tables include variables 'Time' (1=baseline; 2=midline; 3=follow-up), a binary variable indicating whether the outcome was present (0=not present; 1=present), 'n' (i.e., frequency, or the number of households in which the outcome was (not) present), and 'prop' (i.e., the % of households in which the outcome was present).

WASH infrastructure

Generally, the following conclusions can be formulated (see Fig. 6-7):

- Baseline (prior to the intervention): the presence of clean and improved latrines at home was rather **low** (around 5%).
- Midline (1 year after the start of the intervention): the percentage of households having a clean, improved latrine increased significantly (by factor 3), and there were no differences between groups.
- Follow-up (3 years after the start of the intervention/1 year after termination): the % of households with a clean improved latrine was numerically higher in the two groups with **add-on interventions** (around 60%) (i.e., basic intervention with 9 contextualized or non-contextualized household visits) compared to the control group (45%) (i.e., basic intervention with 1 placebo household visit), but the change over time (compared to baseline) was not found to be statistically significant.

Households owning an *improved* latrine

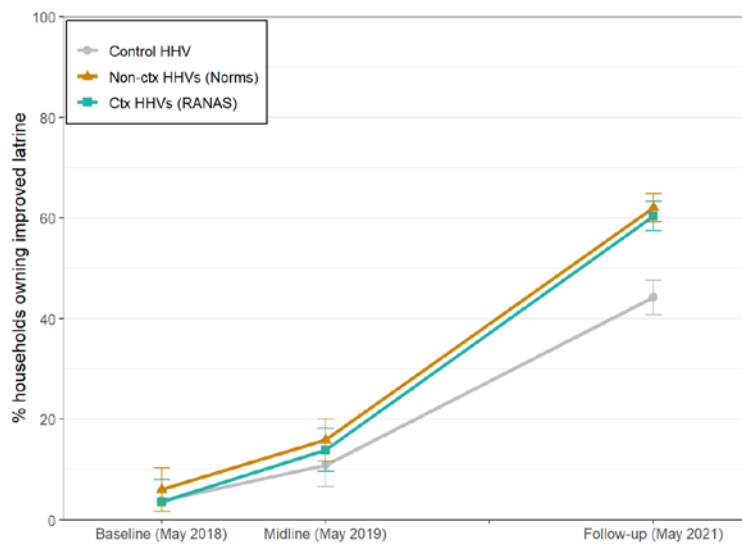


Figure 6. Means \pm SE.

A household should meet the following criteria in order to comply: latrine with pit, slab, walls, roof, door/curtain. Although >90% of the households owned a latrine at baseline, the percentage owning an *improved* latrine was low.

The percentage of households owning an improved latrine significantly increased from baseline (around 5%) to midline (around 15%, $p < 0.001$) and follow-up (around 50%, $p < 0.001$). The increase from baseline to midline did not differ significantly between groups (ctx vs. non-ctx: $p = 0.330$; ctx vs. control: $p = 0.310$; non-ctx vs. control: $p = 0.888$). From baseline to follow-up, the contextualized group increased more than the control group ($p = 0.006$).

Households owning a *clean* improved latrine

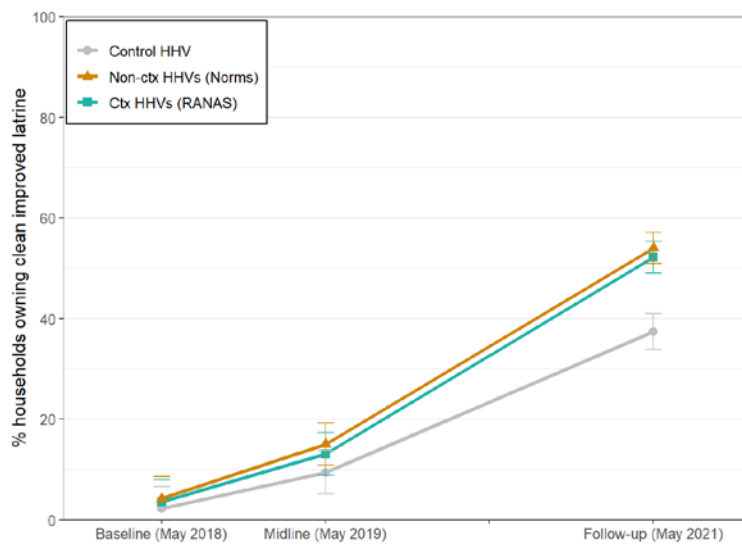


Figure 7. Means \pm SE.

A household should meet the following criteria in order to comply: no faeces on walls or floor, no bad smell in latrine, not many flies in an improved latrine.

The percentage of households owning a clean improved latrine significantly increased from baseline (< 5%) to midline (around 10-15%, $p < 0.001$) and follow-up (around 45%, $p < 0.001$), and did not differ significantly between groups (baseline to follow-up: ctx vs. non-ctx: $p = 0.846$; ctx vs. control: $p = 0.435$; non-ctx vs. control: $p = 0.579$).

Latrine use

Generally, the following conclusions can be formulated (see Fig. 8-14):

- The % of households **using the latrine at home** (and not defecating in the open) was high (90% or higher) at all time points (incl. baseline). At midline, latrine use significantly increased (to around 95%). At follow-up, levels returned to baseline. The interventions did not have a clear (long-term) impact on this behaviour.
- When being **elsewhere** (not at home), about half of the households indicated using the latrine (rather than defecating in the open). The interventions did not have a clear (long-term) impact on this behaviour.

Using the latrine at home

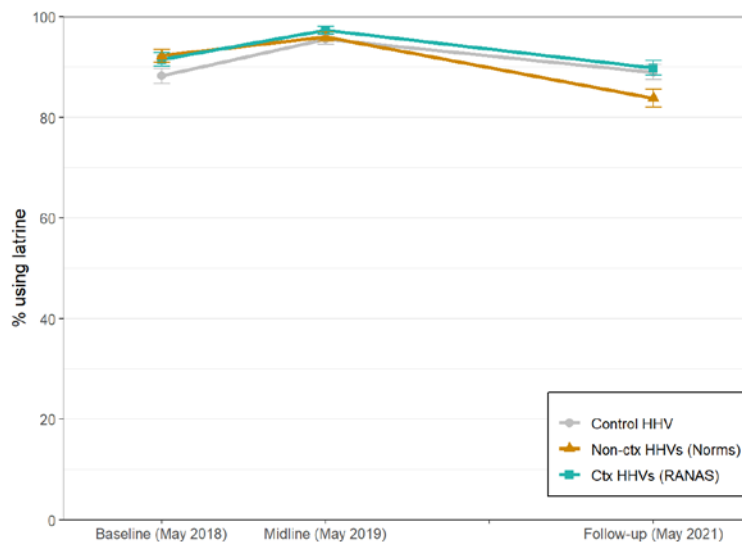


Figure 8. Means \pm SE.

A household should reply "yes" to the question "In the past 2 weeks, did you normally use the latrine when defecating at home?" in order to comply.

Latrine use at home was high at baseline (around 90%) and increased significantly from baseline to midline (to around 95%) in all groups ($p < 0.001$). However, this outcome was decreased again at follow-up ($< 90\%$) (no stat. sign difference between baseline and follow-up, $p = 0.230$).

Owning a clean improved latrine and using it at home

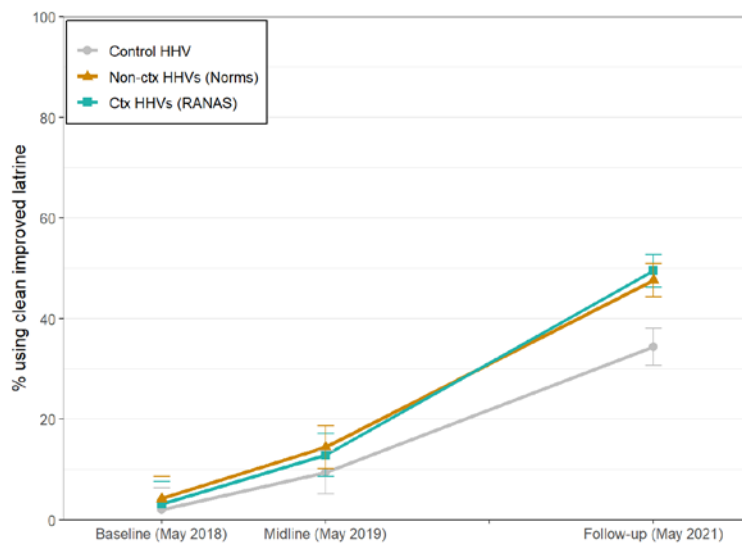


Figure 9. Means \pm SE.

A household should have a clean improved latrine at home and reply "yes" to the question "In the past 2 weeks, did you normally use the latrine when defecating at home?" in order to comply.

Given that 90% or more of the households normally use the latrine when at home, this outcome follows largely the same pattern as 'owning a clean improved latrine'.

The percentage of households owning an improved latrine and using it when at home significantly increased from baseline ($< 5\%$) to midline (around 10-15%, $p < 0.001$) and follow-up (around 35-50%, $p < 0.001$), and did not differ significantly between groups (ctx vs. non-ctx: $p = 0.306$; ctx vs. control: $p = 0.449$; non-ctx vs. control: $p = 0.865$).

Not defecating in the open when at home

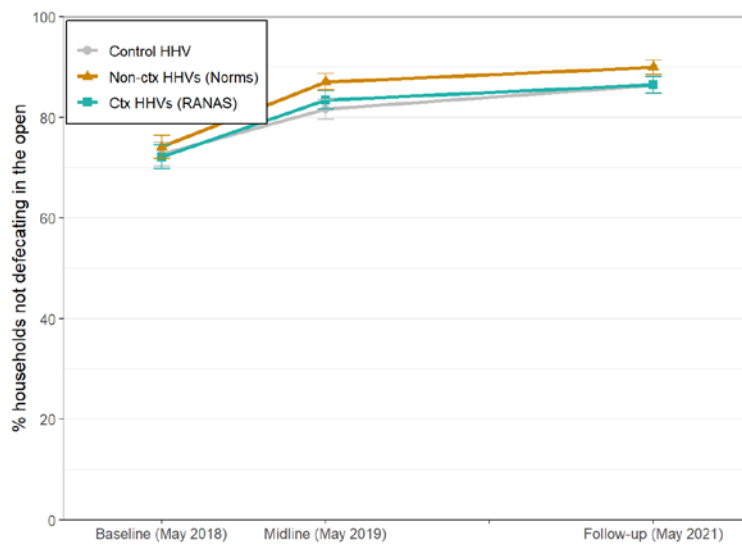


Figure 10. Means \pm SE.

A household should reply "no" to the question "In the past two weeks, when you were at home, did you sometimes defecate in the open?" in order to comply.

The percentage of households not defecating in the open when at home significantly increased from baseline to midline ($p=0.005$) and follow-up ($p<0.001$), with no difference between groups (baseline to follow-up: ctx vs. non-ctx: $p=0.383$; ctx vs. control: $p=0.480$; non-ctx vs. control: $p=0.122$).

Owning a clean improved latrine and not defecating in the open when at home

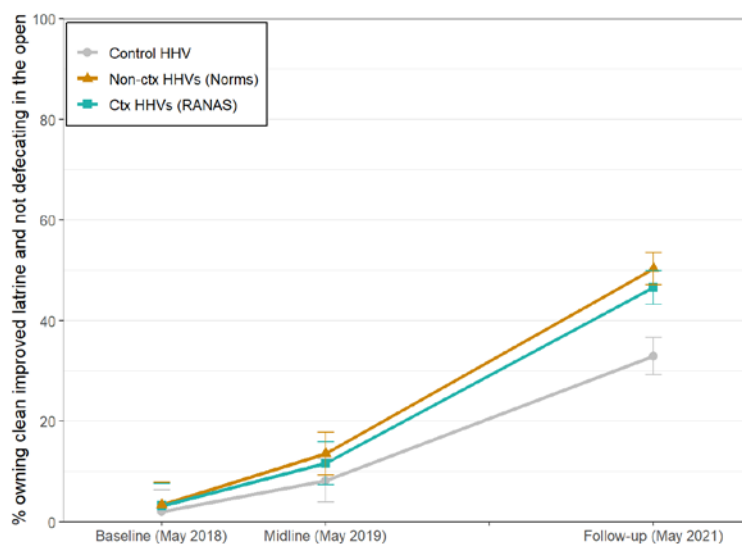


Figure 11. Means \pm SE.

A household should have a clean improved latrine at home and reply "no" to the question "In the past two weeks, when you were at home, did you sometimes defecate in the open?" in order to comply.

The percentage of households owning a clean improved latrine and not defecating in the open when at home significantly increased from baseline to midline ($p < 0.001$) and follow-up ($p < 0.001$), with no significant differences between groups over time (baseline to follow-up: ctx vs. non-ctx: $p = 0.756$; ctx vs. control: $p = 0.467$; non-ctx vs. control: $p = 0.352$).

Owning a clean improved latrine, using it when at home, and not defecating in the open when at home

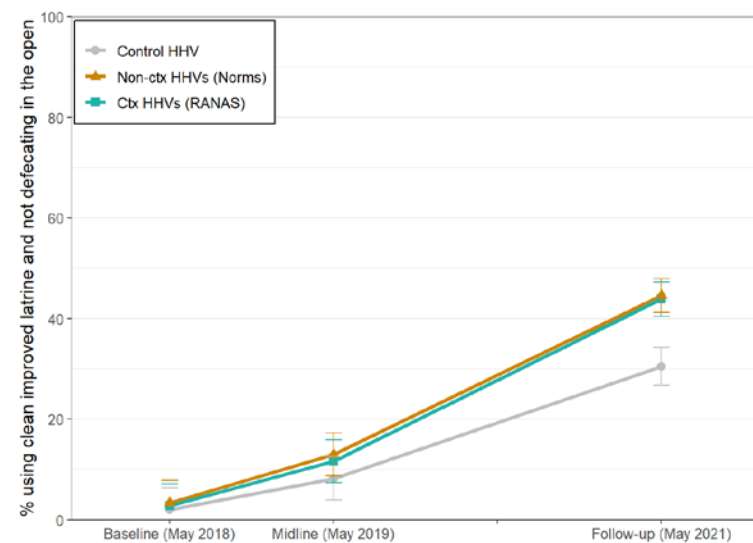


Figure 12. Means \pm SE.

A household should have a clean improved latrine at home, reply "yes" to the question "In the past 2 weeks, did you normally use the latrine when defecating at home?", and reply "no" to the question "In the past two weeks, when you were at home, did you sometimes defecate in the open?" in order to comply.

The percentage of households owning a clean improved latrine, normally using the latrine when at home, and not defecating in the open when at home significantly increased from baseline to midline ($p < 0.001$) and follow-up ($p < 0.001$), with no significant differences between groups over time (baseline to follow-up: ctx vs. non-ctx: $p = 0.686$; ctx vs. control: $p = 0.374$; non-ctx vs. control: $p = 0.617$).

Using the latrine when elsewhere (not at home)

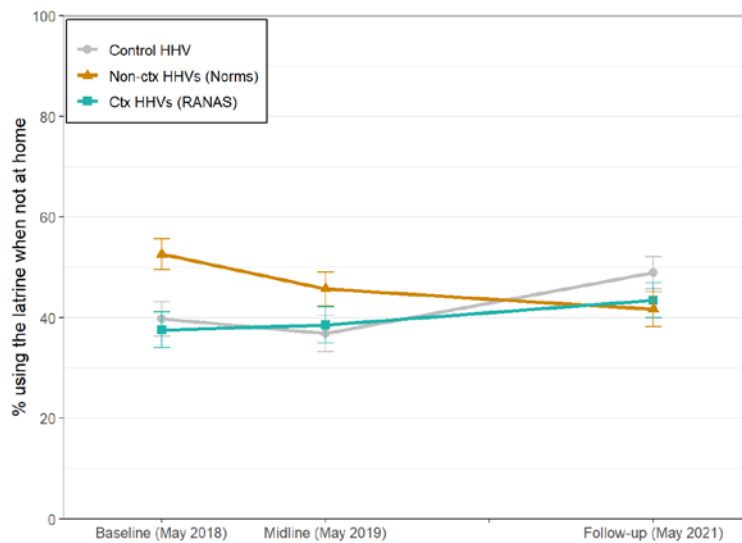


Figure 13. Means \pm SE.

Regarding the question "In the past 2 weeks, did you normally use the latrine when defecating elsewhere (work, school, store, bar, ...)?", the non-contextualized group showed a general decrease in behaviour, whereas the control and contextualized group experience an overall increase (baseline to follow-up: ctx vs. non-ctx: $p < 0.001$; ctx vs. control: $p = 0.477$; non-ctx vs. control: $p < 0.001$).

Not defecating in the open when elsewhere (not at home)

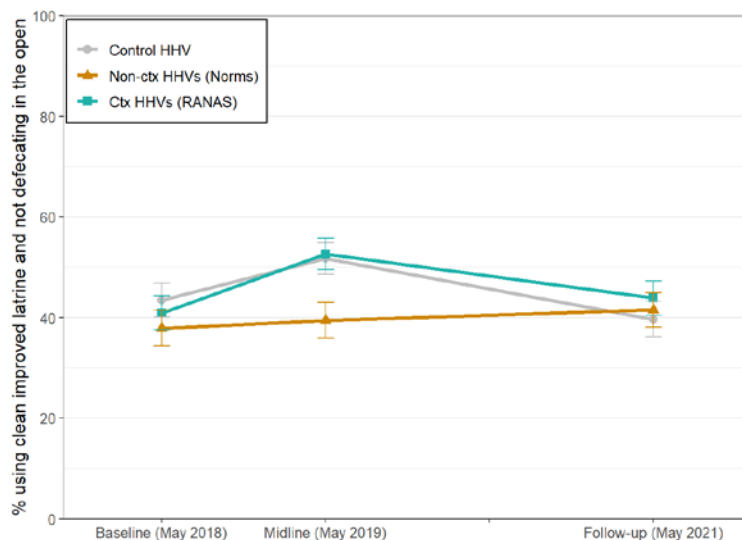


Figure 14. Means \pm SE.

The behaviour related to the question "In the past two weeks, did you sometimes defecate in the open when you were elsewhere (work, school, store, bar, ...)?" increased from baseline to midline ($p = 0.008$), with no significant differences between groups (ctx vs. non-ctx: $p = 0.031$ (not stat. sign. at alpha level of 0.05/3); ctx vs. control: $p = 0.130$; non-ctx vs. control: $p = 0.095$). At follow-up, behaviour returned to baseline levels (baseline to follow-up: $p = 0.236$).

Health

Although there was a numerical decrease in diarrhea prevalence over time in all groups, there was no statistical evidence for an effect of any of the interventions on diarrhea (Fig 15-16; but see Methodological strengths and limitations, p. 23). The same trends were observed for other health-related outcomes (vomiting, seeking medical aid, limitation in activities, hospitalization) (Appendix 2).

Children under 5 years having diarrhea

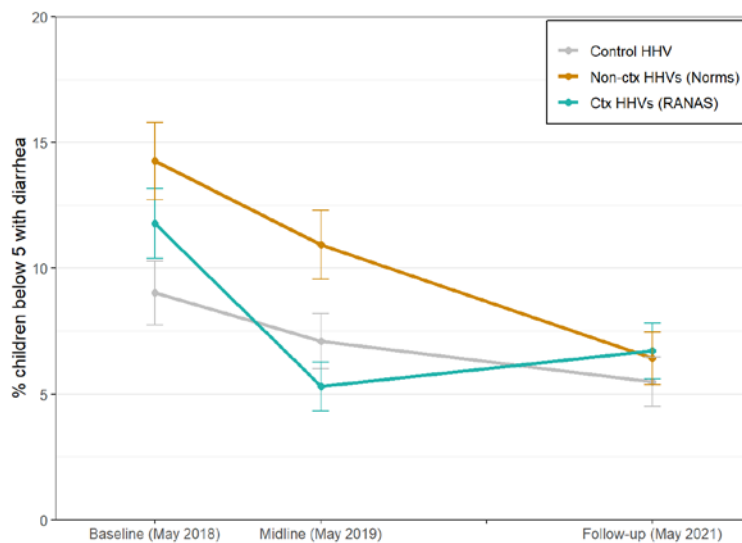


Figure 15. Means ± SE.

The percentage of children with diarrhea during the 2 weeks prior to assessment declined over time (without reaching statistical significance, $p=0.260$), ranging from 5% to 14% (depending on time and group).

People above 5 years having diarrhea

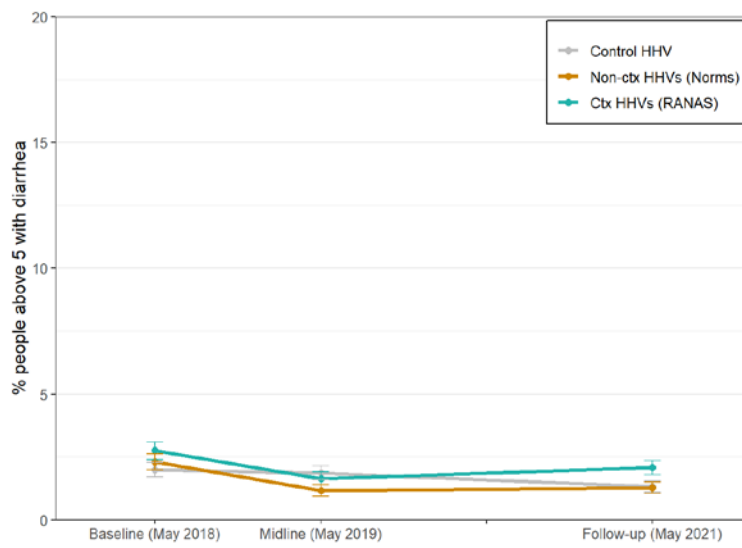


Figure 16. Means \pm SE.

The percentage of people older than 5 years with diarrhea during the 2 weeks prior to assessment remained relatively stable over time, around 1-2% ($p=0.986$).

Discussion

Methodological strengths and limitations

Lack of allocation concealment	Lack of blinding	Incomplete accounting of outcome events	Selective outcome reporting	Other limitations
<p>Lack of randomization: No Cluster randomization was performed</p> <p>Lack of allocation concealment: No Randomization was done by an independent researcher, using a computer-generated random list with R studio</p>	<p>Participants: Yes Participants were not blinded for the intervention status</p> <p>Personnel: Yes TRCS volunteers were not blinded for the intervention status</p> <p>Outcome assessors: No All assessments were performed by trained assessors who were not involved in the implementation of interventions and who were blinded to group allocation</p>	<p>No Drop-outs or outcome assessment in different HHs was limited since 1391/1517 (92%) HHs were assessed at all 3 time points.</p> <p>No difference in proportion of drop-outs across cohorts</p> <p>Intention-to-treat analysis</p>	<p>No Outcome assessment was in line with our a-priori published protocol/study registration</p>	<p>Yes There was insufficient information available about the actual implementation of the planned CLTS/PHAST interventions. (i.e., whether all households effectively received all basic interventions and household visits)</p> <p>Set of unintended interventions (i.e. interventions not aimed for a specific cohort) was present</p> <p>Due to the COVID-19 pandemic, the planned Endline assessment did not take place. In addition, the presence and impact of potential additional COVID-19 hygiene promotion activities is unclear.</p> <p>The sample size was calculated based on the primary outcome (i.e., hand-washing behaviour), for which it was assumed that 5% washed their hands at baseline,</p>

				and an improvement towards 20% was expected after the addition interventions. For health-related outcomes, such as diarrhea, for which effects of WASH interventions may be more subtle, the sample size might have been insufficient to detect meaningful intervention effects.
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Lessons learned

In November 2020, the involved CEBaP researchers and employees from the International Cooperation Department formulated several lessons learned ([Appendix 3](#)).

Conclusions

One year after the start of the intervention (midterm) **hand-washing behaviour** increased at some time points (before cooking or feeding a child) while remaining stable at others (after defecation or before eating), and there were no differences between interventions. At follow-up (3 years after the start of the intervention, 1 year after termination of the interventions) all groups showed significant increases of hand-washing after defecation, and the two groups with add-on interventions showed significantly higher increases than the control group. The contextualized approach showed no difference to the non-contextualised approach.

The outcome **WASH infrastructure** significantly improved at midterm and follow-up, but no difference could be shown between the groups. The outcome **latrine use** significantly improved at midterm, but returned to baseline at follow-up for the three groups, and no difference could be shown between the groups. There was no statistical evidence for an effect of any of the interventions on **diarrhea**. The same trends were observed for other health-related outcomes.

In summary, the WASH interventions resulted in increases of hand-washing behaviour (immediately after and one year after the interventions), WASH infrastructure (immediately after and one year after the interventions) and latrine use (only immediately after the interventions), but not on health outcomes such as diarrhea. In addition, an added value of the two add-on interventions was found on hand-washing behaviour (none of them being superior), but not on WASH infrastructure, latrine use and diarrhea.


References

1. Dockx K, Van Remoortel H, De Buck E, Schelstraete C, Vanderheyden A, Lievens T, et al. Effect of Contextualized Versus Non-Contextualized Interventions for Improving Hand Washing, Sanitation, and Health in Rural Tanzania: Study Design of a Cluster Randomized Controlled Trial. *Int J Environ Res Public Health*. 2019;16(14).



Protocol

Effect of Contextualized Versus Non-Contextualized Interventions for Improving Hand Washing, Sanitation, and Health in Rural Tanzania: Study Design of a Cluster Randomized Controlled Trial

Kim Dockx ^{1,*} , Hans Van Remoortel ¹, Emmy De Buck ^{1,2}, Charlotte Schelstraete ³, An Vanderheyden ³, Tiene Lievens ³, John Thomas Kinyagu ⁴, Simon Mamuya ⁵ and Philippe Vandekerckhove ^{3,6}

¹ Centre for Evidence-Based Practice (CEBaP), Belgian Red Cross, Mechelen 2800, Belgium

² Faculty of Medicine, Department of Public Health and Primary Care, KU Leuven, Leuven 3000, Belgium

³ Belgian Red Cross, Mechelen 2800, Belgium

⁴ Tanzania Red Cross Society, Dar es Salaam, Tanzania

⁵ Department of Environmental and Occupational Health, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

⁶ Faculty of Medicine, Department of Public Health and Primary Care, KU Leuven, Leuven 3000, Belgium

* Correspondence: Kimberly.dockx@rodekruis.be; Tel.: +32-1544-3581

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Abstract: Nearly 90% of diarrhea-related mortalities are the result of unsafe drinking water, poor sanitation, and insufficient hygiene. Although “Water, Sanitation, and Hygiene” (WASH) interventions may significantly reduce the risk of diarrheal disease, it is currently unclear which interventions are the most effective. In this study, we aim to determine the importance of contextualizing a WASH intervention to the local context and the needs for increasing impact ([Clinicaltrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT03709368) NCT03709368). A total of 1500 households in rural Tanzania will participate in this cluster randomized controlled trial. Households will be randomized into one of three cohorts: (1) a control group receiving a basic intervention and 1 placebo household visit, (2) an intervention group receiving a basic intervention + 9 additional household visits which are contextualized to the setting using the RANAS approach, and (3) an intervention group receiving a basic intervention + 9 additional household visits, which are not contextualized, i.e., a general intervention. Assessments will take place at a baseline, 1 and 2 years after the start of the intervention, and 1 year after the completion of the intervention. Measurements involve questionnaires and spot checks. The primary outcome is hand-washing behavior, secondary objectives include, the impact on latrine use, health, WASH infrastructure, quality of life, and cost-effectiveness.

Keywords: Hand-washing; sanitation; RANAS; diarrhea

1. Introduction

Diarrhea is ubiquitous among people in low-and middle-income countries (LMIC) [1]. Each year, approximately 1.7 billion children globally are faced with diarrheal disease. Children under five years of age are particularly vulnerable, with 525,000 mortalities per year [2]. Unsafe drinking water, poor sanitation, and insufficient hygiene are responsible for nearly 90% of these mortalities [3–5].

“Water, Sanitation, and Hygiene” (WASH) interventions were demonstrated to significantly reduce the risk of diarrheal disease [6]. Hand-washing with water and soap, in particular, is shown to significantly reduce the microbial load of the hands [7] and was shown to reduce the risk of diarrhea

with 39–47% [6–10]. Despite its enormous health impacts, only 5–25% of people in LMIC are estimated to wash their hands with water and soap after fecal contact [10,11]. In a Cochrane systematic review by Ejemot-Nwadiaro et al., attempts to change either hygiene practices [12], hand-washing at critical times [13], or soap consumption [14] only led to modest improvements [9].

Several studies have suggested that multifaceted interventions, including both hardware (i.e., improvement of infrastructure) and software (i.e., improvement of knowledge, skills, and attitude), are needed to obtain lasting behavioral changes [15–17]. In addition, contextualizing the interventions and ensuring that the program is tailored to the needs of the participants may further increase impact [16]. Despite the many reports that have been published in recent years, a recent mixed methods systematic review by De Buck et al. showed that there is no consensus as to the most efficacious approach in improving WASH behavior in LMIC [18]. The systematic review also showed that contextualized hand-washing interventions using the ‘Risks, Attitudes, Norms, Abilities, Self-regulation’ (RANAS) model—a theoretical framework which can be used to tailor the content of the intervention to the context at play—show great promise for ameliorating behavior [18]. Indeed, RANAS trials were published to be successful in improving water [19–21], sanitation [22,23], and hygiene [24–26] behavior in various settings around the world. However, these trials made use of a low-quality, uncontrolled before-after study design, and largely focused on short-term behavior change, while long-term changes have gone uninvestigated. Moreover, the effects on health tend to be insignificant. With this study, we want to determine whether multifaceted contextualized interventions, based on the RANAS model versus non-contextualized WASH interventions have a differential impact on behavior and related health outcomes. The evidence regarding the efficacy of WASH interventions is not ideal, particularly as large RCTs are needed, which do not assist in determining long-term effects.

The primary objective of this study is to determine the effectiveness of add-on contextualized and non-contextualized interventions on hand-washing behavior at critical times. As a secondary objective, the study aims to evaluate the impact on latrine use, health, quality of life and hardware coverage. It will also calculate the cost-effectiveness of each approach.

2. Materials and Methods

To draft the protocol, we made use of the reporting criteria provided in the SPIRIT checklist (Supplementary Table S1).

2.1. Design

This study is a prospective, parallel group, single blinded, cRCT with a 2 year implementation period and a 12 month follow-up. It is a collaboration between Belgian Red Cross (BRC), Tanzania Red Cross Society (TRCS), and the Environmental and Occupational Health Department of Muhimbili University of Health and Allied Sciences (MUHAS).

Participants will be randomized to one of three cohorts: A contextualized intervention cohort, a non-contextualized intervention cohort, or a control cohort. A contextualized intervention is defined as an intervention that is adapted to the local context by collecting data at baseline and using this data to fit the intervention to the specific population needs, as prescribed by the RANAS approach. In contrast, a non-contextualized intervention is a general WASH intervention that is not fine-tuned to meet the specific needs of the context at hand. For the purpose of this study, the target population will be subdivided into three cohorts: (1) a control cohort receiving a basic intervention + 1 placebo household visit, (2) a contextualized intervention cohort receiving a basic intervention + 9 household visits which are contextualized to the setting using the RANAS approach, and (3) a non-contextualized intervention cohort receiving a basic intervention + 9 household visits which are not contextualized, i.e., a general intervention. The study flow chart can be found in Figure 1.

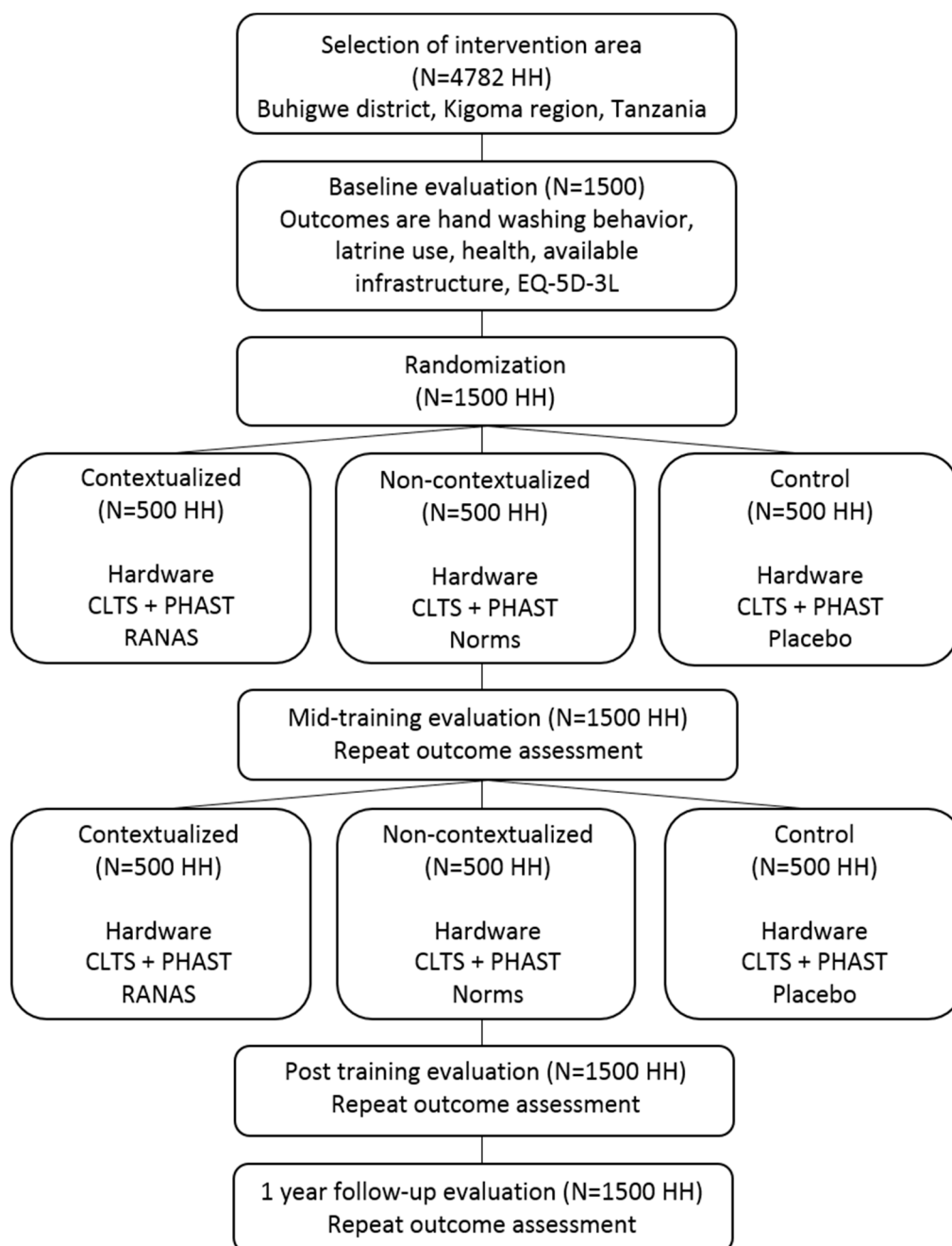


Figure 1. Summary of the study design and intervention protocol. HH = households; CLTS = Community-Led Total Sanitation; PHAST = Participatory Hygiene and Sanitation Transformation; RANAS = Risks Attitudes Norms Abilities Self-regulation; EQ-5D-3L = Quality-of-Life questionnaire.

2.2. Participants and Setting

Participants will be recruited from seven villages in Buhigwe district, Kigoma region, Tanzania. Formative research showed that an estimated 4782 households live in this area, of which a random sample of 1500 households will be included in the study. Sampling was done by an independent researcher (KD) who was not involved in data collection or implementation of the interventions. A household is defined as one or more people who occupy a housing unit. Subjects were excluded as a respondent to the questionnaires if they were below the age of 18 years old at the time of the study. There were no other eligibility criteria.

2.3. Sample Size Calculation

The primary outcome of the study is the prevalence of hand-washing after defecation or latrine using. This prevalence will be compared between intervention and control groups at post-intervention. Since we have an interest in comparing both interventions groups separately, the alpha-level will be set at 0.025 (0.05/2).

The sample size estimate was based on the literature and earlier pilot work, which assumed that 5% of the households wash their hands after defecation, at a baseline, and a 15% improvement is expected following contextualized and non-contextualized interventions. To detect an increase in hand-washing prevalence after defecation or latrine using 5% to 20%, 92 households are needed per group to have 80% power, based on a two-sided Chi-square test ($\alpha = 0.025$). However, the drop-out rate and intra-cluster correlation (ICC) still need to be taken into account. The ICC refers here to the potential correlation in the probability of hand-washing between the households of the same sub-village. The inflation in sample size due to the ICC is given by $1 + ICC*(m - 1)$, where m equals the mean number of households per sub-village.

With 500 households per group (clustered in 9 sub-villages), including a drop-out rate of 20%, the variance inflation factor should be maximal 4.35 (400/92), corresponding to an ICC of 0.076 ($4.35 = 1 + 0.076 \times (45 - 1)$). This closely corresponds to the most conservative estimate found in literature for a comparable outcome [27–29]. The calculation is also conservative, since the analysis will be based on a longitudinal statistical model, including data from earlier time points for drop-out participants and the baseline measurement will be used as a covariate. These further increases the power of the study. In conclusion, a total sample of 1500 households were included, i.e., 500 households per cohort. A detailed overview can be found in Table 1.

Table 1. Total population and sample in the intervention area. The intervention area consists of 3 wards, including 7 villages and 27 sub-villages. A total population of 4782 households live in the intervention area, of which a sample of 1500 households will be included in the study. Four of the sub-villages had a school.

Ward	Village	Sub-Village	Population (n Households)	Sample (n Households)		
1. Nyamugali	1.1. Bulimanyi	1.1.1. Buhinda	161	50		
		1.1.2. Bweru	212	67		
		1.1.3. Lulengala	113	35		
		1.1.4. Mudyangoti	90	28		
	1.2. Nyamugali	1.2.1. Kikulazo	82	26		
		1.2.2. Lukunda	108	34		
		1.2.3. Mbanga	149	47		
		1.2.4. Nyomvi	73	23		
		1.2.5. Sakivungwe	105	33		
		1.2.6. Sokoni (school)	140	44		
		2. Munyegera	2.1. Munyegera	2.1.1. Kabuye (school)	358	114
				2.1.2. Nyakitanga	444	140
2.1.3. Salugale	383			118		
2.2. Songambebe	2.2.1. Bilatenda		209	66		
	2.2.2. Bulambila		257	82		
	2.2.3. Kumsenga		234	72		
	2.2.4. Nyamutukula (school)		162	51		
	3. Buhigwe		3.1. Buhigwe	3.1.1. Buyogwa	192	59
3.1.2. Lugumba		204		65		
3.2. Kavomo		3.2.1. Kitagata	104	32		
		3.2.2. Kitulo	116	37		
		3.2.3. Mnyango	118	37		
		3.2.4. Nyandela	169	54		
3.3. Mulera		3.3.1. Kamazi (school)	243	75		
		3.3.2. Lukaro	116	37		
		3.3.3. Muzenga	122	38		
		3.3.4. Rusange	118	36		

2.4. Allocation and Sampling

In a first step, formative research was done to create a list of all households living in the area. A household number was assigned to each of these households ($n = 4782$). Cluster randomization was used to assign households to one of the three cohorts. Households from the same sub-village will all be assigned to the same treatment arm. The sub-villages will be stratified according to size and whether or not the sub-village has a school. A total of four schools are available in the area. This implies that each cohort will contain at least one school, and one cohort will contain two schools. A detailed overview of the sub-villages with, and without, a school can be found in Table 1. The randomization of the sub-villages to one of the three cohorts will be done by an independent researcher (KD), using a computer-generated random list with R studio (Version 1.0.143, RStudio Inc. Boston, MA, USA) [30].

Following allocation, a representative sample was selected in each sub-village. This sample received the add-on interventions and assessments. As determined by the sample size calculation, the sample should include 31% of the total population living in the intervention area—i.e., 1500 households were included from a total of 4782 households living in the area. As such, 31% of the households were randomly selected using a computer-generated random list with R studio (Version 1.0.143). This sample was proportionally selected to the size of the sub-village (Table 1).

2.5. Description of the Interventions

The intervention was subdivided into a basic intervention, which provides all cohorts equally, and add-on household visits, which differ from one cohort to another. All interventions will be delivered by TRCS volunteers, who received formal training prior to implementation. Participants and TRCS volunteers were not blinded for the intervention status.

2.5.1. Basic Intervention

The basic intervention involves both hardware and software components. Hardware interventions are aimed at improving the infrastructure: An existing water gravity flow scheme will be rehabilitated and extended, 350 tippy taps and 350 pans for pour flush latrines will be distributed, and sanitation blocks will be built in four schools. In addition, community sessions will be provided to each of the sub-villages ($n = 27$), teaching participants how to build a tippy tap, how to build an improved latrine, and how to make liquid soap.

Software interventions involve the improvement of knowledge, skills, and attitude. In order to reach this goal, Community-Led Total Sanitation (CLTS), Participatory Hygiene and Sanitation Transformation (PHAST), and School Water, Sanitation and Hygiene (SWASH) clubs will be used. CLTS sanitation and hand-washing sessions will follow the National Guidelines for Rural Community Led Total Sanitation (R-CLTS) [31], and UNICEF material [32]. In brief, a 1 h meeting will take place in each of the villages involving community leaders and locals to familiarize them with the intervention, and to ensure optimal co-operation during implementation. Then, two community sessions with a duration of 3–5 h each will be organized in each of the sub-villages separately ($n = 27$). A first session will focus on sanitation [31], and a second session will focus on hand-washing [32]. Finally, a series of follow-up community meetings and household visits will take place to monitor improvement. PHAST sessions are based on a manual from the World Health Organization [33]. Considering the overlap with some CLTS activities, only a selection of the full guideline will be enrolled, namely: (1) Health problems in our community, (2) Good and bad hygiene behaviors, (3) Investigating community practices, (4) How diseases spread, (5) Blocking the spread of disease, (6) Selecting the barriers, (7) Choosing sanitation improvements, and (8) Choosing improved hygiene behaviors. These 8 activities will be enrolled in approximately 40 community groups, which are spread out over the sub-villages. Each activity will take between 30 min–2 h to complete.

2.5.2. Add-On Intervention

All cohorts will receive an add-on intervention on top of the basic intervention package. The content of this add-on intervention will differ from one cohort to another.

Contextualized Intervention Cohort

The contextualized intervention cohort will receive nine household visits of 20–40 min each, at a frequency of one visit every two months. The content of these add-on visits is based on the ‘Risks, Attitudes, Norms, Abilities, Self-regulation’ (RANAS) model (www.ranamosler.com) [16]. The RANAS model consists of five behavioral factors, which are considered to be the drivers of WASH behavior [16] (see Figure 2). In a preparatory phase, RANAS dictates that questionnaires and interviews are used to better understand the context at play, i.e., do people in the intervention area wash their hands and why (not)? In a second phase, this data is used to develop the intervention, thus optimally tailoring the program to the needs in the community [16,34].

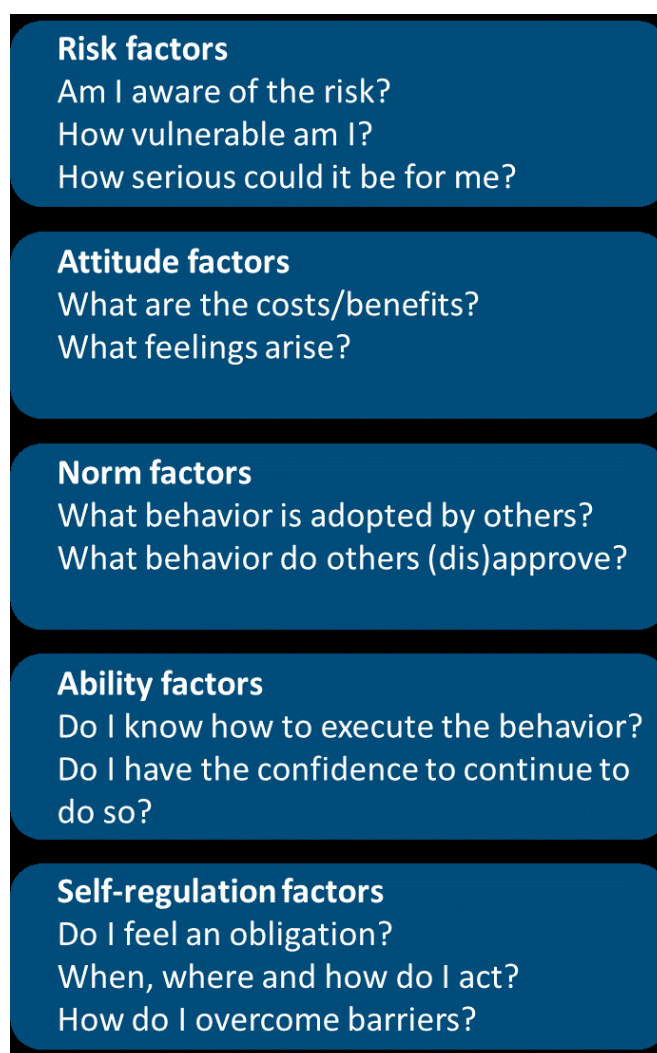


Figure 2. Five components of the RANAS model (<https://www.ranamosler.com/ranas>).

Concretely, baseline data are first gathered through a questionnaire (Table S2). Then, these data will be analyzed to compare (1) people who always wash hands after defecation (do’ers) to people who don’t (non-do’ers); and (2) people who always use the latrine (do’ers) to people who do not (non-do’ers). Do’ers were defined as people who always wash their hands or use the latrine. Non-do’ers were

defined as people who wash their hands or use the latrine most of the time, sometimes, seldom or never. Only those behavioral factors (i.e., 'Risks, Attitudes, Norms, Abilities, and/or Self-Regulation'), that are significantly different between "do'ers" and "non-do'ers" will be included in the intervention, as these are, at least theoretically, considered to be decisive for hand-washing and latrine use behavior in the current setting [16,34]. This implies that the precise content of the intervention can only be determined after baseline data collection has taken place.

Non-Contextualized Intervention

The non-contextualized intervention cohort will also receive nine household visits of 20–40 min each, at a frequency of one visit every two months. The content of these visits involves a general WASH intervention which is not tailored to the context at hand. Based on a study by Mosler et al., who suggested that norms are a universal driver (i.e., not context specific) of hand-washing behavior [35] and other studies and expert input stating that norms of local leaders, in particular, are important in African culture in inducing behavioral change [36–38], the focus would be non-contextualized intervention on norms. Concretely, the 'Norm Behavior Change Techniques' from the RANAS manual (www.ranamosler.com) were used to outline the intervention [16]. These interventions encourage participants to improve their hand-washing and sanitation infrastructure and behavior in order to become a WASH role model within their community. A detailed outline of the non-contextualized intervention can be found in Table S3.

Control

The control cohort will receive one household visit of 20–40 min. During this visit, a placebo poster will be distributed focusing on malaria nets. The main goal of this household visit is to avoid jealousy among the control cohort.

2.6. Assessment Protocol

A repeated measures design will be employed with assessments performed at baseline (May 2018), after one year (May 2019) and after two years (May 2020) of intervention, and at 1 year of follow-up, i.e., one year after the intervention has stopped (May 2021) (Figure 2). All assessments will be performed by trained assessors who are not involved in the implementation of the interventions, and who are blinded to group allocation. Assessments will take place at about the same time of year to avoid variability of performance due to the rainy season.

All data will be collected by means of KoboToolbox (<https://www.kobotoolbox.org/>), or on paper (EQ-5D-3L + informed consent). Moreover, collected data are checked daily during data collection by means of a computer script (R studio), to ensure that no mistakes have taken place – i.e., doubles in the dataset.

2.7. Outcome Measures

2.7.1. Primary Outcome

Hand-washing behavior. The primary outcome is the percentage of households washing hands. The outcome measure will be obtained by means of a self-developed WASH questionnaire, which involves both multiple choice questions and spot checks (Table S4).

Spot checks will be used to determine the hardware situation in the household. Assessors will check whether there is a hand-washing station available, and if so, what type of hand-washing station (i.e., running water or a bucket). Spot checks will also be used to determine the presence of water and/or soap at the time of the measurement. By means of the questionnaire, assessors will probe when people normally wash their hands (i.e., before eating, after using the latrine, etc.), and what they use for hand-washing (i.e., water and/or soap).

A household was defined to have correct hand-washing behavior when they: (1) have a hand-washing station available (spot check), (2) have water and soap available at the hand-washing station (spot check), and (3) indicate that they wash their hands with water and soap (questionnaire). All items must be present. The analysis will be repeated for each of the critical times. Critical times of interest include: after defecation or using the latrine, before cooking or handling food, before eating, and before feeding a child.

2.7.2. Secondary Outcomes

Latrine use. Latrine use is assessed by means of a self-developed WASH questionnaire, involving both multiple choice questions and spot checks (Table S5).

Spot checks will be used to check whether there is a latrine available at the household, and if so, what the latrine looks like (i.e., does it have a roof, a door, etc.), and to determine the latrine cleanliness. By means of the questionnaire, behavioral information about the past two weeks is gathered. These questions probe whether people (1) normally use a latrine when defecating at home; (2) normally use a latrine when defecating elsewhere (i.e., when at work in the field); (3) sometimes defecate in the open when at home; (4) sometimes defecate in the open when they are elsewhere; (5) clean the latrine and how often.

A household is defined to have correct latrine use behavior when: (1) they have a latrine available (spot check), (2) the latrine minimally includes walls, a roof, a door or curtain, and a slab or concrete floor (spot check), (3) the latrine is clean (spot check), (4) they indicate to normally use the latrine when defecating at home (questionnaire), and (5) they indicate to not defecate in the open when they are at home (questionnaire). A similar analysis will be performed for latrine use behavior when people are elsewhere.

Health. Health is assessed using a self-developed health questionnaire (Table S6). The questionnaire is used to probe the prevalence rates of diarrhea, vomiting, limitations of daily activities, the need for medical care due to diarrheal illness in the past two weeks, and hospitalization due to diarrheal illness in the past three months. The WHO definition will be used: 'Diarrhea is defined as the passage of three or more loose or liquid stools per day or more frequent passage than is normal for the individual. Frequent passing of formed stools is not diarrhea, nor is the passing of loose, pasty stools by breastfed babies'. Prevalence is subdivided in people below and above 5 years of age.

Infrastructure. WASH infrastructure is assessed using a self-developed questionnaire and spot checks (Tables S4 and S5). Both hand-washing and latrine infrastructure will be judged.

The quality of the hand-washing infrastructure is scored based on the type of hand-washing facility (i.e., running water versus bucket) (spot check), the presence of water and/or soap (spot check), and whether or not the station is always operational (questionnaire).

The quality of the latrine infrastructure is scored based on the type of facility (i.e., does it have a roof, a door, etc.) (spot check), the cleanliness (spot check), and the number of people who use the latrine (questionnaire). Information about whether or not the pit has ever been emptied, and how will also be gathered (questionnaire) as this will allow for the measurement of Sustainable Development Goal (SDG) 6 according to the WHO/UNICEF JMP (<https://washdata.org>) tools.

Quality of Life. The EQ-5D-3L is a validated questionnaire, examining 5 dimensions: Mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (Figure S1). All items are scored on a 3-point Likert scale. Results of the EQ-5D-3L can be used to calculate the quality-adjusted life-year (QALY), a generic measure of disease burden. The cost per QALY will be used to determine the cost-effectiveness of each intervention arm.

Demographics. Demographic data will be gathered, including the Global Positioning System (GPS) location of the household, village and sub-village, name, age, gender, and education level of the household head. These demographics are crucial to verify that the correct households—i.e., the households that were randomly selected in R—are targeted at each of the intervention and data

collection moments. In addition, socio-economic data is collected, i.e., age and gender of the respondent, main source of income, etc. The questionnaire is available in Table S7.

Compliance. Compliance to the intervention will be monitored in real-time using KoboToolbox (<https://www.kobotoolbox.org/>). Monitoring will involve (1) number of household visits provided, (2) number of community sessions provided, (3) number of people who have been reached, (4) duration, (5) content of the sessions/visits, and (6) compliance of the participants.

2.8. Data Analysis

Statistical analyses will be undertaken using R studio (Version 1.0.143). All analyses will be conducted on an intention-to-treat principle using all randomized participants. Demographic characteristics and baseline data will be summarized by descriptive statistics using means, standard deviations and 95% confidence intervals for continuous variables, median and inter-quartile ranges for non-normal continuous or ordinal data and percentages for categorical data. The primary and secondary outcome measures will be analyzed using generalized linear mixed models with baseline values as a covariate to assess differences between treatment groups and across time. A sensitivity analysis will be performed comparing effectiveness of the interventions in low compliance versus high compliance households. All data will be adjusted for multiple comparisons. A p -value < 0.05 will be considered as statistically significant.

Investigators who are involved in data analysis will be blinded to group allocation. In accordance to the European General Data Protection Regulation (GDPR) law, all private information (i.e., name or GPS) will not appear on any documents except a participant key. This key is needed to match baseline data with midline, end-line, and follow-up data. A pseudonym will be used to protect participants' identities. The key linking the participant name to the data is not accessible to the investigators and will be destroyed after data analysis is complete.

2.9. Ethics and Dissemination

This study was registered at [Clinicaltrials.gov](https://clinicaltrials.gov/) (NCT03709368). An overview of the WHO registration data set can be found in Table S8. Ethical approval was obtained at the Social and Societal Ethics committee (KU Leuven, Belgium), and at the National Institute for Medical Research (Dar es Salaam, Tanzania). In addition, a research permit was obtained at the Tanzania Commission for Science and Technology. The trial progress was overseen by both the National Institute for Medical Research and the Commission for Science and Technology. All eligible subjects will be required to provide a written informed consent, or to sign with a thumb stamp. The informed consent can be found in Table S9. The study results will be published within 24 months of the final data collection date.

3. Discussion

The aim of this study is to establish an effective and feasible solution for improving hand washing behavior, latrine use, health, quality of life, and WASH infrastructure in rural LMIC. What differentiates this project from earlier work in the field is that this study examines the long-term efficacy and cost-effectiveness of a contextualized and non-contextualized add-on intervention, using a large cRCT study design and an active comparison control.

The study objectives and protocol of this study are based on a gap analysis of the available scientific evidence and input from experts in the field [18]. The protocol was designed to involve a combination of infrastructural improvements, community meetings, and add-on household visits in order to maximize uptake by all beneficiaries. Both the contextualized and non-contextualized intervention programs endeavor to achieve resilience and lasting behavior change by implementing a multifaceted approach that relies on community- and household-based structures. Comparison with an active control cohort, involving only infrastructural improvements and community meetings, allow us to determine the added value of add-on household visits, and its cost-effectiveness.

To establish the feasibility of the program, pilot work was performed by Belgian Red Cross (BRC) in close collaboration with Tanzania Red Cross Society (TRCS). In addition, focus group discussions with locals were used to optimize all training materials. With regards to the assessments, assessors are well-trained and blinded to group allocation. Although several outcome measures are self-developed, they are based on extensive experience in the field and have gone through pilot testing. Moreover, some of the outcome measures have been aligned with WHO/UNICEF JMP tools, to allow for the measurement of Sustainable Development Goal (SDG) 6.

This thorough preparation process enables us to confidently advance into a larger cRCT to explore the efficacy of contextualized and non-contextualized interventions compared to an active training control group. After the project is finished, the findings of the study will be disseminated in rural Tanzania by means of billboards, posters, and radio spots.

4. Conclusions

This cRCT will allow us to validate the superiority of a contextualized versus non-contextualized versus placebo add-on interventions on improving hand washing behavior, latrine use, related health outcomes, quality of life, and hardware coverage. It will also calculate the cost-effectiveness of each approach. The knowledge that will be generated by the results of this study are likely to inform WASH research and field practice.

Supplementary Materials: The following are available online at <http://www.mdpi.com/1660-4601/16/14/2529/s1>, Table S1: SPIRIT Guidelines 2013; Table S2: RANAS Questionnaire; Table S3: mini-RANAS intervention (non-contextualized); Table S4: Hand-washing questionnaire; Table S5: Latrine use questionnaire; Table S6: Health questionnaire; Table S7: Demographics questionnaire; Table S8: WHO registration data set; Table S9: Informed consent form; Figure S1: EQ-5D-3L.

Author Contributions: K.D., H.V.R., C.S., A.V., T.L., and E.D.B. participated in the conception, study design, and drafting of the manuscript. J.T.K. and S.M. are responsible for reviewing the study protocol and ensuring that the interventions and assessments are appropriate for a Tanzanian context. All authors contributed to the refinement of the study protocol and approved the final manuscript.

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References

1. Walker, C.L.; Rudan, I.; Liu, L.; Nair, H.; Theodoratou, E.; Bhutta, Z.A.; O'Brien, K.L.; Campbell, H.; Black, R.E. Global burden of childhood pneumonia and diarrhoea. *Lancet* **2013**, *381*, 1405–1416. [[CrossRef](#)]
2. World Health Organization. *Diarrhoeal Disease—Fact Sheet*; WHO: Geneva, Switzerland, 2017.
3. De Buck, E.; Hannes, K.; Cargo, M.; Van Remoortel, H.; Vande Veegaete, A.; Mosler, H.J.; Govender, T.; Vandekerckhove, P.; Young, T. Engagement of stakeholders in the development of a Theory of Change for handwashing and sanitation behaviour change. *Int. J. Environ. Health Res.* **2017**, *28*, 8–22. [[CrossRef](#)] [[PubMed](#)]
4. Prüss-Üstün, A.; Bos, R.; Gore, F.; Bartram, J. *Safer Water, Better Health: Costs, Benefits and Sustainability of Interventions to Protect and Promote Health*; World Health Organization: Geneva, Switzerland, 2008.
5. UNICEF; WHO. *Progress on Sanitation and Drinking Water: Update and MDG Assessment*; UNICEF: New York, NY, USA, 2015.

6. Fewtrell, L.; Kaufmann, R.B.; Kay, D.; Enanoria, W.; Haller, L.; Colford, J.M., Jr. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: A systematic review and meta-analysis. *Lancet Infect. Dis.* **2005**, *5*, 42–52. [[CrossRef](#)]
7. Stilo, A.; Troiano, G.; Melcarne, L.; Gioffrè, M.E.; Nante, N.; Messina, G.; Laganà, P. Hand washing in operating room: A procedural comparison. *Epidemiol. Biostat. Public Health* **2016**, *13*. [[CrossRef](#)]
8. Curtis, V.; Cairncross, S. Effect of washing hands with soap on diarrhoea risk in the community: A systematic review. *Lancet Infect. Dis.* **2003**, *3*, 275–281. [[CrossRef](#)]
9. Ejemot-Nwadiaro, R.I.; Ehiri, J.E.; Arikpo, D.; Meremikwu, M.M.; Critchley, J.A. Hand washing promotion for preventing diarrhoea. *Cochrane Database Syst. Rev.* **2015**, *2015*, CD004265. [[CrossRef](#)] [[PubMed](#)]
10. Freeman, M.C.; Stocks, M.E.; Cumming, O.; Jeandron, A.; Higgins, J.P.; Wolf, J.; Pruss-Ustun, A.; Bonjour, S.; Hunter, P.R.; Fewtrell, L.; et al. Hygiene and health: Systematic review of handwashing practices worldwide and update of health effects. *Trop. Med. Int. Health* **2014**, *19*, 906–916. [[CrossRef](#)] [[PubMed](#)]
11. Curtis, V.A.; Danquah, L.O.; Aunger, R.V. Planned, motivated and habitual hygiene behaviour: An eleven-country review. *Health Educ. Res.* **2009**, *24*, 655–673. [[CrossRef](#)] [[PubMed](#)]
12. Stanton, B.F.; Clemens, J.D. An educational intervention for altering water-sanitation behaviors to reduce childhood diarrhea in urban Bangladesh. II. A randomized trial to assess the impact of the intervention on hygienic behaviors and rates of diarrhea. *Am. J. Epidemiol.* **1987**, *125*, 292–301. [[CrossRef](#)] [[PubMed](#)]
13. Langford, R.; Lunn, P.; Panter-Brick, C. Hand-washing, subclinical infections, and growth: A longitudinal evaluation of an intervention in Nepali slums. *Am. J. Hum. Biol.* **2011**, *23*, 621–629. [[CrossRef](#)] [[PubMed](#)]
14. Nicholson, J.A.; Naeeni, M.; Hoptroff, M.; Matheson, J.R.; Roberts, A.J.; Taylor, D.; Sidibe, M.; Weir, A.J.; Damle, S.G.; Wright, R.L. An investigation of the effects of a hand washing intervention on health outcomes and school absence using a randomised trial in Indian urban communities. *Trop. Med. Int. Health* **2014**, *19*, 284–292. [[CrossRef](#)] [[PubMed](#)]
15. Sonogo, I.L.; Huber, A.C.; Mosler, H.J. Does the implementation of hardware need software? A longitudinal study on fluoride-removal filter use in Ethiopia. *Environ. Sci. Technol.* **2013**, *47*, 12661–12668. [[CrossRef](#)] [[PubMed](#)]
16. Mosler, H.J. A systematic approach to behavior change interventions for the water and sanitation sector in developing countries: A conceptual model, a review, and a guideline. *Int. J. Environ. Health Res.* **2012**, *22*, 431–449. [[CrossRef](#)] [[PubMed](#)]
17. Barasa, E.W.; Cloete, K.; Gilson, L. From bouncing back, to nurturing emergence: Reframing the concept of resilience in health systems strengthening. *Health Policy Plan* **2017**, *32*, iii91–iii94. [[CrossRef](#)] [[PubMed](#)]
18. De Buck, E.; Van Remoortel, H.; Hannes, K.; Govender, T.; Naidoo, S.; Avau, B.; Vande Veegaete, A.; Musekiwa, A.; Lutje, V.; Cargo, M.; et al. Approaches to promote handwashing and sanitation behaviour change in low- and middle-income countries. *Campbell Syst. Rev.* **2017**, *7*, 1–447.
19. Huber, A.C.; Tobias, R.; Mosler, H.J. Evidence-based tailoring of behavior-change campaigns: Increasing fluoride-free water consumption in rural Ethiopia with persuasion. *Appl. Psychol. Health Well-Being* **2014**, *6*, 96–118. [[CrossRef](#)]
20. Inauen, J.; Tobias, R.; Mosler, H.J. The role of commitment strength in enhancing safe water consumption: Mediation analysis of a cluster-randomized trial. *Br. J. Health Psychol.* **2014**, *19*, 701–719. [[CrossRef](#)]
21. Lilje, J.; Mosler, H.J. Effects of a behavior change campaign on household drinking water disinfection in the Lake Chad basin using the RANAS approach. *Sci. Total Environ.* **2018**, *619*, 1599–1607. [[CrossRef](#)]
22. Mosler, H.J.; Sonogo, I.L. Improved latrine cleanliness through behaviour change and changes in quality of latrine construction: A longitudinal intervention study in rural Burundi. *Int. J. Environ. Health Res.* **2017**, *27*, 355–367. [[CrossRef](#)]
23. Tumwebaze, I.K.; Mosler, H.J. Effectiveness of group discussions and commitment in improving cleaning behaviour of shared sanitation users in Kampala, Uganda slums. *Soc. Sci. Med.* **2015**, *147*, 72–79. [[CrossRef](#)]
24. Friedrich, M.N.D.; Kappler, A.; Mosler, H.J. Enhancing handwashing frequency and technique of primary caregivers in Harare, Zimbabwe: A cluster-randomized controlled trial using behavioral and microbial outcomes. *Soc. Sci. Med.* **2018**, *196*, 66–76. [[CrossRef](#)] [[PubMed](#)]
25. Contzen, N.; Meili, I.H.; Mosler, H.J. Changing handwashing behaviour in southern Ethiopia: A longitudinal study on infrastructural and commitment interventions. *Soc. Sci. Med.* **2015**, *124*, 103–114. [[CrossRef](#)] [[PubMed](#)]
26. Seimetz, E.; Kumar, S.; Mosler, H.J. Effects of an awareness raising campaign on intention and behavioural determinants for handwashing. *Health Educ. Res.* **2016**, *31*, 109–120. [[CrossRef](#)] [[PubMed](#)]

27. Biran, A.; Schmidt, W.P.; Varadharajan, K.S.; Rajaraman, D.; Kumar, R.; Greenland, K.; Gopalan, B.; Aunger, R.; Curtis, V. Effect of a behaviour-change intervention on handwashing with soap in India (SuperAmma): A cluster-randomised trial. *Lancet Glob. Health* **2014**, *2*, e145–e154. [[CrossRef](#)]
28. Luby, S.P.; Kadir, M.A.; Yushuf Sharker, M.A.; Yeasmin, F.; Unicomb, L.; Sirajul Islam, M. A community-randomised controlled trial promoting waterless hand sanitizer and handwashing with soap, Dhaka, Bangladesh. *Trop. Med. Int. Health* **2010**, *15*, 1508–1516. [[CrossRef](#)]
29. Pickering, A.J.; Djebbari, H.; Lopez, C.; Coulibaly, M.; Alzua, M.L. Effect of a community-led sanitation intervention on child diarrhoea and child growth in rural Mali: A cluster-randomised controlled trial. *Lancet Glob. Health* **2015**, *3*, e701–e711. [[CrossRef](#)]
30. RStudio_Team. *RStudio: Integrated Development for R*; RStudio, Inc.: Boston, MA, USA, 2015; Available online: <http://www.rstudio.com/> (accessed on 27 June 2019).
31. Environmental Health and Sanitation Section; Ministry of Health, Community Development, Gender, Elderly and Children. *National Guidelines for Rural Community-Led Total Sanitation (R-CLTS)*; Tanzania Ministry of Health Community Development, Gender, Elderly and children: Dar es Salaam, Tanzania, 2016.
32. Maulit, J. How to Trigger for Handwashing with Soap. In *Frontiers of CLTS: Innovations and Insights*; UNICEF: Lilongwe, Malawi, 2014.
33. Sawyer, R.; Simpson-Hébert, M.; Wood, S.; Faul-Doyle, R.; Francis, V. *PHAST Step-by-Step Guide: A Participatory Approach for the Control of Diarrhoeal Disease*; WHO: Geneva, Switzerland, 2000.
34. Contzen, N.; Mosler, H.J. Identifying the psychological determinants of handwashing: Results from two cross-sectional questionnaire studies in Haiti and Ethiopia. *Am. J. Infect. Control* **2015**, *43*, 826–832. [[CrossRef](#)]
35. Mosler, H.J. Psychosocial determinants of handwashing: Quantitative evidence from a multi-country study using the RANAS model of behavior change. *Poster* **2017**.
36. Lubogo, M.; Anguzu, R.; Wanzira, H.; Namugwanya, I.; Namuddu, O.; Ssali, D.; Nanyonga, S.; Ssentongo, J.; Seeley, J. Willingness by people living with HIV/AIDS to utilize HIV services provided by Village Health team workers in Kalungu district, central Uganda. *Afr. Health Sci.* **2017**, *17*, 216–224. [[CrossRef](#)]
37. Downs, J.A.; Mwakisole, A.H.; Chandika, A.B.; Lugoba, S.; Kassim, R.; Laizer, E.; Magambo, K.A.; Lee, M.H.; Kalluvya, S.E.; Downs, D.J.; et al. Educating religious leaders to promote uptake of male circumcision in Tanzania: A cluster randomised trial. *Lancet* **2017**, *389*, 1124–1132. [[CrossRef](#)]
38. Alemayehu, M.; Lemma, H.; Abrha, K.; Adama, Y.; Fisseha, G.; Yebyo, H.; Gebeye, E.; Negash, K.; Yousuf, J.; Fantu, T.; et al. Family planning use and associated factors among pastoralist community of afar region, eastern Ethiopia. *BMC Women's Health* **2016**, *16*, 39. [[CrossRef](#)] [[PubMed](#)]



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Appendix 2: Data analysis

- Time: 1 (baseline), 2 (midline), 3 (follow-up)
- Time_f2: midline is compared to baseline (main effect)
- Time_f3: follow-up is compared to baseline (main effect)
- Time_f2:XXX: the change from baseline to midline is compared between the 2 groups indicated above the table (interaction)
- Time_f3:XXX: the change from baseline to follow-up is compared between the 2 groups indicated above the table (interaction)

For simplicity, the exploratory analyses only contain the basic model (model including all groups):

- Time: overall effect of time (main effect)
- Ctx: Contextualized group is compared to Control (main effect)
- Non-ctx: Non-contextualized group is compared to Control (main effect)
- Time:XXX: change over time is compared between Ctx/Non-ctx and Control (interaction)

1 Washing hands

1.1 Washing hands after defecation

1.1.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	wash_def	n	prop	error
Control HHV	1	0	368	0.7229862	0.0233288
Control HHV	1	1	141	0.2770138	0.0376883
Control HHV	2	0	355	0.7259714	0.0236725
Control HHV	2	1	134	0.2740286	0.0385306
Control HHV	3	0	355	0.7259714	0.0236725
Control HHV	3	1	134	0.2740286	0.0385306
Ctx HHVs (RANAS)	1	0	375	0.7411067	0.0226196
Ctx HHVs (RANAS)	1	1	131	0.2588933	0.0382706
Ctx HHVs (RANAS)	2	0	331	0.6853002	0.0255255
Ctx HHVs (RANAS)	2	1	152	0.3146998	0.0376675
Ctx HHVs (RANAS)	3	0	284	0.5929019	0.0291529
Ctx HHVs (RANAS)	3	1	193	0.4029228	0.0353059
Ctx HHVs (RANAS)	3	NA	2	0.0041754	0.0455957
Non-ctx HHVs (Norms)	1	0	386	0.7689243	0.0214548
Non-ctx HHVs (Norms)	1	1	116	0.2310757	0.0391372

Cohort	Time	wash_def	n	prop	error
Non-ctx HHVs (Norms)	2	0	351	0.7327766	0.0236194
Non-ctx HHVs (Norms)	2	1	128	0.2672234	0.0391127
Non-ctx HHVs (Norms)	3	0	267	0.5482546	0.0304567
Non-ctx HHVs (Norms)	3	1	219	0.4496920	0.0336154
Non-ctx HHVs (Norms)	3	NA	1	0.0020534	0.0452678
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

1.1.2 Statistical Analysis

1.1.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9564263	0.1646866	-5.8075542	0.0000000
Time_f2	-0.0113105	0.1438456	-0.0786293	0.9373275
Time_f3	-0.0240720	0.1438398	-0.1673527	0.8670925
CohortCtx HHVs (RANAS)	-0.1002503	0.2319495	-0.4322073	0.6655908
CohortNon-ctx HHVs (Norms)	-0.2697410	0.2344762	-1.1503982	0.2499799
Time_f2:CohortCtx HHVs (RANAS)	0.2982667	0.2033056	1.4670855	0.1423528
Time_f3:CohortCtx HHVs (RANAS)	0.7150909	0.2014372	3.5499448	0.0003853
Time_f2:CohortNon-ctx HHVs (Norms)	0.2321001	0.2087588	1.1118100	0.2662199
Time_f3:CohortNon-ctx HHVs (Norms)	1.0898983	0.2039396	5.3442219	0.0000001

1.1.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.0489392	0.1751606	-5.9884430	0.0000000
Time_f2	0.2864244	0.1435877	1.9947695	0.0460680
Time_f3	0.6892235	0.1410299	4.8870723	0.0000010
CohortNon-ctx HHVs (Norms)	-0.1785771	0.2467787	-0.7236326	0.4692913
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0653182	0.2084911	-0.3132903	0.7540602
Time_f3:CohortNon-ctx HHVs (Norms)	0.3750218	0.2009789	1.8659765	0.0620446

1.1.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9578230	0.1526541	-6.2744661	0.0000000

	Estimate	Std. Error	z value	Pr(> z)
Time_f2	-0.0135309	0.1435309	-0.0819004	0.9472159
Time_f3	-0.0234011	0.1435418	-0.1630261	0.8704979
CohortCtx HHVs (RANAS)	-0.0920398	0.2148136	-0.4284636	0.6683136
Time_f2:CohortCtx HHVs (RANAS)	0.2983245	0.2028649	1.4705574	0.1414108
Time_f3:CohortCtx HHVs (RANAS)	0.7097582	0.2010655	3.5299849	0.0004156

1.1.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9547178	0.1697738	-5.6234696	0.0000000
Time_f2	-0.0123007	0.1442828	-0.0852539	0.9320595
Time_f3	-0.0244595	0.1442595	-0.1695517	0.8653627
CohortNon-ctx HHVs (Norms)	-0.2909815	0.2415765	-1.2045111	0.2283921
Time_f2:CohortNon-ctx HHVs (Norms)	0.2358294	0.2094633	1.1258747	0.2602186
Time_f3:CohortNon-ctx HHVs (Norms)	1.1019144	0.2051275	5.3718519	0.0000001

1.1.3 Exploratory Analysis

1.1.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9127425	0.1989332	-4.588187	0.0000045
Time	-0.0109387	0.0736871	-0.148448	0.8819892
CohortCtx HHVs (RANAS)	-0.4992071	0.2813601	-1.774264	0.0760195
CohortNon-ctx HHVs (Norms)	-0.9645065	0.2869787	-3.360899	0.0007769
Time:CohortCtx HHVs (RANAS)	0.3614552	0.1037285	3.484627	0.0004928
Time:CohortNon-ctx HHVs (Norms)	0.5567500	0.1056673	5.268897	0.0000001

1.1.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9437615	0.2065552	-4.569052	0.0000049
CohortCtx HHVs (RANAS)	0.6683168	0.2890365	2.312223	0.0207654
CohortNon-ctx HHVs (Norms)	0.7941662	0.2887095	2.750745	0.0059460

1.2 Washing hands before cooking

1.2.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	wash_cook	n	prop	error
Control HHV	1	0	470	0.9233792	0.0122692
Control HHV	1	1	39	0.0766208	0.0425923
Control HHV	2	0	417	0.8527607	0.0173523
Control HHV	2	1	72	0.1472393	0.0417599
Control HHV	3	0	439	0.8977505	0.0144603
Control HHV	3	1	50	0.1022495	0.0428473
Ctx HHVs (RANAS)	1	0	460	0.9090909	0.0134038
Ctx HHVs (RANAS)	1	1	46	0.0909091	0.0423866
Ctx HHVs (RANAS)	2	0	389	0.8053830	0.0200732
Ctx HHVs (RANAS)	2	1	94	0.1946170	0.0408345
Ctx HHVs (RANAS)	3	0	382	0.7974948	0.0205613
Ctx HHVs (RANAS)	3	1	95	0.1983299	0.0409101
Ctx HHVs (RANAS)	3	NA	2	0.0041754	0.0455957
Non-ctx HHVs (Norms)	1	0	463	0.9223108	0.0124402
Non-ctx HHVs (Norms)	1	1	39	0.0776892	0.0428634
Non-ctx HHVs (Norms)	2	0	402	0.8392484	0.0183193
Non-ctx HHVs (Norms)	2	1	77	0.1607516	0.0418579
Non-ctx HHVs (Norms)	3	0	378	0.7761807	0.0214380
Non-ctx HHVs (Norms)	3	1	108	0.2217659	0.0399752
Non-ctx HHVs (Norms)	3	NA	1	0.0020534	0.0452678
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

1.2.2 Statistical Analysis

1.2.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.4822628	0.2181362	-11.3794155	0.0000000
Time_f2	0.7511268	0.2106896	3.5650871	0.0003637
Time_f3	0.3100539	0.2242811	1.3824345	0.1668383
CohortCtx HHVs (RANAS)	0.2152790	0.3006293	0.7160947	0.4739329
CohortNon-ctx HHVs (Norms)	-0.0079265	0.3072901	-0.0257948	0.9794210
Time_f2:CohortCtx HHVs (RANAS)	0.1498111	0.2862651	0.5233299	0.6007447

	Estimate	Std. Error	z value	Pr(> z)
Time_f3:CohortCtx HHVs (RANAS)	0.6125756	0.2963358	2.0671669	0.0387184
Time_f2:CohortNon-ctx HHVs (Norms)	0.0955735	0.2966770	0.3221467	0.7473415
Time_f3:CohortNon-ctx HHVs (Norms)	0.9321865	0.3006777	3.1002848	0.0019333

1.2.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.2739899	0.2079717	-10.9341308	0.0000000
Time_f2	0.9014917	0.1938861	4.6495950	0.0000033
Time_f3	0.9225419	0.1936726	4.7634095	0.0000019
CohortNon-ctx HHVs (Norms)	-0.2181509	0.2997766	-0.7277115	0.4667902
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0545187	0.2850149	-0.1912835	0.8483035
Time_f3:CohortNon-ctx HHVs (Norms)	0.3195670	0.2785731	1.1471566	0.2513169

1.2.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.4933480	0.2251656	-11.0733951	0.0000000
Time_f2	0.7516550	0.2107885	3.5659198	0.0003626
Time_f3	0.3098549	0.2243292	1.3812511	0.1672018
CohortCtx HHVs (RANAS)	0.2274657	0.3101670	0.7333652	0.4633357
Time_f2:CohortCtx HHVs (RANAS)	0.1515061	0.2864037	0.5289948	0.5968090
Time_f3:CohortCtx HHVs (RANAS)	0.6137129	0.2964213	2.0704079	0.0384142

1.2.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.5099052	0.2211487	-11.3494030	0.0000000
Time_f2	0.7535944	0.2102356	3.5845227	0.0003377
Time_f3	0.3118016	0.2234038	1.3956865	0.1628089
CohortNon-ctx HHVs (Norms)	-0.0001456	0.2994722	-0.0004863	0.9996120
Time_f2:CohortNon-ctx HHVs (Norms)	0.0981437	0.2958146	0.3317743	0.7400597
Time_f3:CohortNon-ctx HHVs (Norms)	0.9388158	0.3002282	3.1270079	0.0017660

1.2.3 Exploratory Analysis

1.2.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.3262188	0.2700165	-8.6150980	0.0000000
Time	0.1129415	0.1057318	1.0681880	0.2854357
CohortCtx HHVs (RANAS)	-0.0899373	0.3686278	-0.2439787	0.8072473
CohortNon-ctx HHVs (Norms)	-0.6277238	0.3807309	-1.6487335	0.0992022
Time:CohortCtx HHVs (RANAS)	0.2843906	0.1406733	2.0216396	0.0432136
Time:CohortNon-ctx HHVs (Norms)	0.4664653	0.1441507	3.2359562	0.0012124

1.2.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.353941	0.2807350	-8.384923	0.0000000
CohortCtx HHVs (RANAS)	1.046713	0.3735714	2.801910	0.0050801
CohortNon-ctx HHVs (Norms)	1.100864	0.3710581	2.966825	0.0030089

1.3 Washing hands before eating

1.3.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	wash_eat	n	prop	error
Control HHV	1	0	375	0.7367387	0.0227423
Control HHV	1	1	134	0.2632613	0.0380450
Control HHV	2	0	355	0.7259714	0.0236725
Control HHV	2	1	134	0.2740286	0.0385306
Control HHV	3	0	359	0.7341513	0.0233165
Control HHV	3	1	130	0.2658487	0.0387470
Ctx HHVs (RANAS)	1	0	370	0.7312253	0.0230472
Ctx HHVs (RANAS)	1	1	136	0.2687747	0.0380146
Ctx HHVs (RANAS)	2	0	330	0.6832298	0.0256094
Ctx HHVs (RANAS)	2	1	153	0.3167702	0.0376106
Ctx HHVs (RANAS)	3	0	288	0.6012526	0.0288523
Ctx HHVs (RANAS)	3	1	189	0.3945720	0.0355520
Ctx HHVs (RANAS)	3	NA	2	0.0041754	0.0455957
Non-ctx HHVs (Norms)	1	0	387	0.7709163	0.0213622
Non-ctx HHVs (Norms)	1	1	115	0.2290837	0.0391879

Cohort	Time	wash_eat	n	prop	error
Non-ctx HHVs (Norms)	2	0	353	0.7369520	0.0234342
Non-ctx HHVs (Norms)	2	1	126	0.2630480	0.0392240
Non-ctx HHVs (Norms)	3	0	276	0.5667351	0.0298272
Non-ctx HHVs (Norms)	3	1	210	0.4312115	0.0341752
Non-ctx HHVs (Norms)	3	NA	1	0.0020534	0.0452678
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

1.3.2 Statistical Analysis

1.3.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.0478659	0.1735248	-6.0387093	0.0000000
Time_f2	0.0616085	0.1450517	0.4247350	0.6710298
Time_f3	0.0054555	0.1456893	0.0374464	0.9701291
CohortCtx HHVs (RANAS)	0.0595119	0.2430598	0.2448449	0.8065766
CohortNon-ctx HHVs (Norms)	-0.1967815	0.2460020	-0.7999181	0.4237582
Time_f2:CohortCtx HHVs (RANAS)	0.1835304	0.2037142	0.9009211	0.3676303
Time_f3:CohortCtx HHVs (RANAS)	0.5998161	0.2024957	2.9621175	0.0030553
Time_f2:CohortNon-ctx HHVs (Norms)	0.1527065	0.2103545	0.7259484	0.4678704
Time_f3:CohortNon-ctx HHVs (Norms)	1.0007785	0.2058529	4.8616204	0.0000012

1.3.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9965052	0.1841823	-5.4104281	0.0000001
Time_f2	0.2445386	0.1428667	1.7116563	0.0869600
Time_f3	0.6026058	0.1405240	4.2882783	0.0000180
CohortNon-ctx HHVs (Norms)	-0.2478499	0.2599017	-0.9536292	0.3402714
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0300533	0.2087554	-0.1439642	0.8855288
Time_f3:CohortNon-ctx HHVs (Norms)	0.4004923	0.2014076	1.9884671	0.0467601

1.3.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.0512581	0.1599386	-6.5728834	0.0000000

	Estimate	Std. Error	z value	Pr(> z)
Time_f2	0.0613207	0.1453097	0.4219999	0.6730251
Time_f3	0.0058557	0.1456726	0.0401977	0.9679355
CohortCtx HHVs (RANAS)	0.0595420	0.2237501	0.2661094	0.7901550
Time_f2:CohortCtx HHVs (RANAS)	0.1858806	0.2036495	0.9127475	0.3613753
Time_f3:CohortCtx HHVs (RANAS)	0.5987070	0.2025325	2.9561031	0.0031155

1.3.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.0421959	0.1775740	-5.8690810	0.0000000
Time_f2	0.0613207	0.1453097	0.4219999	0.6730251
Time_f3	0.0054137	0.1459396	0.0370953	0.9704090
CohortNon-ctx HHVs (Norms)	-0.2193224	0.2516702	-0.8714676	0.3834989
Time_f2:CohortNon-ctx HHVs (Norms)	0.1549039	0.2108115	0.7347982	0.4624624
Time_f3:CohortNon-ctx HHVs (Norms)	1.0078132	0.2066974	4.8757901	0.0000011

1.3.3 Exploratory Analysis

1.3.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9810076	0.2071197	-4.7364275	0.0000022
Time	-0.0056035	0.0744031	-0.0753121	0.9399664
CohortCtx HHVs (RANAS)	-0.3127272	0.2912150	-1.0738706	0.2828807
CohortNon-ctx HHVs (Norms)	-0.8822717	0.2975884	-2.9647385	0.0030294
Time:CohortCtx HHVs (RANAS)	0.3101245	0.1041233	2.9784346	0.0028972
Time:CohortNon-ctx HHVs (Norms)	0.5237829	0.1064893	4.9186443	0.0000009

1.3.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.9999945	0.2282185	-4.381741	0.0000118
CohortCtx HHVs (RANAS)	0.7020798	0.3196096	2.196679	0.0280434
CohortNon-ctx HHVs (Norms)	0.7674770	0.3197417	2.400303	0.0163815

1.4 Washing hands before feeding a child

1.4.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	wash_feed	n	prop	error
Control HHV	1	0	496	0.9744597	0.0070836
Control HHV	1	1	13	0.0255403	0.0437545
Control HHV	2	0	453	0.9263804	0.0122699
Control HHV	2	1	36	0.0736196	0.0435251
Control HHV	3	0	471	0.9631902	0.0086762
Control HHV	3	1	18	0.0368098	0.0443815
Ctx HHVs (RANAS)	1	0	479	0.9466403	0.0102691
Ctx HHVs (RANAS)	1	1	27	0.0533597	0.0432531
Ctx HHVs (RANAS)	2	0	443	0.9171843	0.0130943
Ctx HHVs (RANAS)	2	1	40	0.0828157	0.0435767
Ctx HHVs (RANAS)	3	0	463	0.9665971	0.0083507
Ctx HHVs (RANAS)	3	1	14	0.0292276	0.0450185
Ctx HHVs (RANAS)	3	NA	2	0.0041754	0.0455957
Non-ctx HHVs (Norms)	1	0	481	0.9581673	0.0091286
Non-ctx HHVs (Norms)	1	1	21	0.0418327	0.0436887
Non-ctx HHVs (Norms)	2	0	435	0.9081420	0.0138481
Non-ctx HHVs (Norms)	2	1	44	0.0918580	0.0435421
Non-ctx HHVs (Norms)	3	0	454	0.9322382	0.0117958
Non-ctx HHVs (Norms)	3	1	32	0.0657084	0.0438003
Non-ctx HHVs (Norms)	3	NA	1	0.0020534	0.0452678
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

1.4.2 Statistical Analysis

1.4.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.5708441	0.3739813	-12.2221184	0.0000000
Time_f2	1.1936916	0.3425594	3.4846270	0.0004928
Time_f3	0.3980827	0.3799820	1.0476357	0.2948065
CohortCtx HHVs (RANAS)	0.8256759	0.3728904	2.2142588	0.0268110
CohortNon-ctx HHVs (Norms)	0.5271860	0.3877947	1.3594461	0.1740053
Time_f2:CohortCtx HHVs (RANAS)	-0.6849993	0.4358532	-1.5716283	0.1160368

	Estimate	Std. Error	z value	Pr(> z)
Time_f3:CohortCtx HHVs (RANAS)	-1.0658468	0.5145480	-2.0714233	0.0383193
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2481643	0.4465536	-0.5557324	0.5783938
Time_f3:CohortNon-ctx HHVs (Norms)	0.1243239	0.4854173	0.2561176	0.7978600

1.4.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.5816085	0.2993421	-11.964933	0.0000000
Time_f2	0.4995040	0.2678218	1.865061	0.0621728
Time_f3	-0.6567777	0.3438271	-1.910198	0.0561078
CohortNon-ctx HHVs (Norms)	-0.2884136	0.3232105	-0.892340	0.3722107
Time_f2:CohortNon-ctx HHVs (Norms)	0.4218415	0.3910835	1.078648	0.2807446
Time_f3:CohortNon-ctx HHVs (Norms)	1.1685099	0.4560477	2.562254	0.0103995

1.4.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.5815045	0.4231334	-10.827566	0.0000000
Time_f2	1.1951415	0.3440335	3.473910	0.0005129
Time_f3	0.3984925	0.3805305	1.047203	0.2950062
CohortCtx HHVs (RANAS)	0.8267192	0.3740084	2.210430	0.0270754
Time_f2:CohortCtx HHVs (RANAS)	-0.6858651	0.4366101	-1.570887	0.1162089
Time_f3:CohortCtx HHVs (RANAS)	-1.0669514	0.5154368	-2.069995	0.0384528

1.4.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.8279517	0.4705989	-10.2591655	0.0000000
Time_f2	1.2312880	0.3510655	3.5072881	0.0004527
Time_f3	0.4084945	0.3852882	1.0602310	0.2890395
CohortNon-ctx HHVs (Norms)	0.5372251	0.3996516	1.3442336	0.1788729
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2489148	0.4540789	-0.5481752	0.5835716
Time_f3:CohortNon-ctx HHVs (Norms)	0.1307265	0.4926541	0.2653515	0.7907387

1.4.3 Exploratory Analysis

1.4.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.2511364	0.4241849	-10.0218954	0.0000000
Time	0.2101931	0.1630946	1.2887801	0.1974746
CohortCtx HHVs (RANAS)	1.1973366	0.4904868	2.4411189	0.0146418
CohortNon-ctx HHVs (Norms)	0.3963991	0.4997280	0.7932296	0.4276441
Time:CohortCtx HHVs (RANAS)	-0.4665874	0.2212121	-2.1092305	0.0349247
Time:CohortNon-ctx HHVs (Norms)	0.0058082	0.2155486	0.0269461	0.9785028

1.4.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.3234539	0.2773000	-11.9850484	0.0000000
CohortCtx HHVs (RANAS)	-0.2169221	0.3979333	-0.5451218	0.5856697
CohortNon-ctx HHVs (Norms)	0.6555712	0.3437035	1.9073740	0.0564722

1.5 Washing hands before other activities

1.5.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	wash_other	n	prop	error
Control HHV	1	0	502	0.9862475	0.0051979
Control HHV	1	1	7	0.0137525	0.0440184
Control HHV	2	0	453	0.9263804	0.0122699
Control HHV	2	1	36	0.0736196	0.0435251
Control HHV	3	0	440	0.8997955	0.0143149
Control HHV	3	1	49	0.1002045	0.0428961
Ctx HHVs (RANAS)	1	0	482	0.9525692	0.0096818
Ctx HHVs (RANAS)	1	1	24	0.0474308	0.0433883
Ctx HHVs (RANAS)	2	0	437	0.9047619	0.0140421
Ctx HHVs (RANAS)	2	1	46	0.0952381	0.0432806
Ctx HHVs (RANAS)	3	0	422	0.8810021	0.0157617
Ctx HHVs (RANAS)	3	1	55	0.1148225	0.0429880
Ctx HHVs (RANAS)	3	NA	2	0.0041754	0.0455957
Non-ctx HHVs (Norms)	1	0	488	0.9721116	0.0074535
Non-ctx HHVs (Norms)	1	1	14	0.0278884	0.0440054

Cohort	Time	wash_other	n	prop	error
Non-ctx HHVs (Norms)	2	0	425	0.8872651	0.0153413
Non-ctx HHVs (Norms)	2	1	54	0.1127349	0.0430387
Non-ctx HHVs (Norms)	3	0	416	0.8542094	0.0173022
Non-ctx HHVs (Norms)	3	1	70	0.1437372	0.0419314
Non-ctx HHVs (Norms)	3	NA	1	0.0020534	0.0452678
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

1.5.2 Statistical Analysis

1.5.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.4420122	0.4193750	-10.5919802	0.0000000
Time_f2	1.7844983	0.4205754	4.2429927	0.0000221
Time_f3	2.1176506	0.4120267	5.1395957	0.0000003
CohortCtx HHVs (RANAS)	1.2255538	0.4786843	2.5602549	0.0104595
CohortNon-ctx HHVs (Norms)	0.7419890	0.5071268	1.4631233	0.1434336
Time_f2:CohortCtx HHVs (RANAS)	-1.0108275	0.4962405	-2.0369711	0.0416529
Time_f3:CohortCtx HHVs (RANAS)	-1.1299596	0.4853308	-2.3282256	0.0199001
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2627658	0.5218152	-0.5035610	0.6145699
Time_f3:CohortNon-ctx HHVs (Norms)	-0.3058757	0.5107164	-0.5989149	0.5492296

1.5.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.1615676	0.2620011	-12.067002	0.0000000
Time_f2	0.7666460	0.2630626	2.914310	0.0035648
Time_f3	0.9796685	0.2565780	3.818209	0.0001344
CohortNon-ctx HHVs (Norms)	-0.4938887	0.3725672	-1.325637	0.1849601
Time_f2:CohortNon-ctx HHVs (Norms)	0.7454590	0.4056534	1.837675	0.0661103
Time_f3:CohortNon-ctx HHVs (Norms)	0.8196831	0.3961783	2.068975	0.0385484

1.5.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.586241	0.4420568	-10.374778	0.0000000

	Estimate	Std. Error	z value	Pr(> z)
Time_f2	2.147032	0.4147442	5.176761	0.0000002
Time_f3	2.147032	0.4147442	5.176761	0.0000002
CohortCtx HHVs (RANAS)	1.253446	0.5003359	2.505208	0.0122379
Time_f2:CohortCtx HHVs (RANAS)	-1.020571	0.4993179	-2.043930	0.0409605
Time_f3:CohortCtx HHVs (RANAS)	-1.140960	0.4883631	-2.336294	0.0194759

1.5.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.3758439	0.4157839	-10.5243214	0.0000000
Time_f2	1.7774323	0.4106880	4.3279382	0.0000151
Time_f3	2.1048231	0.4023047	5.2319124	0.0000002
CohortNon-ctx HHVs (Norms)	0.7557483	0.5008690	1.5088741	0.1313310
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2666025	0.5096200	-0.5231398	0.6008770
Time_f3:CohortNon-ctx HHVs (Norms)	-0.3081469	0.4987400	-0.6178509	0.5366737

1.5.3 Exploratory Analysis

1.5.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.6572031	0.4313044	-10.797950	0.0000000
Time	0.8292708	0.1559607	5.317178	0.0000001
CohortCtx HHVs (RANAS)	1.1433705	0.5259756	2.173809	0.0297195
CohortNon-ctx HHVs (Norms)	0.6381126	0.5362802	1.189887	0.2340910
Time:CohortCtx HHVs (RANAS)	-0.3673181	0.1994703	-1.841468	0.0655530
Time:CohortNon-ctx HHVs (Norms)	-0.0739894	0.2008240	-0.368429	0.7125534

1.5.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.2430071	0.2464002	-9.1031062	0.0000000
CohortCtx HHVs (RANAS)	0.1721661	0.3402149	0.5060509	0.6128209
CohortNon-ctx HHVs (Norms)	0.4781562	0.3335045	1.4337322	0.1516487

2 WASH infrastructure

2.1 Households owning a latrine

2.1.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	latrine	n	prop	error
Control HHV	1	0	42	0.0825147	0.0424562
Control HHV	1	1	467	0.9174853	0.0127323
Control HHV	2	0	36	0.0736196	0.0435251
Control HHV	2	1	453	0.9263804	0.0122699
Control HHV	3	0	27	0.0552147	0.0439554
Control HHV	3	1	462	0.9447853	0.0106261
Ctx HHVs (RANAS)	1	0	37	0.0731225	0.0427992
Ctx HHVs (RANAS)	1	1	469	0.9268775	0.0120213
Ctx HHVs (RANAS)	2	0	26	0.0538302	0.0442600
Ctx HHVs (RANAS)	2	1	457	0.9461698	0.0105570
Ctx HHVs (RANAS)	3	0	29	0.0605428	0.0442864
Ctx HHVs (RANAS)	3	1	450	0.9394572	0.0112425
Non-ctx HHVs (Norms)	1	0	38	0.0756972	0.0429097
Non-ctx HHVs (Norms)	1	1	464	0.9243028	0.0122797
Non-ctx HHVs (Norms)	2	0	32	0.0668058	0.0441386
Non-ctx HHVs (Norms)	2	1	447	0.9331942	0.0118097
Non-ctx HHVs (Norms)	3	0	19	0.0390144	0.0444216
Non-ctx HHVs (Norms)	3	1	468	0.9609856	0.0089505
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

2.1.2 Statistical Analysis

2.1.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	6.7979202	0.4380437	15.5188182	0.0000000
Time_f2	0.2722144	0.3472905	0.7838233	0.4331438
Time_f3	0.8418371	0.3691753	2.2803181	0.0225888

	Estimate	Std. Error	z value	Pr(> z)
CohortCtx HHVs (RANAS)	0.1249935	0.4505515	0.2774232	0.7814552
CohortNon-ctx HHVs (Norms)	0.0367307	0.4500951	0.0816065	0.9349596
Time_f2:CohortCtx HHVs (RANAS)	0.2204910	0.5078601	0.4341570	0.6641745
Time_f3:CohortCtx HHVs (RANAS)	-0.6052591	0.5188646	-1.1665067	0.2434096
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0045096	0.5069259	-0.0088960	0.9929021
Time_f3:CohortNon-ctx HHVs (Norms)	0.6190719	0.5576240	1.1101959	0.2669146

2.1.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	6.9253741	0.5027612	13.7746796	0.0000000
Time_f2	0.4927866	0.3710576	1.3280598	0.1841583
Time_f3	0.2366222	0.3649491	0.6483706	0.5167453
CohortNon-ctx HHVs (Norms)	-0.0884089	0.4576888	-0.1931637	0.8468308
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2250153	0.5234599	-0.4298617	0.6672963
Time_f3:CohortNon-ctx HHVs (Norms)	1.2246508	0.5584239	2.1930486	0.0283039

2.1.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	6.6203139	0.4901220	13.5074824	0.0000000
Time_f2	0.2658027	0.3431920	0.7745015	0.4386343
Time_f3	0.8248507	0.3658919	2.2543562	0.0241738
CohortCtx HHVs (RANAS)	0.1233559	0.4399443	0.2803898	0.7791784
Time_f2:CohortCtx HHVs (RANAS)	0.2194654	0.5020834	0.4371094	0.6620320
Time_f3:CohortCtx HHVs (RANAS)	-0.5904699	0.5134173	-1.1500779	0.2501118

2.1.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	6.9602763	0.4849489	14.3525988	0.0000000
Time_f2	0.2780372	0.3511755	0.7917331	0.4285163
Time_f3	0.8571292	0.3731064	2.2972781	0.0216029
CohortNon-ctx HHVs (Norms)	0.0348783	0.4603342	0.0757673	0.9396042
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0049204	0.5129307	-0.0095927	0.9923463
Time_f3:CohortNon-ctx HHVs (Norms)	0.6316401	0.5631934	1.1215332	0.2620610

2.1.3 Exploratory Analysis

2.1.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	6.2422364	0.5236425	11.9207968	0.0000000
Time	0.3582670	0.1825001	1.9631063	0.0496338
CohortCtx HHVs (RANAS)	0.5552737	0.6254096	0.8878560	0.3746182
CohortNon-ctx HHVs (Norms)	-0.4060326	0.6068507	-0.6690815	0.5034435
Time:CohortCtx HHVs (RANAS)	-0.2188630	0.2650871	-0.8256270	0.4090157
Time:CohortNon-ctx HHVs (Norms)	0.3432355	0.2753858	1.2463804	0.2126248

2.1.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	3.0895028	0.3207967	9.6307193	0.0000000
CohortCtx HHVs (RANAS)	-0.1580246	0.4268029	-0.3702519	0.7111948
CohortNon-ctx HHVs (Norms)	0.3520228	0.4508638	0.7807741	0.4349353

2.2 Households owning an improved latrine

2.2.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	imp_latrine	n	prop	error
Control HHV	1	0	448	0.8801572	0.0153443
Control HHV	1	1	19	0.0373281	0.0434891
Control HHV	1	NA	42	0.0825147	0.0424562
Control HHV	2	0	400	0.8179959	0.0192924
Control HHV	2	1	53	0.1083845	0.0427006
Control HHV	2	NA	36	0.0736196	0.0435251
Control HHV	3	0	246	0.5030675	0.0318782
Control HHV	3	1	216	0.4417178	0.0337888
Control HHV	3	NA	27	0.0552147	0.0439554
Ctx HHVs (RANAS)	1	0	451	0.8913043	0.0146565
Ctx HHVs (RANAS)	1	1	18	0.0355731	0.0436576
Ctx HHVs (RANAS)	1	NA	37	0.0731225	0.0427992
Ctx HHVs (RANAS)	2	0	390	0.8074534	0.0199662

Cohort	Time	imp_latrine	n	prop	error
Ctx HHVs (RANAS)	2	1	67	0.1387164	0.0422279
Ctx HHVs (RANAS)	2	NA	26	0.0538302	0.0442600
Ctx HHVs (RANAS)	3	0	161	0.3361169	0.0372287
Ctx HHVs (RANAS)	3	1	289	0.6033403	0.0287767
Ctx HHVs (RANAS)	3	NA	29	0.0605428	0.0442864
Non-ctx HHVs (Norms)	1	0	434	0.8645418	0.0164267
Non-ctx HHVs (Norms)	1	1	30	0.0597610	0.0432780
Non-ctx HHVs (Norms)	1	NA	38	0.0756972	0.0429097
Non-ctx HHVs (Norms)	2	0	371	0.7745303	0.0216958
Non-ctx HHVs (Norms)	2	1	76	0.1586639	0.0419099
Non-ctx HHVs (Norms)	2	NA	32	0.0668058	0.0441386
Non-ctx HHVs (Norms)	3	0	166	0.3408624	0.0367895
Non-ctx HHVs (Norms)	3	1	302	0.6201232	0.0279291
Non-ctx HHVs (Norms)	3	NA	19	0.0390144	0.0444216
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

2.2.2 Statistical Analysis

2.2.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.6994454	0.3789060	-9.7634915	0.0000000
Time_f2	1.2575018	0.2898229	4.3388628	0.0000143
Time_f3	3.6551774	0.2886285	12.6639531	0.0000000
CohortCtx HHVs (RANAS)	-0.2873314	0.5161620	-0.5566689	0.5777537
CohortNon-ctx HHVs (Norms)	0.4498265	0.4957389	0.9073861	0.3642027
Time_f2:CohortCtx HHVs (RANAS)	0.4278102	0.4092959	1.0452345	0.2959146
Time_f3:CohortCtx HHVs (RANAS)	1.1439301	0.3950553	2.8956203	0.0037841
Time_f2:CohortNon-ctx HHVs (Norms)	0.0664279	0.3809903	0.1743558	0.8615859
Time_f3:CohortNon-ctx HHVs (Norms)	0.7249863	0.3677989	1.9711487	0.0487069

2.2.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.4600917	0.4815833	-9.2613093	0.0000000
Time_f2	1.8230236	0.3081951	5.9151604	0.0000000
Time_f3	5.3363023	0.3922502	13.6043325	0.0000000
CohortNon-ctx HHVs (Norms)	0.8727134	0.5921920	1.4737000	0.1405624
Time_f2:CohortNon-ctx HHVs (Norms)	-0.3882811	0.3977596	-0.9761703	0.3289801
Time_f3:CohortNon-ctx HHVs (Norms)	-0.4456081	0.3996341	-1.1150404	0.2648331

2.2.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.5495184	0.3467426	-10.2367530	0.0000000
Time_f2	1.2293956	0.2873382	4.2785672	0.0000188
Time_f3	3.5312283	0.2903663	12.1612864	0.0000000
CohortCtx HHVs (RANAS)	-0.2806267	0.4650888	-0.6033831	0.5462539
Time_f2:CohortCtx HHVs (RANAS)	0.4116246	0.4051026	1.0160998	0.3095819
Time_f3:CohortCtx HHVs (RANAS)	1.0790158	0.3896483	2.7692044	0.0056193

2.2.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.5622082	0.3749665	-9.5000696	0.0000000
Time_f2	1.2319239	0.2869341	4.2934037	0.0000176
Time_f3	3.5130864	0.2875113	12.2189507	0.0000000
CohortNon-ctx HHVs (Norms)	0.4181921	0.4868355	0.8590008	0.3903401
Time_f2:CohortNon-ctx HHVs (Norms)	0.0529174	0.3760877	0.1407049	0.8881031
Time_f3:CohortNon-ctx HHVs (Norms)	0.6687563	0.3619313	1.8477435	0.0646395

2.2.3 Exploratory Analysis

2.2.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.9779895	0.4564037	-13.0980306	0.0000000
Time	1.9663214	0.1457969	13.4867155	0.0000000
CohortCtx HHVs (RANAS)	-0.8522430	0.6037302	-1.4116288	0.1580593
CohortNon-ctx HHVs (Norms)	-0.0646507	0.5851511	-0.1104855	0.9120244
Time:CohortCtx HHVs (RANAS)	0.5272591	0.1967174	2.6802868	0.0073559
Time:CohortNon-ctx HHVs (Norms)	0.3497402	0.1895033	1.8455631	0.0649557

2.2.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.1024977	0.3077065	0.3331021	0.7390572
CohortCtx HHVs (RANAS)	0.6586759	0.4381315	1.5033749	0.1327424
CohortNon-ctx HHVs (Norms)	0.8840687	0.4399548	2.0094537	0.0444890

2.3 Households owning a clean improved latrine

2.3.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	cleanlatrine	n	prop	error
Control HHV	1	0	456	0.8958743	0.0143028
Control HHV	1	1	11	0.0216110	0.0438427
Control HHV	1	NA	42	0.0825147	0.0424562
Control HHV	2	0	407	0.8323108	0.0185182
Control HHV	2	1	46	0.0940695	0.0430421
Control HHV	2	NA	36	0.0736196	0.0435251
Control HHV	3	0	279	0.5705521	0.0296347
Control HHV	3	1	183	0.3742331	0.0357727
Control HHV	3	NA	27	0.0552147	0.0439554
Ctx HHVs (RANAS)	1	0	451	0.8913043	0.0146565
Ctx HHVs (RANAS)	1	1	18	0.0355731	0.0436576
Ctx HHVs (RANAS)	1	NA	37	0.0731225	0.0427992
Ctx HHVs (RANAS)	2	0	394	0.8157350	0.0195321
Ctx HHVs (RANAS)	2	1	63	0.1304348	0.0424304
Ctx HHVs (RANAS)	2	NA	26	0.0538302	0.0442600
Ctx HHVs (RANAS)	3	0	200	0.4175365	0.0348712
Ctx HHVs (RANAS)	3	1	250	0.5219207	0.0315924
Ctx HHVs (RANAS)	3	NA	29	0.0605428	0.0442864
Non-ctx HHVs (Norms)	1	0	443	0.8824701	0.0153011
Non-ctx HHVs (Norms)	1	1	21	0.0418327	0.0436887
Non-ctx HHVs (Norms)	1	NA	38	0.0756972	0.0429097
Non-ctx HHVs (Norms)	2	0	375	0.7828810	0.0212903

Cohort	Time	cleanlatrine	n	prop	error
Non-ctx HHVs (Norms)	2	1	72	0.1503132	0.0421174
Non-ctx HHVs (Norms)	2	NA	32	0.0668058	0.0441386
Non-ctx HHVs (Norms)	3	0	205	0.4209446	0.0344822
Non-ctx HHVs (Norms)	3	1	263	0.5400411	0.0307323
Non-ctx HHVs (Norms)	3	NA	19	0.0390144	0.0444216
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

2.3.2 Statistical Analysis

2.3.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.1762829	0.4067411	-10.2676685	0.0000000
Time_f2	1.6538801	0.3529336	4.6860936	0.0000028
Time_f3	3.7762855	0.3431843	11.0036668	0.0000000
CohortCtx HHVs (RANAS)	0.3739810	0.5222256	0.7161292	0.4739116
CohortNon-ctx HHVs (Norms)	0.6970787	0.5155074	1.3522188	0.1763053
Time_f2:CohortCtx HHVs (RANAS)	-0.1086679	0.4545311	-0.2390770	0.8110459
Time_f3:CohortCtx HHVs (RANAS)	0.3382649	0.4323224	0.7824366	0.4339580
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0689844	0.4444935	-0.1551977	0.8766654
Time_f3:CohortNon-ctx HHVs (Norms)	0.2654250	0.4237795	0.6263281	0.5310998

2.3.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.9761584	0.3982591	-9.9838491	0.0000000
Time_f2	1.5856039	0.2926845	5.4174511	0.0000001
Time_f3	4.2782252	0.3207706	13.3373369	0.0000000
CohortNon-ctx HHVs (Norms)	0.3759770	0.5145499	0.7306911	0.4649679
Time_f2:CohortNon-ctx HHVs (Norms)	0.0390292	0.3993288	0.0977369	0.9221412
Time_f3:CohortNon-ctx HHVs (Norms)	-0.0750442	0.3858841	-0.1944734	0.8458052

2.3.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.1487941	0.4007399	-10.3528337	0.0000000

	Estimate	Std. Error	z value	Pr(> z)
Time_f2	1.6325940	0.3508171	4.6536899	0.0000033
Time_f3	3.7703688	0.3489488	10.8049325	0.0000000
CohortCtx HHVs (RANAS)	0.3564550	0.5029060	0.7087905	0.4784545
Time_f2:CohortCtx HHVs (RANAS)	-0.1064215	0.4543076	-0.2342498	0.8147910
Time_f3:CohortCtx HHVs (RANAS)	0.3377667	0.4324598	0.7810361	0.4347813

2.3.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.0637679	0.4057261	-10.0160384	0.0000000
Time_f2	1.6325940	0.3508171	4.6536899	0.0000033
Time_f3	3.6760252	0.3426204	10.7291498	0.0000000
CohortNon-ctx HHVs (Norms)	0.6668252	0.5103909	1.3064991	0.1913829
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0770747	0.4410942	-0.1747352	0.8612877
Time_f3:CohortNon-ctx HHVs (Norms)	0.2331977	0.4200744	0.5551344	0.5788028

2.3.3 Exploratory Analysis

2.3.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-6.1797191	0.4725572	-13.0771865	0.0000000
Time	1.9238483	0.1541632	12.4792982	0.0000000
CohortCtx HHVs (RANAS)	-0.0404525	0.6003713	-0.0673791	0.9462799
CohortNon-ctx HHVs (Norms)	0.2835865	0.5958462	0.4759392	0.6341177
Time:CohortCtx HHVs (RANAS)	0.2256662	0.1985425	1.1366141	0.2556997
Time:CohortNon-ctx HHVs (Norms)	0.1998149	0.1966581	1.0160524	0.3096044

2.3.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.2633694	0.2565754	-1.026479	0.3046656
CohortCtx HHVs (RANAS)	0.5856757	0.3645017	1.606785	0.1081016
CohortNon-ctx HHVs (Norms)	0.7457740	0.3641163	2.048176	0.0405428

3 Sanitation

3.1 Households that normally use the latrine when at home

3.1.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	uselatrine	n	prop	error
Control HHV	1	0	36	0.0707269	0.0427280
Control HHV	1	1	449	0.8821218	0.0152180
Control HHV	1	NA	24	0.0471513	0.0432666
Control HHV	2	0	10	0.0204499	0.0447568
Control HHV	2	1	467	0.9550102	0.0095919
Control HHV	2	NA	12	0.0245399	0.0446633
Control HHV	3	0	46	0.0940695	0.0430421
Control HHV	3	1	435	0.8895706	0.0150275
Control HHV	3	NA	8	0.0163599	0.0448501
Ctx HHVs (RANAS)	1	0	27	0.0533597	0.0432531
Ctx HHVs (RANAS)	1	1	463	0.9150198	0.0129594
Ctx HHVs (RANAS)	1	NA	16	0.0316206	0.0437469
Ctx HHVs (RANAS)	2	0	4	0.0082816	0.0453128
Ctx HHVs (RANAS)	2	1	470	0.9730849	0.0074649
Ctx HHVs (RANAS)	2	NA	9	0.0186335	0.0450757
Ctx HHVs (RANAS)	3	0	38	0.0793319	0.0438413
Ctx HHVs (RANAS)	3	1	430	0.8977035	0.0146138
Ctx HHVs (RANAS)	3	NA	11	0.0229645	0.0451635
Non-ctx HHVs (Norms)	1	0	24	0.0478088	0.0435522
Non-ctx HHVs (Norms)	1	1	463	0.9223108	0.0124402
Non-ctx HHVs (Norms)	1	NA	15	0.0298805	0.0439603
Non-ctx HHVs (Norms)	2	0	9	0.0187891	0.0452599
Non-ctx HHVs (Norms)	2	1	460	0.9603340	0.0091000
Non-ctx HHVs (Norms)	2	NA	10	0.0208768	0.0452117
Non-ctx HHVs (Norms)	3	0	71	0.1457906	0.0418811
Non-ctx HHVs (Norms)	3	1	408	0.8377823	0.0182509
Non-ctx HHVs (Norms)	3	NA	8	0.0164271	0.0449406
NA	1	NA	11	1.0000000	0.0000000

Cohort	Time	uselatrine	n	prop	error
NA	3	NA	1	1.0000000	0.0000000

3.1.2 Statistical Analysis

3.1.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	2.5333998	0.1861414	13.6100794	0.0000000
Time_f2	1.3206801	0.3630796	3.6374395	0.0002754
Time_f3	-0.2791720	0.2324914	-1.2007839	0.2298350
CohortCtx HHVs (RANAS)	0.3012389	0.2793506	1.0783544	0.2808756
CohortNon-ctx HHVs (Norms)	0.4497928	0.2872496	1.5658605	0.1173813
Time_f2:CohortCtx HHVs (RANAS)	0.6060482	0.6497905	0.9326825	0.3509839
Time_f3:CohortCtx HHVs (RANAS)	-0.1383344	0.3490918	-0.3962695	0.6919062
Time_f2:CohortNon-ctx HHVs (Norms)	-0.3430549	0.5373557	-0.6384130	0.5232049
Time_f3:CohortNon-ctx HHVs (Norms)	-0.9336089	0.3382584	-2.7600467	0.0057793

3.1.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	2.8371141	0.2028521	13.9861190	0.0000000
Time_f2	1.9256452	0.5397094	3.5679300	0.0003598
Time_f3	-0.4164564	0.2605062	-1.5986430	0.1098999
CohortNon-ctx HHVs (Norms)	0.1341557	0.2975567	0.4508578	0.6520920
Time_f2:CohortNon-ctx HHVs (Norms)	-0.9497561	0.6696752	-1.4182339	0.1561225
Time_f3:CohortNon-ctx HHVs (Norms)	-0.7953465	0.3580976	-2.2210331	0.0263487

3.1.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	3.3223176	0.3252981	10.2131475	0.0000000
Time_f2	1.4102189	0.3776511	3.7341844	0.0001883
Time_f3	-0.3324311	0.2482211	-1.3392541	0.1804880
CohortCtx HHVs (RANAS)	0.3247427	0.2958428	1.0976866	0.2723414
Time_f2:CohortCtx HHVs (RANAS)	0.6036806	0.6623338	0.9114447	0.3620611
Time_f3:CohortCtx HHVs (RANAS)	-0.1204994	0.3682877	-0.3271882	0.7435256

3.1.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	3.0297262	0.2728078	11.1057163	0.0000000
Time_f2	1.3677901	0.3703236	3.6934992	0.0002212
Time_f3	-0.3104409	0.2418311	-1.2837096	0.1992436
CohortNon-ctx HHVs (Norms)	0.4443512	0.2904597	1.5298206	0.1260611
Time_f2:CohortNon-ctx HHVs (Norms)	-0.3546402	0.5455562	-0.6500526	0.5156582
Time_f3:CohortNon-ctx HHVs (Norms)	-0.9887608	0.3511861	-2.8154895	0.0048703

3.2 Households that normally use the clean improved latrine when at home

3.2.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	uselatrine	n	prop	error
Control HHV	1	0	453	0.8899804	0.0147020
Control HHV	1	1	10	0.0196464	0.0438867
Control HHV	1	NA	46	0.0903733	0.0422739
Control HHV	2	0	407	0.8323108	0.0185182
Control HHV	2	1	46	0.0940695	0.0430421
Control HHV	2	NA	36	0.0736196	0.0435251
Control HHV	3	0	294	0.6012270	0.0285567
Control HHV	3	1	168	0.3435583	0.0366390
Control HHV	3	NA	27	0.0552147	0.0439554
Ctx HHVs (RANAS)	1	0	453	0.8952569	0.0143876
Ctx HHVs (RANAS)	1	1	16	0.0316206	0.0437469
Ctx HHVs (RANAS)	1	NA	37	0.0731225	0.0427992
Ctx HHVs (RANAS)	2	0	395	0.8178054	0.0194220
Ctx HHVs (RANAS)	2	1	62	0.1283644	0.0424809
Ctx HHVs (RANAS)	2	NA	26	0.0538302	0.0442600
Ctx HHVs (RANAS)	3	0	213	0.4446764	0.0340491
Ctx HHVs (RANAS)	3	1	237	0.4947808	0.0324767
Ctx HHVs (RANAS)	3	NA	29	0.0605428	0.0442864
Non-ctx HHVs (Norms)	1	0	442	0.8804781	0.0154302

Cohort	Time	uselatrine	n	prop	error
Non-ctx HHVs (Norms)	1	1	21	0.0418327	0.0436887
Non-ctx HHVs (Norms)	1	NA	39	0.0776892	0.0428634
Non-ctx HHVs (Norms)	2	0	378	0.7891441	0.0209810
Non-ctx HHVs (Norms)	2	1	69	0.1440501	0.0422724
Non-ctx HHVs (Norms)	2	NA	32	0.0668058	0.0441386
Non-ctx HHVs (Norms)	3	0	236	0.4845996	0.0325318
Non-ctx HHVs (Norms)	3	1	232	0.4763860	0.0327900
Non-ctx HHVs (Norms)	3	NA	19	0.0390144	0.0444216
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

3.2.2 Statistical Analysis

3.2.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.1273094	0.3989532	-10.3453476	0.0000000
Time_f2	1.7129275	0.3627687	4.7218170	0.0000023
Time_f3	3.5772620	0.3494837	10.2358479	0.0000000
CohortCtx HHVs (RANAS)	0.3580362	0.5136153	0.6970902	0.4857464
CohortNon-ctx HHVs (Norms)	0.7775941	0.4998336	1.5557058	0.1197781
Time_f2:CohortCtx HHVs (RANAS)	-0.1051301	0.4679963	-0.2246388	0.8222603
Time_f3:CohortCtx HHVs (RANAS)	0.3309395	0.4445535	0.7444313	0.4566156
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2312921	0.4510833	-0.5127480	0.6081276
Time_f3:CohortNon-ctx HHVs (Norms)	-0.0550961	0.4277355	-0.1288087	0.8975090

3.2.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.8755422	0.3725129	-10.4037792	0.0000000
Time_f2	1.6305816	0.2990129	5.4532146	0.0000000
Time_f3	3.9986321	0.3098433	12.9053372	0.0000000
CohortNon-ctx HHVs (Norms)	0.4546276	0.4825702	0.9420965	0.3461433
Time_f2:CohortNon-ctx HHVs (Norms)	-0.1282360	0.4021917	-0.3188430	0.7498455
Time_f3:CohortNon-ctx HHVs (Norms)	-0.3925720	0.3837186	-1.0230724	0.3062736

3.2.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.1239993	0.3954780	-10.4278849	0.0000000
Time_f2	1.7136827	0.3634201	4.7154312	0.0000024
Time_f3	3.5895313	0.3542281	10.1333891	0.0000000
CohortCtx HHVs (RANAS)	0.3419505	0.4991613	0.6850502	0.4933123
Time_f2:CohortCtx HHVs (RANAS)	-0.1018102	0.4684089	-0.2173532	0.8279331
Time_f3:CohortCtx HHVs (RANAS)	0.3372600	0.4453435	0.7573030	0.4488683

3.2.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.0447061	0.4005340	-10.0982839	0.0000000
Time_f2	1.6985112	0.3616372	4.6967270	0.0000026
Time_f3	3.5083735	0.3492954	10.0441435	0.0000000
CohortNon-ctx HHVs (Norms)	0.7539669	0.4993523	1.5098896	0.1310716
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2364038	0.4491592	-0.5263253	0.5986622
Time_f3:CohortNon-ctx HHVs (Norms)	-0.0723927	0.4256227	-0.1700865	0.8649421

3.2.3 Exploratory Analysis

3.2.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.9294274	0.4543673	-13.0498553	0.0000000
Time	1.8010840	0.1504772	11.9691495	0.0000000
CohortCtx HHVs (RANAS)	-0.0641331	0.5826334	-0.1100745	0.9123503
CohortNon-ctx HHVs (Norms)	0.5443855	0.5722521	0.9513035	0.3414503
Time:CohortCtx HHVs (RANAS)	0.2250751	0.1958557	1.1491882	0.2504784
Time:CohortNon-ctx HHVs (Norms)	0.0298031	0.1913421	0.1557581	0.8762237

3.2.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.4125173	0.2302604	-1.791526	0.0732090
CohortCtx HHVs (RANAS)	0.5883639	0.3264451	1.802337	0.0714925
CohortNon-ctx HHVs (Norms)	0.5594044	0.3251531	1.720434	0.0853536

3.3 Households that do not defecate in the open when at home

3.3.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	notdef	n	prop	error
Control HHV	1	0	115	0.2259332	0.0389969
Control HHV	1	1	370	0.7269155	0.0231627
Control HHV	1	NA	24	0.0471513	0.0432666
Control HHV	2	0	78	0.1595092	0.0414584
Control HHV	2	1	399	0.8159509	0.0194005
Control HHV	2	NA	12	0.0245399	0.0446633
Control HHV	3	0	59	0.1206544	0.0424058
Control HHV	3	1	422	0.8629857	0.0167390
Control HHV	3	NA	8	0.0163599	0.0448501
Ctx HHVs (RANAS)	1	0	125	0.2470356	0.0385755
Ctx HHVs (RANAS)	1	1	365	0.7213439	0.0234671
Ctx HHVs (RANAS)	1	NA	16	0.0316206	0.0437469
Ctx HHVs (RANAS)	2	0	71	0.1469979	0.0420244
Ctx HHVs (RANAS)	2	1	403	0.8343685	0.0185182
Ctx HHVs (RANAS)	2	NA	9	0.0186335	0.0450757
Ctx HHVs (RANAS)	3	0	54	0.1127349	0.0430387
Ctx HHVs (RANAS)	3	1	414	0.8643006	0.0168314
Ctx HHVs (RANAS)	3	NA	11	0.0229645	0.0451635
Non-ctx HHVs (Norms)	1	0	115	0.2290837	0.0391879
Non-ctx HHVs (Norms)	1	1	372	0.7410359	0.0227127
Non-ctx HHVs (Norms)	1	NA	15	0.0298805	0.0439603
Non-ctx HHVs (Norms)	2	0	52	0.1085595	0.0431398
Non-ctx HHVs (Norms)	2	1	417	0.8705637	0.0164384
Non-ctx HHVs (Norms)	2	NA	10	0.0208768	0.0452117
Non-ctx HHVs (Norms)	3	0	41	0.0841889	0.0433649
Non-ctx HHVs (Norms)	3	1	438	0.8993840	0.0143737
Non-ctx HHVs (Norms)	3	NA	8	0.0164271	0.0449406
NA	1	NA	11	1.0000000	0.0000000

Cohort	Time	notdef	n	prop	error
NA	3	NA	1	1.0000000	0.0000000

3.3.2 Statistical Analysis

3.3.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.1848055	0.1410034	8.4026729	0.0000000
Time_f2	0.4668514	0.1644448	2.8389558	0.0045261
Time_f3	0.8079681	0.1762564	4.5840498	0.0000046
CohortCtx HHVs (RANAS)	-0.0622708	0.1938407	-0.3212470	0.7480232
CohortNon-ctx HHVs (Norms)	0.0405066	0.1951301	0.2075878	0.8355508
Time_f2:CohortCtx HHVs (RANAS)	0.2084715	0.2334953	0.8928296	0.3719485
Time_f3:CohortCtx HHVs (RANAS)	0.1740387	0.2504959	0.6947765	0.4871954
Time_f2:CohortNon-ctx HHVs (Norms)	0.4555837	0.2453089	1.8571836	0.0632850
Time_f3:CohortNon-ctx HHVs (Norms)	0.4059002	0.2627289	1.5449392	0.1223610

3.3.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.0972756	0.1305410	8.4055986	0.0000000
Time_f2	0.6679592	0.1655658	4.0344026	0.0000547
Time_f3	0.9708286	0.1782758	5.4456546	0.0000001
CohortNon-ctx HHVs (Norms)	0.1072541	0.1846693	0.5807903	0.5613818
Time_f2:CohortNon-ctx HHVs (Norms)	0.2425553	0.2459995	0.9859994	0.3241334
Time_f3:CohortNon-ctx HHVs (Norms)	0.2307185	0.2643917	0.8726391	0.3828598

3.3.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.2062066	0.1460341	8.2597582	0.0000000
Time_f2	0.4731524	0.1649347	2.8687263	0.0041213
Time_f3	0.8191119	0.1765839	4.6386549	0.0000035
CohortCtx HHVs (RANAS)	-0.0579368	0.2000113	-0.2896677	0.7720705
Time_f2:CohortCtx HHVs (RANAS)	0.2114222	0.2340929	0.9031553	0.3664435
Time_f3:CohortCtx HHVs (RANAS)	0.1770308	0.2507089	0.7061209	0.4801129

3.3.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.1787975	0.1437425	8.200757	0.0000000
Time_f2	0.4674905	0.1645660	2.840749	0.0045008
Time_f3	0.8079267	0.1765075	4.577293	0.0000047
CohortNon-ctx HHVs (Norms)	0.0521682	0.1972570	0.264468	0.7914193
Time_f2:CohortNon-ctx HHVs (Norms)	0.4549288	0.2453830	1.853954	0.0637457
Time_f3:CohortNon-ctx HHVs (Norms)	0.4061499	0.2627475	1.545781	0.1221576

3.3.3 Exploratory Analysis

3.3.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.8116425	0.2017091	4.0238276	0.0000573
Time	0.4157517	0.0908944	4.5740075	0.0000048
CohortCtx HHVs (RANAS)	-0.1655302	0.2826531	-0.5856302	0.5581241
CohortNon-ctx HHVs (Norms)	-0.2422074	0.2907097	-0.8331590	0.4047550
Time:CohortCtx HHVs (RANAS)	0.1028350	0.1297083	0.7928173	0.4278843
Time:CohortNon-ctx HHVs (Norms)	0.2834617	0.1379741	2.0544552	0.0399317

3.4 Owning a clean improved latrine and do not defecate in the open

3.4.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	latrine_notdef	n	prop	error
Control HHV	1	0	453	0.8899804	0.0147020
Control HHV	1	1	10	0.0196464	0.0438867
Control HHV	1	NA	46	0.0903733	0.0422739
Control HHV	2	0	413	0.8445808	0.0178278
Control HHV	2	1	40	0.0817996	0.0433326
Control HHV	2	NA	36	0.0736196	0.0435251
Control HHV	3	0	301	0.6155419	0.0280395
Control HHV	3	1	161	0.3292434	0.0370363
Control HHV	3	NA	27	0.0552147	0.0439554
Ctx HHVs (RANAS)	1	0	453	0.8952569	0.0143876

Cohort	Time	latrine_notdef	n	prop	error
Ctx HHVs (RANAS)	1	1	16	0.0316206	0.0437469
Ctx HHVs (RANAS)	1	NA	37	0.0731225	0.0427992
Ctx HHVs (RANAS)	2	0	401	0.8302277	0.0187482
Ctx HHVs (RANAS)	2	1	56	0.1159420	0.0427826
Ctx HHVs (RANAS)	2	NA	26	0.0538302	0.0442600
Ctx HHVs (RANAS)	3	0	227	0.4739040	0.0331409
Ctx HHVs (RANAS)	3	1	223	0.4655532	0.0334029
Ctx HHVs (RANAS)	3	NA	29	0.0605428	0.0442864
Non-ctx HHVs (Norms)	1	0	446	0.8884462	0.0149070
Non-ctx HHVs (Norms)	1	1	17	0.0338645	0.0438700
Non-ctx HHVs (Norms)	1	NA	39	0.0776892	0.0428634
Non-ctx HHVs (Norms)	2	0	382	0.7974948	0.0205613
Non-ctx HHVs (Norms)	2	1	65	0.1356994	0.0424781
Non-ctx HHVs (Norms)	2	NA	32	0.0668058	0.0441386
Non-ctx HHVs (Norms)	3	0	223	0.4579055	0.0333636
Non-ctx HHVs (Norms)	3	1	245	0.5030801	0.0319432
Non-ctx HHVs (Norms)	3	NA	19	0.0390144	0.0444216
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

3.4.2 Statistical Analysis

3.4.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.2849698	0.4147182	-10.3322440	0.0000000
Time_f2	1.5682122	0.3697618	4.2411418	0.0000222
Time_f3	3.6123030	0.3553112	10.1665905	0.0000000
CohortCtx HHVs (RANAS)	0.3532037	0.5308526	0.6653518	0.5058255
CohortNon-ctx HHVs (Norms)	0.5829646	0.5275128	1.1051194	0.2691078
Time_f2:CohortCtx HHVs (RANAS)	-0.0468929	0.4772911	-0.0982479	0.9217354
Time_f3:CohortCtx HHVs (RANAS)	0.3219848	0.4499073	0.7156692	0.4741956
Time_f2:CohortNon-ctx HHVs (Norms)	0.0912573	0.4711751	0.1936802	0.8464263
Time_f3:CohortNon-ctx HHVs (Norms)	0.4467426	0.4462095	1.0011949	0.3167326

3.4.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.0766659	0.4027239	-10.1227318	0.0000000
Time_f2	1.5536940	0.3073465	5.0551864	0.0000004
Time_f3	4.0586736	0.3257279	12.4603199	0.0000000
CohortNon-ctx HHVs (Norms)	0.2734764	0.5226639	0.5232357	0.6008103
Time_f2:CohortNon-ctx HHVs (Norms)	0.1340002	0.4244401	0.3157105	0.7522222
Time_f3:CohortNon-ctx HHVs (Norms)	0.1258301	0.4056202	0.3102166	0.7563962

3.4.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.2771375	0.4097498	-10.4384120	0.0000000
Time_f2	1.5682294	0.3705887	4.2317253	0.0000232
Time_f3	3.6227365	0.3612523	10.0282738	0.0000000
CohortCtx HHVs (RANAS)	0.3319218	0.5111804	0.6493242	0.5161288
Time_f2:CohortCtx HHVs (RANAS)	-0.0440968	0.4780081	-0.0922511	0.9264985
Time_f3:CohortCtx HHVs (RANAS)	0.3280067	0.4510952	0.7271341	0.4671438

3.4.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.1701643	0.4156634	-10.0325520	0.0000000
Time_f2	1.5504078	0.3679227	4.2139499	0.0000251
Time_f3	3.5209750	0.3548930	9.9212289	0.0000000
CohortNon-ctx HHVs (Norms)	0.5587459	0.5246748	1.0649377	0.2869041
Time_f2:CohortNon-ctx HHVs (Norms)	0.0825372	0.4683133	0.1762436	0.8601026
Time_f3:CohortNon-ctx HHVs (Norms)	0.4124225	0.4431246	0.9307146	0.3520012

3.4.3 Exploratory Analysis

3.4.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-6.2820952	0.4897481	-12.8271977	0.0000000
Time	1.8817505	0.1600966	11.7538475	0.0000000
CohortCtx HHVs (RANAS)	0.0369651	0.6187695	0.0597396	0.9523630
CohortNon-ctx HHVs (Norms)	0.1332781	0.6190179	0.2153057	0.8295290

	Estimate	Std. Error	z value	Pr(> z)
Time:CohortCtx HHVs (RANAS)	0.1884767	0.2055475	0.9169499	0.3591689
Time:CohortNon-ctx HHVs (Norms)	0.2663584	0.2058825	1.2937398	0.1957553

3.4.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.4953994	0.2340025	-2.117069	0.0342540
CohortCtx HHVs (RANAS)	0.5436627	0.3313305	1.640847	0.1008291
CohortNon-ctx HHVs (Norms)	0.7898670	0.3309918	2.386364	0.0170159

3.5 Owning a clean improved latrine, use latrine at home, and do not defecating in the open

3.5.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	latrine_notdef	n	prop	error
Control HHV	1	0	453	0.8899804	0.0147020
Control HHV	1	1	10	0.0196464	0.0438867
Control HHV	1	NA	46	0.0903733	0.0422739
Control HHV	2	0	413	0.8445808	0.0178278
Control HHV	2	1	40	0.0817996	0.0433326
Control HHV	2	NA	36	0.0736196	0.0435251
Control HHV	3	0	313	0.6400818	0.0271299
Control HHV	3	1	149	0.3047035	0.0377077
Control HHV	3	NA	27	0.0552147	0.0439554
Ctx HHVs (RANAS)	1	0	455	0.8992095	0.0141135
Ctx HHVs (RANAS)	1	1	14	0.0276680	0.0438361
Ctx HHVs (RANAS)	1	NA	37	0.0731225	0.0427992
Ctx HHVs (RANAS)	2	0	401	0.8302277	0.0187482
Ctx HHVs (RANAS)	2	1	56	0.1159420	0.0427826
Ctx HHVs (RANAS)	2	NA	26	0.0538302	0.0442600
Ctx HHVs (RANAS)	3	0	240	0.5010438	0.0322748
Ctx HHVs (RANAS)	3	1	210	0.4384134	0.0342405
Ctx HHVs (RANAS)	3	NA	29	0.0605428	0.0442864

Cohort	Time	latrine_notdef	n	prop	error
Non-ctx HHVs (Norms)	1	0	446	0.8884462	0.0149070
Non-ctx HHVs (Norms)	1	1	17	0.0338645	0.0438700
Non-ctx HHVs (Norms)	1	NA	39	0.0776892	0.0428634
Non-ctx HHVs (Norms)	2	0	385	0.8037578	0.0202408
Non-ctx HHVs (Norms)	2	1	62	0.1294363	0.0426317
Non-ctx HHVs (Norms)	2	NA	32	0.0668058	0.0441386
Non-ctx HHVs (Norms)	3	0	251	0.5154004	0.0315447
Non-ctx HHVs (Norms)	3	1	217	0.4455852	0.0337406
Non-ctx HHVs (Norms)	3	NA	19	0.0390144	0.0444216
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

3.5.2 Statistical Analysis

3.5.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.1596459	0.3989156	-10.4273820	0.0000000
Time_f2	1.5452705	0.3675065	4.2047437	0.0000261
Time_f3	3.3706944	0.3497759	9.6367264	0.0000000
CohortCtx HHVs (RANAS)	0.2362290	0.5202191	0.4540952	0.6497603
CohortNon-ctx HHVs (Norms)	0.5664235	0.5087424	1.1133796	0.2655454
Time_f2:CohortCtx HHVs (RANAS)	0.0804229	0.4830928	0.1664751	0.8677831
Time_f3:CohortCtx HHVs (RANAS)	0.4026791	0.4549609	0.8850851	0.3761107
Time_f2:CohortNon-ctx HHVs (Norms)	0.0222279	0.4689610	0.0473981	0.9621959
Time_f3:CohortNon-ctx HHVs (Norms)	0.2397721	0.4415405	0.5430355	0.5871054

3.5.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.0411857	0.3872530	-10.4355188	0.0000000
Time_f2	1.6512505	0.3171890	5.2058889	0.0000002
Time_f3	3.8691761	0.3231259	11.9742051	0.0000000
CohortNon-ctx HHVs (Norms)	0.3614644	0.5026537	0.7191122	0.4720718
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0635166	0.4311711	-0.1473119	0.8828859

	Estimate	Std. Error	z value	Pr(> z)
Time_f3:CohortNon-ctx HHVs (Norms)	-0.1656067	0.4092974	-0.4046122	0.6857626

3.5.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.1358002	0.3918287	-10.5551243	0.0000000
Time_f2	1.5418349	0.3676095	4.1942197	0.0000274
Time_f3	3.3675801	0.3529518	9.5411903	0.0000000
CohortCtx HHVs (RANAS)	0.2176271	0.5010566	0.4343365	0.6640441
Time_f2:CohortCtx HHVs (RANAS)	0.0825183	0.4829942	0.1708473	0.8643438
Time_f3:CohortCtx HHVs (RANAS)	0.4042431	0.4550829	0.8882845	0.3743877

3.5.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.0801803	0.4030750	-10.1226331	0.0000000
Time_f2	1.5344090	0.3664444	4.1872895	0.0000282
Time_f3	3.3109541	0.3498670	9.4634647	0.0000000
CohortNon-ctx HHVs (Norms)	0.5491033	0.5110329	1.0744969	0.2826000
Time_f2:CohortNon-ctx HHVs (Norms)	0.0164604	0.4671666	0.0352346	0.9718926
Time_f3:CohortNon-ctx HHVs (Norms)	0.2201353	0.4396777	0.5006742	0.6166004

3.5.3 Exploratory Analysis

3.5.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.9949984	0.4690062	-12.7823435	0.0000000
Time	1.7551015	0.1551269	11.3139737	0.0000000
CohortCtx HHVs (RANAS)	-0.0244980	0.6008484	-0.0407724	0.9674774
CohortNon-ctx HHVs (Norms)	0.2959438	0.5966511	0.4960082	0.6198886
Time:CohortCtx HHVs (RANAS)	0.1966507	0.2021241	0.9729207	0.3305927
Time:CohortNon-ctx HHVs (Norms)	0.1341602	0.2003803	0.6695279	0.5031588

3.5.3.2 Include households with 0 at baseline (effect of Cohort at follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.6260368	0.2153357	-2.907260	0.0036461
CohortCtx HHVs (RANAS)	0.5422328	0.3040213	1.783535	0.0744992

	Estimate	Std. Error	z value	Pr(> z)
CohortNon-ctx HHVs (Norms)	0.6290903	0.3029892	2.076280	0.0378681

3.6 Households that use the latrine when elsewhere (not at home)

3.6.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	nothome_uselat	n	prop	error
Control HHV	1	0	307	0.6031434	0.0279227
Control HHV	1	1	202	0.3968566	0.0344232
Control HHV	2	0	309	0.6319018	0.0274364
Control HHV	2	1	180	0.3680982	0.0359476
Control HHV	3	0	250	0.5112474	0.0316148
Control HHV	3	1	239	0.4887526	0.0323341
Ctx HHVs (RANAS)	1	0	316	0.6245059	0.0272412
Ctx HHVs (RANAS)	1	1	190	0.3754941	0.0351312
Ctx HHVs (RANAS)	2	0	297	0.6149068	0.0282364
Ctx HHVs (RANAS)	2	1	186	0.3850932	0.0356805
Ctx HHVs (RANAS)	3	0	271	0.5657620	0.0301090
Ctx HHVs (RANAS)	3	1	208	0.4342380	0.0343676
Non-ctx HHVs (Norms)	1	0	238	0.4741036	0.0323667
Non-ctx HHVs (Norms)	1	1	264	0.5258964	0.0307316
Non-ctx HHVs (Norms)	2	0	260	0.5427975	0.0308949
Non-ctx HHVs (Norms)	2	1	219	0.4572025	0.0336629
Non-ctx HHVs (Norms)	3	0	284	0.5831622	0.0292563
Non-ctx HHVs (Norms)	3	1	203	0.4168378	0.0346043
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

3.6.2 Statistical Analysis

3.6.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.4415783	0.1236838	-3.5702197	0.0003567

	Estimate	Std. Error	z value	Pr(> z)
Time_f2	-0.1237198	0.1308283	-0.9456656	0.3443192
Time_f3	0.3755561	0.1284993	2.9226307	0.0034709
CohortCtx HHVs (RANAS)	-0.0146117	0.1755644	-0.0832268	0.9336712
CohortNon-ctx HHVs (Norms)	0.5570353	0.1741128	3.1992775	0.0013777
Time_f2:CohortCtx HHVs (RANAS)	0.1646650	0.1856166	0.8871242	0.3750120
Time_f3:CohortCtx HHVs (RANAS)	-0.1307204	0.1833156	-0.7130895	0.4757904
Time_f2:CohortNon-ctx HHVs (Norms)	-0.1616332	0.1839160	-0.8788425	0.3794867
Time_f3:CohortNon-ctx HHVs (Norms)	-0.8188359	0.1823252	-4.4910729	0.0000071

3.6.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.4468604	0.1396429	-3.2000226	0.0013742
Time_f2	0.0416551	0.1317845	0.3160846	0.7519383
Time_f3	0.2449129	0.1308503	1.8717031	0.0612477
CohortNon-ctx HHVs (Norms)	0.5739336	0.1953276	2.9383129	0.0033000
Time_f2:CohortNon-ctx HHVs (Norms)	-0.3299910	0.1848686	-1.7850030	0.0742608
Time_f3:CohortNon-ctx HHVs (Norms)	-0.6897656	0.1842332	-3.7439814	0.0001811

3.6.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.4243427	0.1003206	-4.2298645	0.0000234
Time_f2	-0.1226613	0.1305651	-0.9394650	0.3474921
Time_f3	0.3742890	0.1282190	2.9191380	0.0035100
CohortCtx HHVs (RANAS)	-0.0584200	0.1436421	-0.4067054	0.6842244
Time_f2:CohortCtx HHVs (RANAS)	0.1629761	0.1851511	0.8802334	0.3787329
Time_f3:CohortCtx HHVs (RANAS)	-0.1301614	0.1828371	-0.7118980	0.4765280

3.6.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.4425194	0.1351672	-3.2738660	0.0010609
Time_f2	-0.1245622	0.1308955	-0.9516160	0.3412918
Time_f3	0.3759156	0.1285670	2.9238880	0.0034569
CohortNon-ctx HHVs (Norms)	0.5653622	0.1907024	2.9646311	0.0030305
Time_f2:CohortNon-ctx HHVs (Norms)	-0.1631281	0.1841962	-0.8856215	0.3758215

	Estimate	Std. Error	z value	Pr(> z)
Time_f3:CohortNon-ctx HHVs (Norms)	-0.8208392	0.1826058	-4.4951428	0.0000070

3.6.3 Exploratory Analysis

3.6.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.7889368	0.1714852	-4.6006126	0.0000042
Time	0.2084451	0.0668431	3.1184252	0.0018182
CohortCtx HHVs (RANAS)	0.1444538	0.2437774	0.5925642	0.5534729
CohortNon-ctx HHVs (Norms)	1.2100331	0.2416782	5.0067940	0.0000006
Time:CohortCtx HHVs (RANAS)	-0.0751728	0.0954347	-0.7876885	0.4308789
Time:CohortNon-ctx HHVs (Norms)	-0.4746941	0.0949172	-5.0011376	0.0000006

3.7 Households that do not defecate in the open when elsewhere (not at home)

3.7.1 Overview Table

Frequencies (n) and proportions (prop) of households performing desired behavior (indicator = 1) or not performing desired behavior (indicator = 0) per Cohort and Time

Cohort	Time	nothome_notdef	n	prop	error
Control HHV	1	0	288	0.5658153	0.0292064
Control HHV	1	1	221	0.4341847	0.0333410
Control HHV	2	0	236	0.4826176	0.0325276
Control HHV	2	1	253	0.5173824	0.0314157
Control HHV	3	0	295	0.6032720	0.0284834
Control HHV	3	1	194	0.3967280	0.0351239
Ctx HHVs (RANAS)	1	0	299	0.5909091	0.0284338
Ctx HHVs (RANAS)	1	1	207	0.4090909	0.0341732
Ctx HHVs (RANAS)	2	0	229	0.4741201	0.0329966
Ctx HHVs (RANAS)	2	1	254	0.5258799	0.0313307
Ctx HHVs (RANAS)	3	0	269	0.5615866	0.0302534
Ctx HHVs (RANAS)	3	1	210	0.4384134	0.0342405
Non-ctx HHVs (Norms)	1	0	312	0.6215139	0.0274583
Non-ctx HHVs (Norms)	1	1	190	0.3784861	0.0351863
Non-ctx HHVs (Norms)	2	0	290	0.6054280	0.0287009

Cohort	Time	nothome_notdef	n	prop	error
Non-ctx HHVs (Norms)	2	1	189	0.3945720	0.0355520
Non-ctx HHVs (Norms)	3	0	285	0.5852156	0.0291841
Non-ctx HHVs (Norms)	3	1	202	0.4147844	0.0346652
NA	1	NA	11	1.0000000	0.0000000
NA	3	NA	1	1.0000000	0.0000000

3.7.2 Statistical Analysis

3.7.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.2679664	0.1268342	-2.1127293	0.0346239
Time_f2	0.3365345	0.1278768	2.6317085	0.0084957
Time_f3	-0.1531388	0.1292570	-1.1847628	0.2361113
CohortCtx HHVs (RANAS)	-0.1210632	0.1795068	-0.6744215	0.5000434
CohortNon-ctx HHVs (Norms)	-0.2405166	0.1804743	-1.3326916	0.1826330
Time_f2:CohortCtx HHVs (RANAS)	0.1397925	0.1817878	0.7689873	0.4419008
Time_f3:CohortCtx HHVs (RANAS)	0.2779166	0.1832322	1.5167451	0.1293310
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2591441	0.1840661	-1.4078860	0.1591648
Time_f3:CohortNon-ctx HHVs (Norms)	0.3067702	0.1842397	1.6650606	0.0959007

3.7.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.3859205	0.1342667	-2.8742828	0.0040495
Time_f2	0.4771297	0.1293078	3.6898760	0.0002244
Time_f3	0.1250550	0.1299719	0.9621697	0.3359643
CohortNon-ctx HHVs (Norms)	-0.1321723	0.1903095	-0.6945122	0.4873611
Time_f2:CohortNon-ctx HHVs (Norms)	-0.4001082	0.1851571	-2.1609115	0.0307022
Time_f3:CohortNon-ctx HHVs (Norms)	0.0287006	0.1848411	0.1552716	0.8766072

3.7.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.2708614	0.1112329	-2.4350832	0.0148884
Time_f2	0.3356225	0.1276676	2.6288777	0.0085667

	Estimate	Std. Error	z value	Pr(> z)
Time_f3	-0.1532993	0.1290524	-1.1878840	0.2348791
CohortCtx HHVs (RANAS)	-0.1144402	0.1576813	-0.7257687	0.4679806
Time_f2:CohortCtx HHVs (RANAS)	0.1399384	0.1814880	0.7710617	0.4406704
Time_f3:CohortCtx HHVs (RANAS)	0.2771924	0.1829364	1.5152389	0.1297119

3.7.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.2737386	0.1373460	-1.993058	0.0462551
Time_f2	0.3383550	0.1284073	2.635015	0.0084134
Time_f3	-0.1538846	0.1296786	-1.186661	0.2353612
CohortNon-ctx HHVs (Norms)	-0.2318437	0.1952032	-1.187704	0.2349500
Time_f2:CohortNon-ctx HHVs (Norms)	-0.2595033	0.1847225	-1.404828	0.1600725
Time_f3:CohortNon-ctx HHVs (Norms)	0.3086701	0.1849430	1.669002	0.0951171

3.7.3 Exploratory Analysis

3.7.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.0320319	0.1692133	-0.1892989	0.8498586
Time	-0.0832083	0.0661059	-1.2587113	0.2081346
CohortCtx HHVs (RANAS)	-0.2612761	0.2399718	-1.0887784	0.2762516
CohortNon-ctx HHVs (Norms)	-0.6101284	0.2427152	-2.5137633	0.0119451
Time:CohortCtx HHVs (RANAS)	0.1317400	0.0939711	1.4019203	0.1609390
Time:CohortNon-ctx HHVs (Norms)	0.1787372	0.0950450	1.8805541	0.0600326

4 Health

4.1 Children under 5 years with diarrhea

4.1.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	510	46	0.0901961	0.0126848
1	Ctx HHVs (RANAS)	535	63	0.1177570	0.0139351
1	Non-ctx HHVs (Norms)	519	74	0.1425819	0.0153478

Time	Cohort	children	children_sick	prop	error
2	Control HHV	549	39	0.0710383	0.0109637
2	Ctx HHVs (RANAS)	528	28	0.0530303	0.0097524
2	Non-ctx HHVs (Norms)	522	57	0.1091954	0.0136508
3	Control HHV	529	29	0.0548204	0.0098969
3	Ctx HHVs (RANAS)	507	34	0.0670611	0.0111086
3	Non-ctx HHVs (Norms)	561	36	0.0641711	0.0103463

4.1.2 Statistical Analysis

4.1.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.7691086	0.2429109	-11.3996875	0.0000000
Time_f2	-0.4363402	0.3816037	-1.1434380	0.2528568
Time_f3	-0.4295648	0.3817619	-1.1252165	0.2604973
CohortCtx HHVs (RANAS)	0.4399578	0.3181168	1.3830071	0.1666627
CohortNon-ctx HHVs (Norms)	0.7890382	0.2996111	2.6335414	0.0084500
Time_f2:CohortCtx HHVs (RANAS)	-0.5133687	0.5311182	-0.9665810	0.3337536
Time_f3:CohortCtx HHVs (RANAS)	-0.3075477	0.5181120	-0.5935930	0.5527844
Time_f2:CohortNon-ctx HHVs (Norms)	0.1742342	0.4631742	0.3761742	0.7067874
Time_f3:CohortNon-ctx HHVs (Norms)	-0.6550890	0.5012660	-1.3068690	0.1912572

4.1.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.3291484	0.2054382	-11.3374673	0.0000000
Time_f2	-0.9497130	0.3694963	-2.5702912	0.0101613
Time_f3	-0.7371157	0.3502999	-2.1042418	0.0353574
CohortNon-ctx HHVs (Norms)	0.3490782	0.2701134	1.2923395	0.1962396
Time_f2:CohortNon-ctx HHVs (Norms)	0.6876079	0.4532402	1.5170937	0.1292430
Time_f3:CohortNon-ctx HHVs (Norms)	-0.3475389	0.4777302	-0.7274794	0.4669323

4.1.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.7691118	0.2429906	-11.3959637	0.0000000

	Estimate	Std. Error	z value	Pr(> z)
Time_f2	-0.4363409	0.3817993	-1.1428540	0.2530992
Time_f3	-0.4295617	0.3818153	-1.1250511	0.2605674
CohortCtx HHVs (RANAS)	0.4399586	0.3182250	1.3825392	0.1668062
Time_f2:CohortCtx HHVs (RANAS)	-0.5133633	0.5314040	-0.9660510	0.3340187
Time_f3:CohortCtx HHVs (RANAS)	-0.3075475	0.5181905	-0.5935027	0.5528448

4.1.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.7691136	0.2429614	-11.3973393	0.0000000
Time_f2	-0.4363383	0.3817350	-1.1430398	0.2530221
Time_f3	-0.4295564	0.3817924	-1.1251046	0.2605447
CohortNon-ctx HHVs (Norms)	0.7890451	0.2996463	2.6332549	0.0084571
Time_f2:CohortNon-ctx HHVs (Norms)	0.1742304	0.4632755	0.3760836	0.7068547
Time_f3:CohortNon-ctx HHVs (Norms)	-0.6551015	0.5012839	-1.3068472	0.1912646

4.1.3 Exploratory Analysis

4.1.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.7158390	0.4237242	-6.4094498	0.0000000
Time	-0.1940075	0.2051782	-0.9455564	0.3443749
CohortCtx HHVs (RANAS)	0.7422359	0.5587040	1.3284958	0.1840144
CohortNon-ctx HHVs (Norms)	1.4465676	0.5187025	2.7888195	0.0052901
Time:CohortCtx HHVs (RANAS)	-0.2357221	0.2782937	-0.8470261	0.3969806
Time:CohortNon-ctx HHVs (Norms)	-0.4045771	0.2603092	-1.5542172	0.1201326

4.2 People above 5 years (%) that had diarrhea during the past 2 weeks

4.2.0.1 Overview Table

Total amount of persons older than 5 years, total amount of sick persons, and proportion (prop) of sick persons per Cohort and Time

Time	Cohort	people	people_sick	prop	error
1	Control HHV	2355	47	0.0199575	0.0028819
1	Ctx HHVs (RANAS)	2298	63	0.0274151	0.0034063
1	Non-ctx HHVs (Norms)	2393	55	0.0229837	0.0030633

Time	Cohort	people	people_sick	prop	error
2	Control HHV	2366	44	0.0185968	0.0027774
2	Ctx HHVs (RANAS)	2320	38	0.0163793	0.0026352
2	Non-ctx HHVs (Norms)	2321	27	0.0116329	0.0022257
3	Control HHV	2569	34	0.0132347	0.0022547
3	Ctx HHVs (RANAS)	2509	52	0.0207254	0.0028442
3	Non-ctx HHVs (Norms)	2582	33	0.0127808	0.0022106

4.2.1 Statistical Analysis

4.2.1.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.7854074	0.5013398	-9.5452369	0.0000000
Time_f2	0.0126043	0.7089038	0.0177800	0.9858144
Time_f3	-0.0124467	0.7094306	-0.0175446	0.9860021
CohortCtx HHVs (RANAS)	0.2485190	0.6732772	0.3691184	0.7120395
CohortNon-ctx HHVs (Norms)	-0.2835016	0.7652274	-0.3704802	0.7110248
Time_f2:CohortCtx HHVs (RANAS)	-0.9331740	1.0983394	-0.8496226	0.3955349
Time_f3:CohortCtx HHVs (RANAS)	0.1819981	0.9348559	0.1946803	0.8456432
Time_f2:CohortNon-ctx HHVs (Norms)	-1.0857319	1.3539499	-0.8018996	0.4226110
Time_f3:CohortNon-ctx HHVs (Norms)	-13.0820658	724.0783651	-0.0180672	0.9855852

4.2.1.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.5368915	0.4495366	-10.0923733	0.0000000
Time_f2	-0.9205630	0.8390711	-1.0971217	0.2725882
Time_f3	0.1695553	0.6089895	0.2784207	0.7806894
CohortNon-ctx HHVs (Norms)	-0.5320139	0.7330892	-0.7257151	0.4680135
Time_f2:CohortNon-ctx HHVs (Norms)	-0.1525691	1.4287776	-0.1067829	0.9149612
Time_f3:CohortNon-ctx HHVs (Norms)	-14.1953785	115.9451848	-0.1224318	0.9025570

4.2.1.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.7854235	0.5020461	-9.5318411	0.0000000

	Estimate	Std. Error	z value	Pr(> z)
Time_f2	0.0126245	0.7101033	0.0177784	0.9858156
Time_f3	-0.0124184	0.7099866	-0.0174910	0.9860449
CohortCtx HHVs (RANAS)	0.2485416	0.6738835	0.3688199	0.7122620
Time_f2:CohortCtx HHVs (RANAS)	-0.9331964	1.0992451	-0.8489429	0.3959130
Time_f3:CohortCtx HHVs (RANAS)	0.1819555	0.9353792	0.1945259	0.8457641

4.2.1.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.7854054	0.5019446	-9.5337327	0.0000000
Time_f2	0.0126047	0.7098403	0.0177571	0.9858326
Time_f3	-0.0124510	0.7099467	-0.0175380	0.9860074
CohortNon-ctx HHVs (Norms)	-0.2835011	0.7661896	-0.3700143	0.7113719
Time_f2:CohortNon-ctx HHVs (Norms)	-1.0857345	1.3561407	-0.8006061	0.4233597
Time_f3:CohortNon-ctx HHVs (Norms)	-13.1263252	418.0762505	-0.0313970	0.9749530

4.2.2 Exploratory Analysis

4.2.2.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.1788773	0.8802328	-5.8835311	0.0000000
Time	0.1275915	0.3910747	0.3262587	0.7442286
CohortCtx HHVs (RANAS)	-0.4642718	1.2812858	-0.3623484	0.7170917
CohortNon-ctx HHVs (Norms)	10.3503650	274.0351756	0.0377702	0.9698709
Time:CohortCtx HHVs (RANAS)	0.2685054	0.5506988	0.4875722	0.6258529
Time:CohortNon-ctx HHVs (Norms)	-11.3767462	274.0285546	-0.0415166	0.9668840

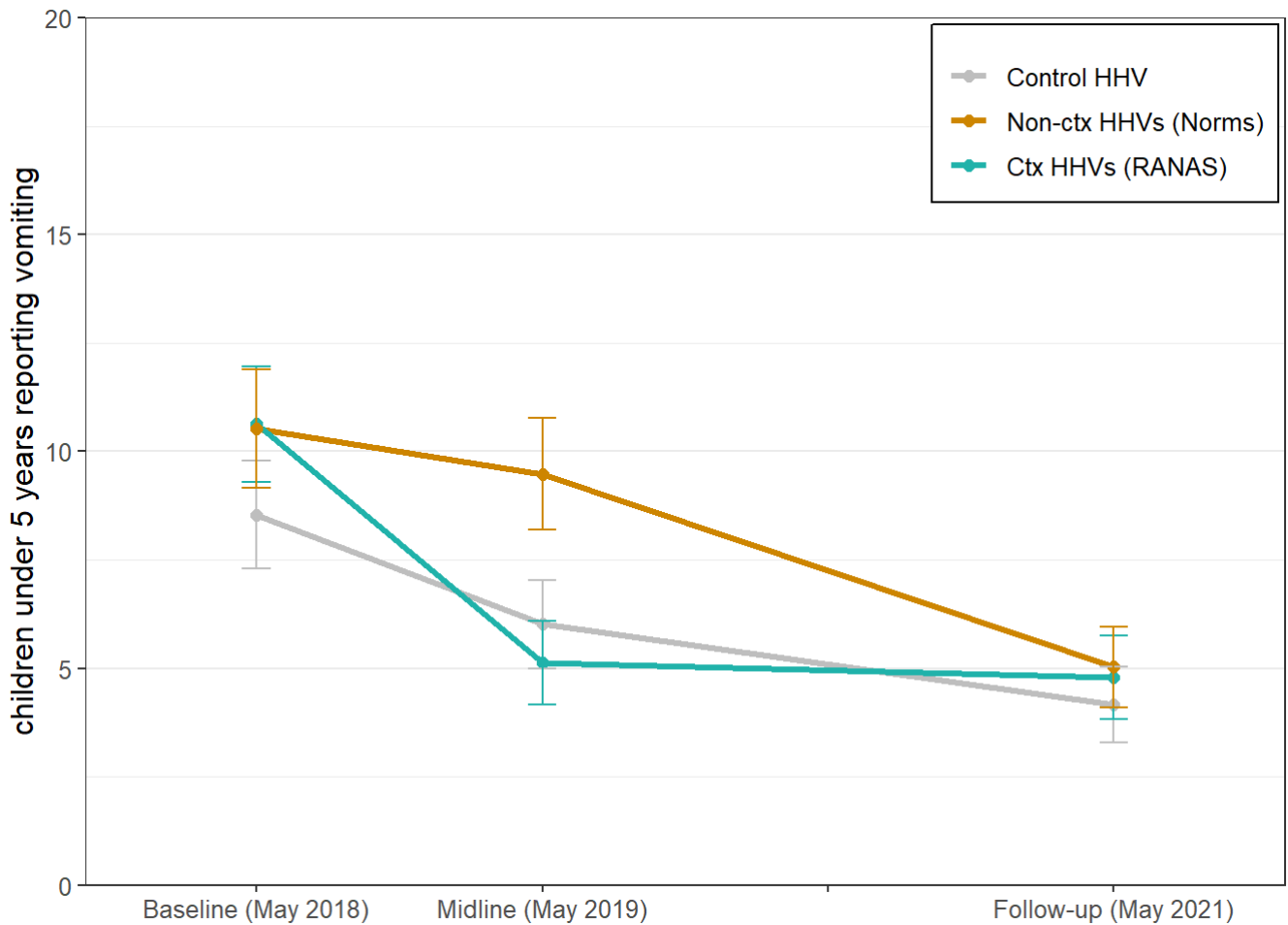
4.3 Children under 5 years reporting vomiting

4.3.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	504	43	0.0853175	0.0124434
1	Ctx HHVs (RANAS)	527	56	0.1062619	0.0134242
1	Non-ctx HHVs (Norms)	504	53	0.1051587	0.0136641

Time	Cohort	children	children_sick	prop	error
2	Control HHV	549	33	0.0601093	0.0101443
2	Ctx HHVs (RANAS)	526	27	0.0513308	0.0096217
2	Non-ctx HHVs (Norms)	517	49	0.0947776	0.0128821
3	Control HHV	528	22	0.0416667	0.0086963
3	Ctx HHVs (RANAS)	501	24	0.0479042	0.0095413
3	Non-ctx HHVs (Norms)	557	28	0.0502693	0.0092581



4.3.2 Statistical Analysis

4.3.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.7585974	0.2430394	-11.3504144	0.0000000
Time_f2	-0.5372435	0.3915497	-1.3720953	0.1700338
Time_f3	-0.7345388	0.4166037	-1.7631597	0.0778736
CohortCtx HHVs (RANAS)	0.2121275	0.3322933	0.6383742	0.5232301
CohortNon-ctx HHVs (Norms)	0.4145765	0.3181368	1.3031391	0.1925273
Time_f2:CohortCtx HHVs (RANAS)	-0.2870250	0.5550562	-0.5171098	0.6050795

	Estimate	Std. Error	z value	Pr(> z)
Time_f3:CohortCtx HHVs (RANAS)	0.0476991	0.5651559	0.0843998	0.9327385
Time_f2:CohortNon-ctx HHVs (Norms)	0.3963590	0.4924762	0.8048289	0.4209184
Time_f3:CohortNon-ctx HHVs (Norms)	-0.2306590	0.5567186	-0.4143189	0.6786406

4.3.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.5464634	0.2265951	-11.2379429	0.0000000
Time_f2	-0.8242772	0.3933927	-2.0953036	0.0361440
Time_f3	-0.6868550	0.3818892	-1.7985715	0.0720865
CohortNon-ctx HHVs (Norms)	0.2024399	0.3057737	0.6620581	0.5079340
Time_f2:CohortNon-ctx HHVs (Norms)	0.6833946	0.4939712	1.3834706	0.1665206
Time_f3:CohortNon-ctx HHVs (Norms)	-0.2783352	0.5312497	-0.5239253	0.6003305

4.3.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.7586017	0.2430550	-11.3497032	0.0000000
Time_f2	-0.5372346	0.3915960	-1.3719104	0.1700913
Time_f3	-0.7345354	0.4166136	-1.7631096	0.0778820
CohortCtx HHVs (RANAS)	0.2121367	0.3323132	0.6383638	0.5232369
Time_f2:CohortCtx HHVs (RANAS)	-0.2870391	0.5551190	-0.5170766	0.6051027
Time_f3:CohortCtx HHVs (RANAS)	0.0476842	0.5651710	0.0843712	0.9327613

4.3.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.7586034	0.2430541	-11.3497485	0.0000000
Time_f2	-0.5372331	0.3915971	-1.3719028	0.1700937
Time_f3	-0.7345309	0.4166114	-1.7631080	0.0778823
CohortNon-ctx HHVs (Norms)	0.4145809	0.3181665	1.3030312	0.1925641
Time_f2:CohortNon-ctx HHVs (Norms)	0.3963494	0.4925558	0.8046792	0.4210048
Time_f3:CohortNon-ctx HHVs (Norms)	-0.2306614	0.5567323	-0.4143130	0.6786449

4.3.3 Exploratory Analysis

4.3.3.1 Include households that were measured at all times

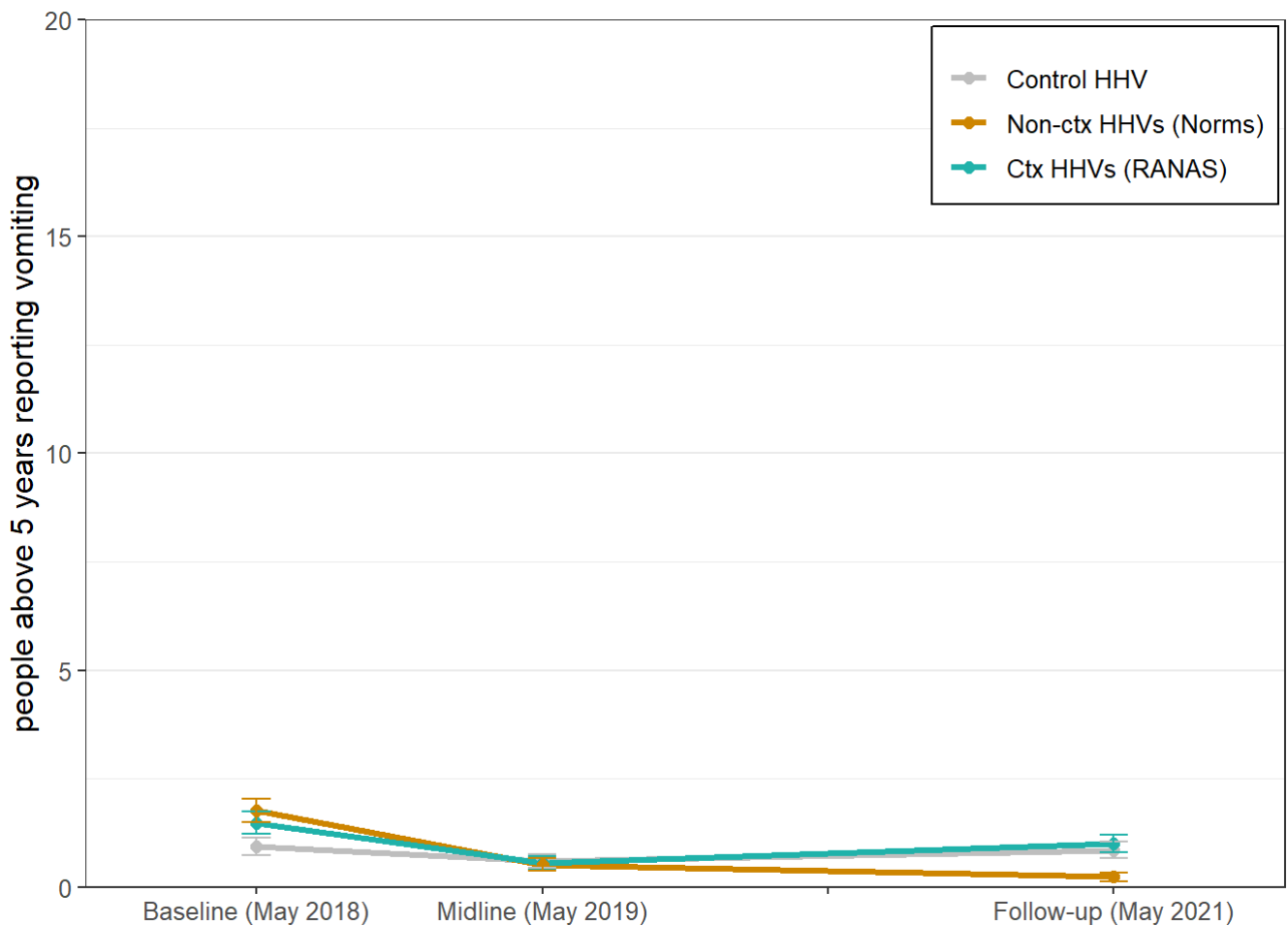
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.5235576	0.4345477	-5.8073197	0.0000000
Time	-0.3585047	0.2205698	-1.6253570	0.1040865
CohortCtx HHVs (RANAS)	0.2038656	0.5936259	0.3434244	0.7312792
CohortNon-ctx HHVs (Norms)	0.7180946	0.5589861	1.2846376	0.1989190
Time:CohortCtx HHVs (RANAS)	0.0070662	0.3008441	0.0234879	0.9812611
Time:CohortNon-ctx HHVs (Norms)	-0.1318961	0.2868851	-0.4597525	0.6456939

4.4 People above 5 years reporting vomiting

4.4.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	2355	22	0.0093418	0.0019824
1	Ctx HHVs (RANAS)	2298	34	0.0147955	0.0025186
1	Non-ctx HHVs (Norms)	2393	42	0.0175512	0.0026843
2	Control HHV	2360	14	0.0059322	0.0015807
2	Ctx HHVs (RANAS)	2315	13	0.0056156	0.0015531
2	Non-ctx HHVs (Norms)	2321	12	0.0051702	0.0014886
3	Control HHV	2569	22	0.0085636	0.0018179
3	Ctx HHVs (RANAS)	2509	25	0.0099641	0.0019829
3	Non-ctx HHVs (Norms)	2582	6	0.0023238	0.0009476



4.4.2 Statistical Analysis

4.4.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-6.1779341	0.9997604	-6.1794145	0.0000000
Time_f2	0.7098693	1.2247086	0.5796230	0.5621689
Time_f3	-0.0123827	1.4149435	-0.0087514	0.9930175
CohortCtx HHVs (RANAS)	1.4157586	1.1185728	1.2656830	0.2056266
CohortNon-ctx HHVs (Norms)	1.3988090	1.1187349	1.2503489	0.2111721
Time_f2:CohortCtx HHVs (RANAS)	-2.0982968	1.6586720	-1.2650463	0.2058547
Time_f3:CohortCtx HHVs (RANAS)	-0.6998111	1.6601015	-0.4215472	0.6733556
Time_f2:CohortNon-ctx HHVs (Norms)	-14.8409158	724.0773439	-0.0204963	0.9836475
Time_f3:CohortNon-ctx HHVs (Norms)	-1.3946962	1.8045434	-0.7728804	0.4395932

4.4.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.7621728	0.5021319	-9.4839077	0.0000000
Time_f2	-1.3884329	1.1199427	-1.2397357	0.2150732

	Estimate	Std. Error	z value	Pr(> z)
Time_f3	-0.7121966	0.8684658	-0.8200629	0.4121803
CohortNon-ctx HHVs (Norms)	-0.0169513	0.7100968	-0.0238718	0.9809549
Time_f2:CohortNon-ctx HHVs (Norms)	-13.3205412	789.9403915	-0.0168627	0.9865461
Time_f3:CohortNon-ctx HHVs (Norms)	-0.6948883	1.4171774	-0.4903326	0.6238985

4.4.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-6.1779454	0.9999484	-6.1782640	0.0000000
Time_f2	0.7098868	1.2251913	0.5794089	0.5623133
Time_f3	-0.0123695	1.4149807	-0.0087418	0.9930251
CohortCtx HHVs (RANAS)	1.4157730	1.1188263	1.2654091	0.2057247
Time_f2:CohortCtx HHVs (RANAS)	-2.0983206	1.6596386	-1.2643238	0.2061138
Time_f3:CohortCtx HHVs (RANAS)	-0.6998306	1.6602034	-0.4215331	0.6733659

4.4.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-6.1779399	1.001035	-6.1715542	0.0000000
Time_f2	0.7098775	1.226451	0.5788064	0.5627198
Time_f3	-0.0123765	1.415670	-0.0087425	0.9930246
CohortNon-ctx HHVs (Norms)	1.3988169	1.119898	1.2490576	0.2116440
Time_f2:CohortNon-ctx HHVs (Norms)	-15.5047616	824.611232	-0.0188025	0.9849987
Time_f3:CohortNon-ctx HHVs (Norms)	-1.3947111	1.805071	-0.7726628	0.4397220

4.4.3 Exploratory Analysis

4.4.3.1 Include households that were measured at all times

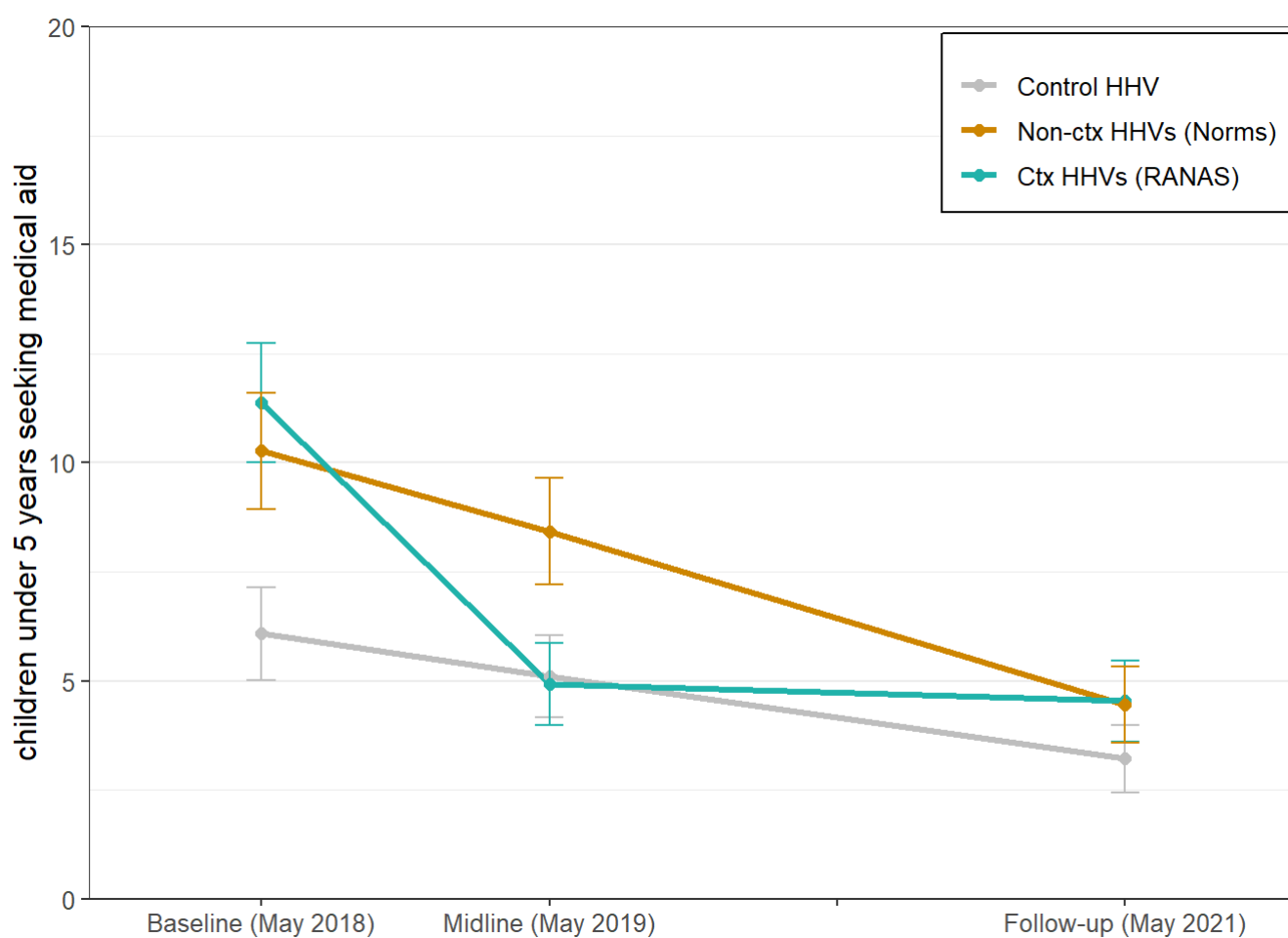
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-6.0763098	1.5282040	-3.9761118	0.0000701
Time	-0.0240879	0.7074222	-0.0340502	0.9728371
CohortCtx HHVs (RANAS)	1.2206191	1.8379591	0.6641166	0.5066157
CohortNon-ctx HHVs (Norms)	1.7646698	1.9370464	0.9110106	0.3622898
Time:CohortCtx HHVs (RANAS)	-0.2594762	0.8720472	-0.2975484	0.7660479
Time:CohortNon-ctx HHVs (Norms)	-0.8360126	1.0091058	-0.8284688	0.4074051

4.5 Children under 5 years seeking medical aid

4.5.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	510	31	0.0607843	0.0105802
1	Ctx HHVs (RANAS)	536	61	0.1138060	0.0137172
1	Non-ctx HHVs (Norms)	516	53	0.1027132	0.0133645
2	Control HHV	549	28	0.0510018	0.0093894
2	Ctx HHVs (RANAS)	528	26	0.0492424	0.0094165
2	Non-ctx HHVs (Norms)	522	44	0.0842912	0.0121600
3	Control HHV	529	17	0.0321361	0.0076679
3	Ctx HHVs (RANAS)	507	23	0.0453649	0.0092422
3	Non-ctx HHVs (Norms)	561	25	0.0445633	0.0087118



4.5.2 Statistical Analysis

4.5.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.3843999	0.3215068	-10.5266832	0.0000000
Time_f2	-0.2399405	0.4812763	-0.4985505	0.6180961
Time_f3	-0.5276156	0.5228590	-1.0090973	0.3129280
CohortCtx HHVs (RANAS)	0.9640345	0.3856591	2.4997061	0.0124296
CohortNon-ctx HHVs (Norms)	1.0148748	0.3813348	2.6613748	0.0077822
Time_f2:CohortCtx HHVs (RANAS)	-0.6185555	0.6093649	-1.0150824	0.3100666
Time_f3:CohortCtx HHVs (RANAS)	-0.7586037	0.6819975	-1.1123262	0.2659979
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0915413	0.5742951	-0.1593977	0.8733555
Time_f3:CohortNon-ctx HHVs (Norms)	-0.4186967	0.6400356	-0.6541772	0.5129976

4.5.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.4203682	0.2130321	-11.3615215	0.0000000
Time_f2	-0.8584923	0.3738487	-2.2963631	0.0216551
Time_f3	-1.2862129	0.4378883	-2.9373080	0.0033108
CohortNon-ctx HHVs (Norms)	0.0508440	0.2957249	0.1719300	0.8634925
Time_f2:CohortNon-ctx HHVs (Norms)	0.5270087	0.4878773	1.0802075	0.2800498
Time_f3:CohortNon-ctx HHVs (Norms)	0.3399015	0.5727341	0.5934717	0.5528655

4.5.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.3843966	0.3215092	-10.5265940	0.0000000
Time_f2	-0.2399418	0.4813220	-0.4985058	0.6181276
Time_f3	-0.5276238	0.5228524	-1.0091257	0.3129144
CohortCtx HHVs (RANAS)	0.9640290	0.3856566	2.4997082	0.0124296
Time_f2:CohortCtx HHVs (RANAS)	-0.6185501	0.6093764	-1.0150542	0.3100800
Time_f3:CohortCtx HHVs (RANAS)	-0.7585885	0.6819929	-1.1123114	0.2660043

4.5.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.3843860	0.3215243	-10.5260653	0.0000000
Time_f2	-0.2399573	0.4813426	-0.4985165	0.6181200
Time_f3	-0.5276380	0.5228567	-1.0091447	0.3129052
CohortNon-ctx HHVs (Norms)	1.0148611	0.3813550	2.6611982	0.0077863

	Estimate	Std. Error	z value	Pr(> z)
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0915254	0.5743711	-0.1593489	0.8733940
Time_f3:CohortNon-ctx HHVs (Norms)	-0.4186757	0.6400341	-0.6541460	0.5130178

4.5.3 Exploratory Analysis

4.5.3.1 Include households that were measured at all times

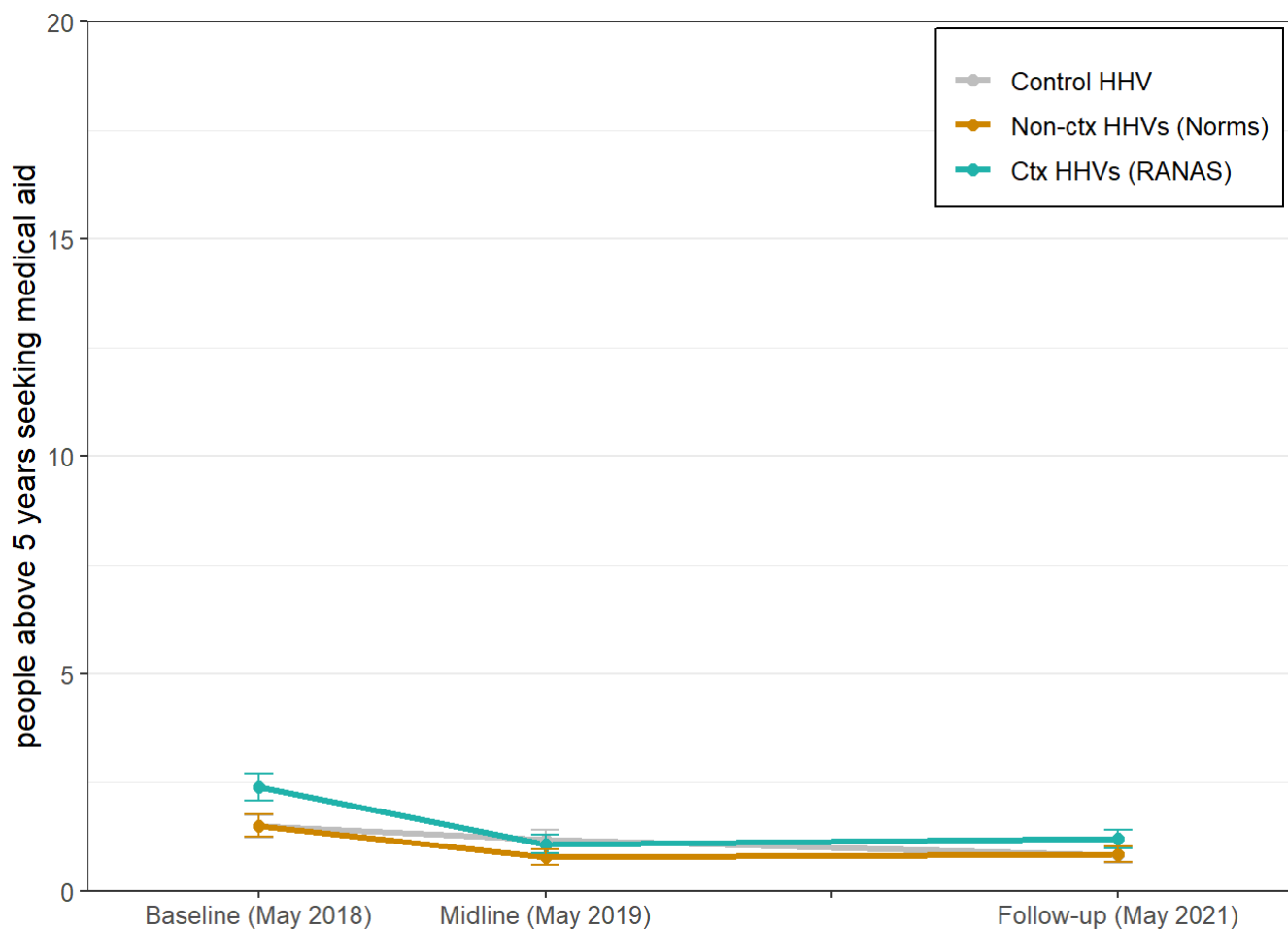
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.2253932	0.5570717	-5.7899072	0.0000000
Time	-0.2493966	0.2747566	-0.9077003	0.3640366
CohortCtx HHVs (RANAS)	1.3418683	0.6846689	1.9598792	0.0500099
CohortNon-ctx HHVs (Norms)	1.4315339	0.6609118	2.1659983	0.0303113
Time:CohortCtx HHVs (RANAS)	-0.3757228	0.3510968	-1.0701402	0.2845562
Time:CohortNon-ctx HHVs (Norms)	-0.2825250	0.3332438	-0.8478026	0.3965479

4.6 People above 5 years seeking medical aid

4.6.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	2355	35	0.0148620	0.0024934
1	Ctx HHVs (RANAS)	2298	55	0.0239339	0.0031884
1	Non-ctx HHVs (Norms)	2393	36	0.0150439	0.0024884
2	Control HHV	2366	28	0.0118343	0.0022232
2	Ctx HHVs (RANAS)	2320	25	0.0107759	0.0021435
2	Non-ctx HHVs (Norms)	2321	18	0.0077553	0.0018208
3	Control HHV	2569	21	0.0081744	0.0017765
3	Ctx HHVs (RANAS)	2509	30	0.0119570	0.0021699
3	Non-ctx HHVs (Norms)	2582	22	0.0085205	0.0018088



4.6.2 Statistical Analysis

4.6.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.7854032	0.5020826	-9.5311075	0.0000000
Time_f2	-0.6847664	0.8684430	-0.7884990	0.4304049
Time_f3	-0.7097164	0.8684133	-0.8172565	0.4137819
CohortCtx HHVs (RANAS)	-0.6741851	0.8684561	-0.7763031	0.4375701
CohortNon-ctx HHVs (Norms)	-1.3863002	1.1199007	-1.2378779	0.2157613
Time_f2:CohortCtx HHVs (RANAS)	-0.0083780	1.5028140	-0.0055749	0.9955519
Time_f3:CohortCtx HHVs (RANAS)	1.6175349	1.2076343	1.3394245	0.1804325
Time_f2:CohortNon-ctx HHVs (Norms)	0.7144353	1.6608526	0.4301618	0.6670780
Time_f3:CohortNon-ctx HHVs (Norms)	-11.6302922	474.2468018	-0.0245237	0.9804349

4.6.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.4595853	0.7085515	-7.7052762	0.0000000
Time_f2	-0.6931479	1.2262752	-0.5652466	0.5719060

	Estimate	Std. Error	z value	Pr(> z)
Time_f3	0.9078158	0.8391373	1.0818442	0.2793218
CohortNon-ctx HHVs (Norms)	-0.7121175	1.2262768	-0.5807151	0.5614325
Time_f2:CohortNon-ctx HHVs (Norms)	0.7228140	1.8726781	0.3859788	0.6995124
Time_f3:CohortNon-ctx HHVs (Norms)	-13.9824488	228.9767550	-0.0610649	0.9513075

4.6.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.7854048	0.5018235	-9.5360320	0.0000000
Time_f2	-0.6847551	0.8677425	-0.7891225	0.4300404
Time_f3	-0.7097133	0.8682219	-0.8174331	0.4136810
CohortCtx HHVs (RANAS)	-0.6741897	0.8678929	-0.7768121	0.4372697
Time_f2:CohortCtx HHVs (RANAS)	-0.0083798	1.5012452	-0.0055819	0.9955463
Time_f3:CohortCtx HHVs (RANAS)	1.6175392	1.2071773	1.3399350	0.1802665

4.6.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.7854033	0.5020826	-9.5311073	0.0000000
Time_f2	-0.6847656	0.8684428	-0.7884983	0.4304053
Time_f3	-0.7097147	0.8684128	-0.8172549	0.4137828
CohortNon-ctx HHVs (Norms)	-1.3863051	1.1199028	-1.2378798	0.2157606
Time_f2:CohortNon-ctx HHVs (Norms)	0.7144395	1.6608540	0.4301640	0.6670764
Time_f3:CohortNon-ctx HHVs (Norms)	-11.8368240	525.8387656	-0.0225104	0.9820408

4.6.3 Exploratory Analysis

4.6.3.1 Include households that were measured at all times

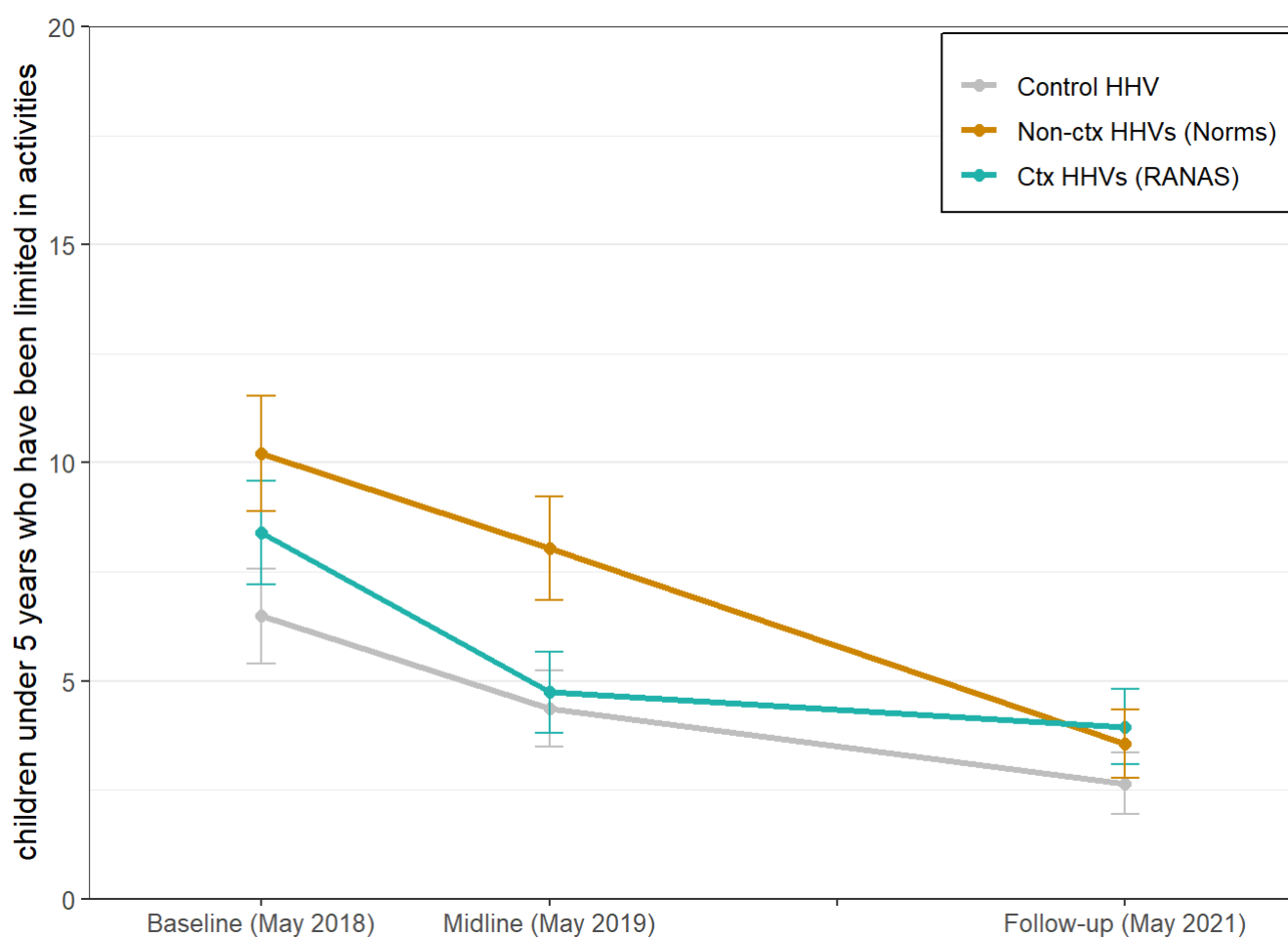
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.8077101	0.9507382	-5.0568182	0.0000004
Time	-0.2413851	0.4693914	-0.5142512	0.6070764
CohortCtx HHVs (RANAS)	-1.5620575	1.5132738	-1.0322372	0.3019610
CohortNon-ctx HHVs (Norms)	10.0281641	105.0617748	0.0954502	0.9239573
Time:CohortCtx HHVs (RANAS)	0.8121078	0.6664225	1.2186081	0.2229930
Time:CohortNon-ctx HHVs (Norms)	-11.0567280	105.0617064	-0.1052403	0.9161851

4.7 Children under 5 years who have been limited in activities

4.7.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	509	33	0.0648330	0.0109140
1	Ctx HHVs (RANAS)	536	45	0.0839552	0.0119784
1	Non-ctx HHVs (Norms)	519	53	0.1021195	0.0132917
2	Control HHV	549	24	0.0437158	0.0087262
2	Ctx HHVs (RANAS)	528	25	0.0473485	0.0092428
2	Non-ctx HHVs (Norms)	522	42	0.0804598	0.0119053
3	Control HHV	529	14	0.0264650	0.0069789
3	Ctx HHVs (RANAS)	507	20	0.0394477	0.0086451
3	Non-ctx HHVs (Norms)	561	20	0.0356506	0.0078283



4.7.2 Statistical Analysis

4.7.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.2822731	0.3070110	-10.6910588	0.0000000
Time_f2	-0.6363960	0.5137894	-1.2386321	0.2154818
Time_f3	-1.0418586	0.5895277	-1.7672768	0.0771819
CohortCtx HHVs (RANAS)	0.3591039	0.4055642	0.8854426	0.3759180
CohortNon-ctx HHVs (Norms)	0.9904615	0.3654697	2.7101053	0.0067262
Time_f2:CohortCtx HHVs (RANAS)	0.1819821	0.6614634	0.2751204	0.7832238
Time_f3:CohortCtx HHVs (RANAS)	0.2584537	0.7510561	0.3441204	0.7307558
Time_f2:CohortNon-ctx HHVs (Norms)	0.1696054	0.6019364	0.2817663	0.7781227
Time_f3:CohortNon-ctx HHVs (Norms)	-0.1894221	0.7079941	-0.2675476	0.7890476

4.7.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.9231658	0.2650722	-11.0278085	0.0000000
Time_f2	-0.4544184	0.4167815	-1.0903037	0.2755794
Time_f3	-0.7834130	0.4654341	-1.6831879	0.0923387
CohortNon-ctx HHVs (Norms)	0.6313536	0.3310534	1.9071052	0.0565070
Time_f2:CohortNon-ctx HHVs (Norms)	-0.0123725	0.5216694	-0.0237171	0.9810782
Time_f3:CohortNon-ctx HHVs (Norms)	-0.4478622	0.6085638	-0.7359330	0.4617715

4.7.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.2822815	0.3071158	-10.6874402	0.0000000
Time_f2	-0.6363832	0.5140872	-1.2378897	0.2157570
Time_f3	-1.0418539	0.5896042	-1.7670394	0.0772216
CohortCtx HHVs (RANAS)	0.3591193	0.4056725	0.8852443	0.3760249
Time_f2:CohortCtx HHVs (RANAS)	0.1819580	0.6617792	0.2749527	0.7833526
Time_f3:CohortCtx HHVs (RANAS)	0.2584391	0.7511645	0.3440513	0.7308077

4.7.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.2822772	0.3071431	-10.6864761	0.0000000
Time_f2	-0.6363940	0.5141532	-1.2377516	0.2158082
Time_f3	-1.0418542	0.5896233	-1.7669827	0.0772311
CohortNon-ctx HHVs (Norms)	0.9904635	0.3656055	2.7091047	0.0067465

	Estimate	Std. Error	z value	Pr(> z)
Time_f2:CohortNon-ctx HHVs (Norms)	0.1696055	0.6023047	0.2815942	0.7782547
Time_f3:CohortNon-ctx HHVs (Norms)	-0.1894194	0.7080825	-0.2675103	0.7890763

4.7.3 Exploratory Analysis

4.7.3.1 Include households that were measured at all times

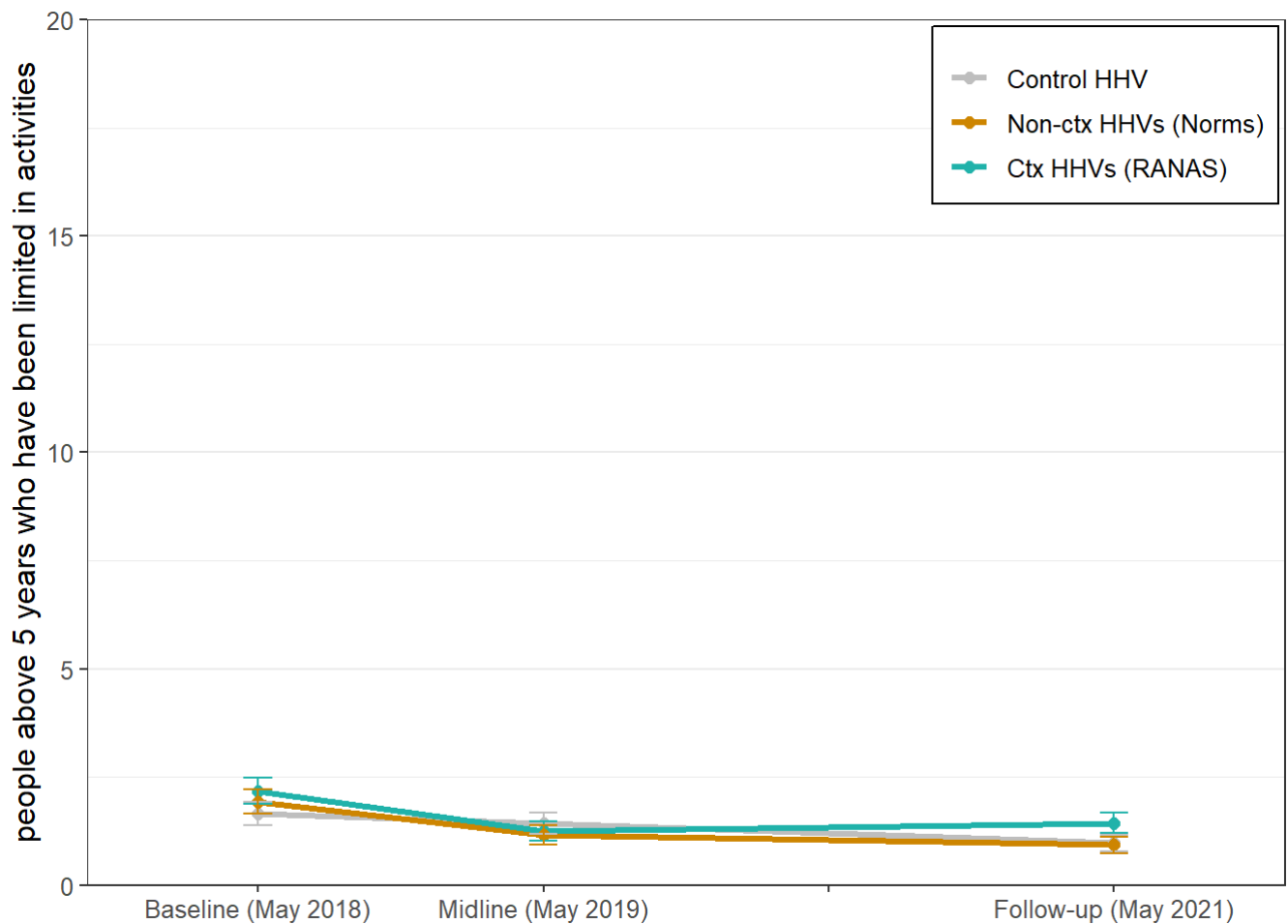
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.8281084	0.5752713	-4.9161298	0.0000009
Time	-0.5638767	0.3128112	-1.8026102	0.0714495
CohortCtx HHVs (RANAS)	0.2922394	0.7323703	0.3990322	0.6898695
CohortNon-ctx HHVs (Norms)	1.2130735	0.6749893	1.7971745	0.0723079
Time:CohortCtx HHVs (RANAS)	0.1780633	0.3897300	0.4568888	0.6477510
Time:CohortNon-ctx HHVs (Norms)	-0.0750386	0.3677262	-0.2040611	0.8383057

4.8 People above 5 years who have been limited in activities

4.8.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	2355	39	0.0165605	0.0026298
1	Ctx HHVs (RANAS)	2298	50	0.0217581	0.0030434
1	Non-ctx HHVs (Norms)	2393	46	0.0192227	0.0028069
2	Control HHV	2366	34	0.0143702	0.0024467
2	Ctx HHVs (RANAS)	2320	29	0.0125000	0.0023066
2	Non-ctx HHVs (Norms)	2321	27	0.0116329	0.0022257
3	Control HHV	2569	25	0.0097314	0.0019368
3	Ctx HHVs (RANAS)	2509	36	0.0143483	0.0023742
3	Non-ctx HHVs (Norms)	2582	24	0.0092951	0.0018885



4.8.2 Statistical Analysis

4.8.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.0751694	0.5791504	-8.7631283	0.0000000
Time_f2	-0.3950037	0.9151629	-0.4316211	0.6660168
Time_f3	-0.0124288	0.8190280	-0.0151751	0.9878925
CohortCtx HHVs (RANAS)	-0.3844139	0.9151731	-0.4200450	0.6744526
CohortNon-ctx HHVs (Norms)	0.2960423	0.7664965	0.3862279	0.6993279
Time_f2:CohortCtx HHVs (RANAS)	0.3971278	1.3571233	0.2926247	0.7698090
Time_f3:CohortCtx HHVs (RANAS)	1.1046771	1.1583238	0.9536859	0.3402426
Time_f2:CohortNon-ctx HHVs (Norms)	-0.9678984	1.4462943	-0.6692265	0.5033510
Time_f3:CohortNon-ctx HHVs (Norms)	-13.2892514	382.3264351	-0.0347589	0.9722720

4.8.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.4595855	0.7086097	-7.7046444	0.0000000
Time_f2	0.0021313	1.0021273	0.0021268	0.9983031

	Estimate	Std. Error	z value	Pr(> z)
Time_f3	1.0922488	0.8190901	1.3334904	0.1823709
CohortNon-ctx HHVs (Norms)	0.6804614	0.8684634	0.7835235	0.4333198
Time_f2:CohortNon-ctx HHVs (Norms)	-1.3650463	1.5028348	-0.9083143	0.3637122
Time_f3:CohortNon-ctx HHVs (Norms)	-14.8241747	474.0889716	-0.0312688	0.9750552

4.8.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.0751557	0.5788426	-8.7677649	0.0000000
Time_f2	-0.3950250	0.9144763	-0.4319686	0.6657643
Time_f3	-0.0124492	0.8187471	-0.0152052	0.9878684
CohortCtx HHVs (RANAS)	-0.3844374	0.9145939	-0.4203367	0.6742395
Time_f2:CohortCtx HHVs (RANAS)	0.3971642	1.3560235	0.2928889	0.7696071
Time_f3:CohortCtx HHVs (RANAS)	1.1047078	1.1577626	0.9541748	0.3399952

4.8.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.0751737	0.5788546	-8.7676133	0.0000000
Time_f2	-0.3949931	0.9145300	-0.4319083	0.6658081
Time_f3	-0.0124238	0.8187887	-0.0151734	0.9878939
CohortNon-ctx HHVs (Norms)	0.2960492	0.7661071	0.3864331	0.6991759
Time_f2:CohortNon-ctx HHVs (Norms)	-0.9679201	1.4452253	-0.6697365	0.5030258
Time_f3:CohortNon-ctx HHVs (Norms)	-13.8821834	92.7089424	-0.1497394	0.8809702

4.8.3 Exploratory Analysis

4.8.3.1 Include households that were measured at all times

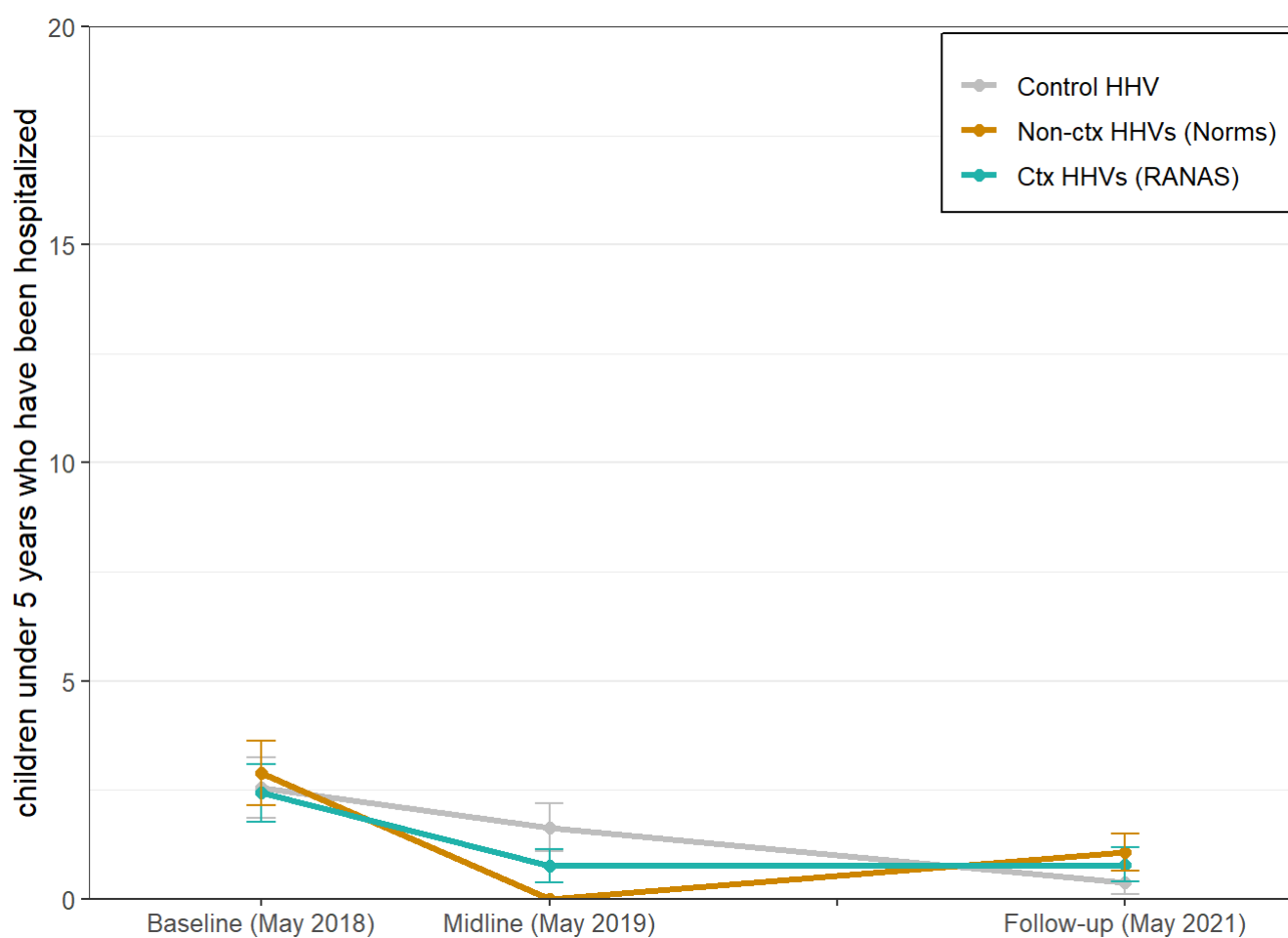
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.6766750	1.0738439	-5.2863132	0.0000001
Time	0.1930801	0.4691676	0.4115376	0.6806783
CohortCtx HHVs (RANAS)	-0.5786432	1.5206885	-0.3805140	0.7035639
CohortNon-ctx HHVs (Norms)	13.1023366	21.4057317	0.6120948	0.5404751
Time:CohortCtx HHVs (RANAS)	0.4239737	0.6358216	0.6668124	0.5048920
Time:CohortNon-ctx HHVs (Norms)	-13.0009429	21.4026099	-0.6074466	0.5435546

4.9 Children under 5 years who have been hospitalized

4.9.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	510	13	0.0254902	0.0069790
1	Ctx HHVs (RANAS)	536	13	0.0242537	0.0066447
1	Non-ctx HHVs (Norms)	519	15	0.0289017	0.0073538
2	Control HHV	549	9	0.0163934	0.0054195
2	Ctx HHVs (RANAS)	528	4	0.0075758	0.0037735
2	Non-ctx HHVs (Norms)	522	0	0.0000000	0.0000000
3	Control HHV	529	2	0.0037807	0.0026683
3	Ctx HHVs (RANAS)	507	4	0.0078895	0.0039292
3	Non-ctx HHVs (Norms)	561	6	0.0106952	0.0043429



4.9.2 Statistical Analysis

4.9.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.7511845	0.3823781	-9.8101448	0.0000000
Time_f2	-0.5795476	0.6320618	-0.9169160	0.3591867
Time_f3	-1.9691307	1.0721451	-1.8366271	0.0662650
CohortCtx HHVs (RANAS)	-0.3058043	0.5913317	-0.5171451	0.6050548
CohortNon-ctx HHVs (Norms)	0.0000025	0.5407640	0.0000046	0.9999964
Time_f2:CohortCtx HHVs (RANAS)	-0.3774286	1.0518011	-0.3588403	0.7197146
Time_f3:CohortCtx HHVs (RANAS)	0.3528030	1.5350521	0.2298313	0.8182229
Time_f2:CohortNon-ctx HHVs (Norms)	-17.2049199	2731.5139341	-0.0062987	0.9949744
Time_f3:CohortNon-ctx HHVs (Norms)	-0.0258971	1.5162154	-0.0170801	0.9863727

4.9.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-4.0569904	0.4509923	-8.9956974	0.0000000
Time_f2	-0.9569697	0.8404726	-1.1386090	0.2548663
Time_f3	-1.6163454	1.0985873	-1.4712944	0.1412115
CohortNon-ctx HHVs (Norms)	0.3058086	0.5912436	0.5172295	0.6049960
Time_f2:CohortNon-ctx HHVs (Norms)	-17.9150638	48.2723749	-0.3711246	0.7105448
Time_f3:CohortNon-ctx HHVs (Norms)	-0.3786754	1.5350363	-0.2466883	0.8051495

4.9.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.7511833	0.3823346	-9.8112574	0.0000000
Time_f2	-0.5795514	0.6319488	-0.9170860	0.3590976
Time_f3	-1.9691265	1.0721329	-1.8366441	0.0662625
CohortCtx HHVs (RANAS)	-0.3058042	0.5912576	-0.5172099	0.6050097
Time_f2:CohortCtx HHVs (RANAS)	-0.3774222	1.0515720	-0.3589124	0.7196606
Time_f3:CohortCtx HHVs (RANAS)	0.3527881	1.5350378	0.2298237	0.8182287

4.9.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-3.7511828	0.3823778	-9.8101483	0.0000000
Time_f2	-0.5795504	0.6320619	-0.9169204	0.3591843
Time_f3	-1.9691311	1.0721444	-1.8366287	0.0662647
CohortNon-ctx HHVs (Norms)	-0.0000013	0.5407640	-0.0000024	0.9999981

	Estimate	Std. Error	z value	Pr(> z)
Time_f2:CohortNon-ctx HHVs (Norms)	-18.3495718	4841.3052650	-0.0037902	0.9969759
Time_f3:CohortNon-ctx HHVs (Norms)	-0.0258888	1.5162131	-0.0170746	0.9863771

4.9.3 Exploratory Analysis

4.9.3.1 Include households that were measured at all times

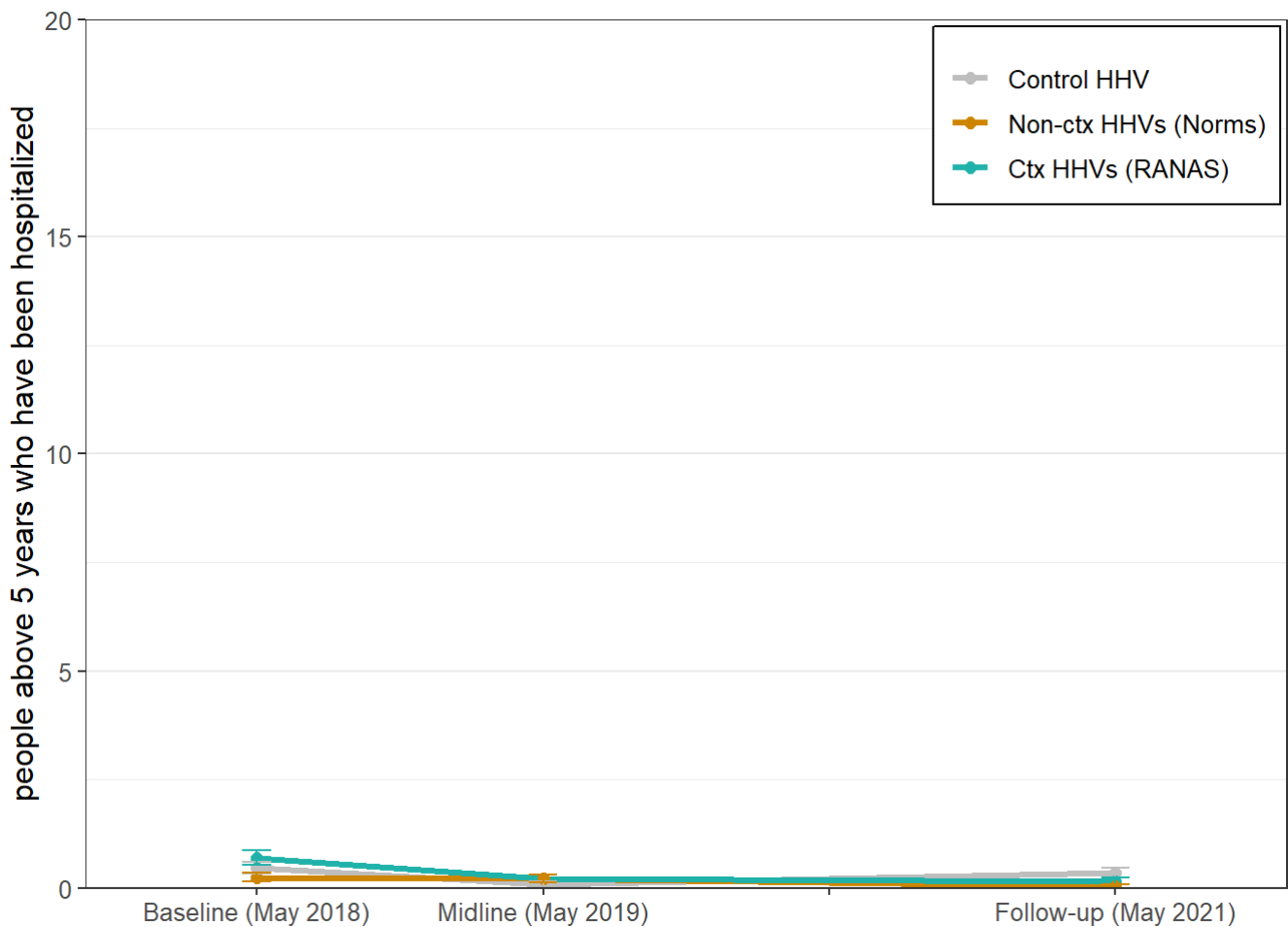
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.9758794	0.7255078	-4.1017881	0.0000410
Time	-0.7842522	0.4248453	-1.8459711	0.0648964
CohortCtx HHVs (RANAS)	-0.1468139	1.1192435	-0.1311724	0.8956389
CohortNon-ctx HHVs (Norms)	0.1189211	1.2514876	0.0950238	0.9242959
Time:CohortCtx HHVs (RANAS)	-0.0908576	0.6675199	-0.1361122	0.8917326
Time:CohortNon-ctx HHVs (Norms)	-0.4973767	0.8175172	-0.6083990	0.5429228

4.10 People above 5 years who have been hospitalized

4.10.1 Overview Table

Total amount of children, total amount of sick children, and proportion (prop) of sick children per Cohort and Time

Time	Cohort	children	children_sick	prop	error
1	Control HHV	2355	11	0.0046709	0.0014050
1	Ctx HHVs (RANAS)	2292	16	0.0069808	0.0017391
1	Non-ctx HHVs (Norms)	2386	6	0.0025147	0.0010253
2	Control HHV	2366	2	0.0008453	0.0005975
2	Ctx HHVs (RANAS)	2320	5	0.0021552	0.0009628
2	Non-ctx HHVs (Norms)	2321	5	0.0021542	0.0009624
3	Control HHV	2569	9	0.0035033	0.0011657
3	Ctx HHVs (RANAS)	2509	4	0.0015943	0.0007965
3	Non-ctx HHVs (Norms)	2582	1	0.0003873	0.0003872



4.10.2 Statistical Analysis

4.10.2.1 Model including all groups

Time_f2/f3 show the effect of Time over all 3 groups (f2: baseline to midline; f3: baseline to follow-up)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.4827203	7.085754e-01	-7.7376666	0.0000000
Time_f2	-15.3543497	1.532686e+03	-0.0100179	0.9920070
Time_f3	-0.7075962	1.226430e+00	-0.5769563	0.5639690
CohortCtx HHVs (RANAS)	-15.4754402	1.638688e+03	-0.0094438	0.9924651
CohortNon-ctx HHVs (Norms)	-15.4937902	1.641638e+03	-0.0094380	0.9924697
Time_f2:CohortCtx HHVs (RANAS)	0.1965654	3.092214e+06	0.0000001	0.9999999
Time_f3:CohortCtx HHVs (RANAS)	-1.9998384	6.501359e+03	-0.0003076	0.9997546
Time_f2:CohortNon-ctx HHVs (Norms)	-1.3299909	3.108759e+06	-0.0000004	0.9999997
Time_f3:CohortNon-ctx HHVs (Norms)	-2.0610258	6.697027e+03	-0.0003078	0.9997544

4.10.2.2 Contextualized versus Non-contextualized

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-21.928289	2661.652	-0.0082386	0.9934266
Time_f2	-5.225194	36346.127	-0.0001438	0.9998853

	Estimate	Std. Error	z value	Pr(> z)
Time_f3	-1.979844	7584.961	-0.0002610	0.9997917
CohortNon-ctx HHVs (Norms)	-9.420793	268035.555	-0.0000351	0.9999720
Time_f2:CohortNon-ctx HHVs (Norms)	13.657976	270184.125	0.0000506	0.9999597
Time_f3:CohortNon-ctx HHVs (Norms)	9.411292	268222.703	0.0000351	0.9999720

4.10.2.3 Contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.4827200	7.085753e-01	-7.7376675	0.0000000
Time_f2	-15.8759243	1.989351e+03	-0.0079805	0.9936326
Time_f3	-0.7075956	1.226429e+00	-0.5769560	0.5639692
CohortCtx HHVs (RANAS)	-16.1216146	2.263660e+03	-0.0071219	0.9943176
Time_f2:CohortCtx HHVs (RANAS)	-0.0280160	3.092215e+06	0.0000000	1.0000000
Time_f3:CohortCtx HHVs (RANAS)	-0.1445049	4.115511e+03	-0.0000351	0.9999720

4.10.2.4 Non-contextualized versus Control

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-5.4827204	7.085754e-01	-7.7376665	0.0000000
Time_f2	-15.7938553	1.909372e+03	-0.0082718	0.9934002
Time_f3	-0.7075948	1.226429e+00	-0.5769554	0.5639696
CohortNon-ctx HHVs (Norms)	-15.9075581	2.018952e+03	-0.0078791	0.9937134
Time_f2:CohortNon-ctx HHVs (Norms)	-1.6903967	3.108759e+06	-0.0000005	0.9999996
Time_f3:CohortNon-ctx HHVs (Norms)	-3.3676427	1.547848e+04	-0.0002176	0.9998264

4.10.3 Exploratory Analysis

4.10.3.1 Include households that were measured at all times

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-6.483282	1.872865e+00	-3.4616911	0.0005368
Time	-0.024065	8.670125e-01	-0.0277562	0.9778566
CohortCtx HHVs (RANAS)	-6.116858	4.856160e+04	-0.0001260	0.9998995
CohortNon-ctx HHVs (Norms)	-7.079274	2.185923e+04	-0.0003239	0.9997416
Time:CohortCtx HHVs (RANAS)	-7.518834	4.852159e+04	-0.0001550	0.9998764
Time:CohortNon-ctx HHVs (Norms)	-6.237195	2.179513e+04	-0.0002862	0.9997717



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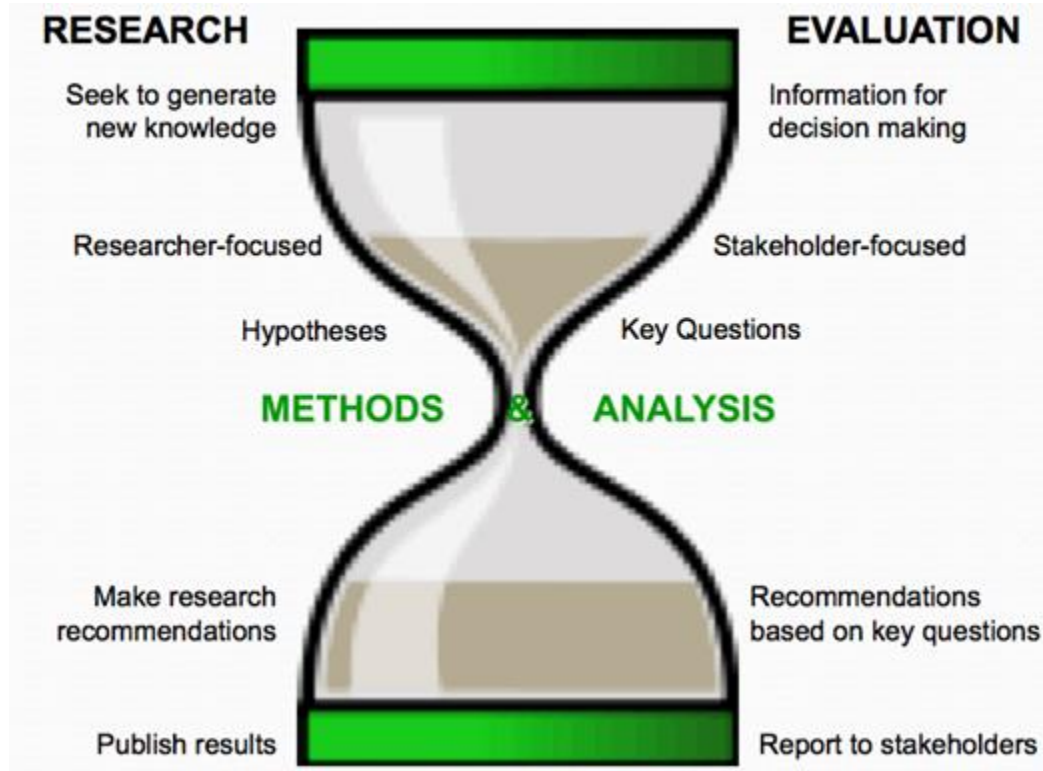
Impactstudie Tanzania: Lessons learned

Charlotte Schelstraete (Focal Point WASH)
Kim Dockx (Researcher CEBaP)
Hans Van Remoortel (Coordinating Researcher CEBaP)
Emmy De Buck (Manager CEBaP)
Dries Goeminne (Head of Expertise and Support)
Tiene Lievens (Manager HD-Internationaal)

Limitations

- + No accurate cost data were available
- + Sensitivity analysis was not performed
- + EQ-5D
 - Assessed by 1 person within the household
 - = not necessarily the person with diarrhea
 - Could be different people at baseline vs midline

Lessons learned – Design of the study



Lessons learned – Design of the study

- + Comparing packages that contain a lot of interventions (CLTS + PHAST + hardware + (mini)RANAS) will result in limited differences between cohorts, and thus limited conclusions that can be made
- + Developing our own intervention is time-consuming. Might be better to rely on existing packages / interventions

Lessons learned – Ethical approval

- + Ethical approval is needed in Belgium + location of study
- + Time consuming → provide sufficient time for the process to complete (several months)
- + Helpful (sometimes even obligated) to include a local researcher

Lessons learned - implementation

- + Difficult to manage an RCT from a distance, without the involvement of a researcher on site who understands and values the importance of randomization, blinding, allocation concealment, ...
- + Track intervention more carefully using hard data
 - GPS
 - Pictures / Videos
 - Signatures when a session is completed / materials are delivered
 - Progress reports with 'proof' of progress
- + Continuous follow-up of data is needed

Lessons learned - measurement

- + Track measurement more carefully
 - GPS at each timepoint to ensure that the correct households are assessed
 - Combine questions (subjective) + observations (objective)
 - Assess same person within the household

- + Detailed data regarding costs difficult (impossible) to retrieve
 - Other format for data collection is needed
 - Or at least the possibility to go back to the invoices and retrieve data from there