**Educational intervention to reduce disease related to sub-optimal basic hygiene in Rwanda: initial evaluation and feasibility study**

**Abstract**

A controlled pilot and feasibility study was conducted in Rwanda, Africa, to initially assess the impact and practicality of an educational intervention using an interactive DVD on the topic of basic hygiene, including water and sanitation. Baseline and follow-up data for relevant morbidities were collected from health center records in two districts (intervention and control) and changes were compared. Qualitative data were obtained through observations, discussions and feedback. There was a 39% decrease in incident cases of infection with intestinal worms and parasites between baseline and follow-up in the intervention district (4995 reduced to 3069), compared to 13% (5002 reduced to 4356) in the control district (p=<0.0001). Findings relating to diarrhea and dysentery were less clear. Qualitative data indicated a high level of acceptability for the intervention. Using local personnel such as community health workers was suggested as a practical method of delivery for future evaluation and implementation.

**Introduction**

In recent years, there has been a shift in the global burden of disease, with a reduction in morbidity related to water, sanitation and hygiene (Lim et al, 2012). There are nevertheless large between-country variations, with the World Health Organization (WHO) reporting particularly slow progress relating to water, sanitation and hygiene in sub-Saharan Africa (WHO, 2016). Young children are at particularly high risk for diarrhea (Walker et al, 2013). In Rwanda, despite a decrease in deaths from diarrheal diseases, these were the fourth most common cause of death in 2012, after respiratory disease, HIV/AIDS and stroke (WHO, 2015).

Morbidity and mortality associated with sub-optimal water supply, sanitation and hygiene are not limited to diarrheal diseases. In 2004, 881,000 non-diarrheal deaths were attributable globally to poor quality water, sanitation and hygiene, including deaths from the parasitic worm and intestinal nematode infections (WHO, 2014). A systematic review and meta-analysis confirmed the link between infection with intestinal worms and sub-optimal sanitation access and usage (Ziegelbauer et al, 2012).

Low rates of hand-washing have been observed in low- and middle-income countries (LMICs) such as Ghana (Scott, Lawson, & Curtis, 2007). A study in Tanzania highlighted the difficulty of avoiding contamination if good water and sanitation are lacking (Pickering, Julian, Mamuya, Boehm, & Davis, 2011), and a 27% reduction in the risk of diarrhea was identified in Eritrean households where a toilet facility was available (Woldemicael, 2001). Improving sanitation and water supply in LMICs is clearly important for reducing diarrheal disease (Wolf, et al, 2014), but there is also a role for education promoting optimal use of the facilities available.

Evidence regarding the impact of educational interventions designed to improve hygiene is, however, limited and inconsistent. Positive results were obtained, for example, in a school-based study in rural China, where an educational intervention increased knowledge and reduced rates of infection with soil-transmitted helminths (Bieri et al, 2013) and in a study in Zaire in which an educational intervention reduced cases of diarrhea in young children (Haggerty, Muladi, Kirkwood, Ashworth, & Manunebo, 1994). Negative results have also, however, been reported. After a knowledge and awareness campaign in India, for example, there was no observed increase in handwashing with soap. (Biran et al, 2009). Even where a statistically significant impact has been shown, this may be very modest, as demonstrated in a school-based study in Kenya, in which there was an increase from 6% to 14% of parents treating their water (O’Reilly et al, 2008). Increased knowledge does not necessarily lead to behavior change, as recognized in a study which used emotional drivers such as nurture and disgust (Biran et al, 2014). Even in countries where there are high levels of education, behavior relating to hygiene is far from optimal; in a UK study, observations suggested that child-carers washed their hands with soap on only 42% of occasions after changing a baby’s nappy (Curtis et al, 2003).

Despite these limitations regarding the impact of education, additional evidence is warranted, especially relating to LMICs. A systematic review and meta-analysis of trials assessing the effectiveness of handwashing initiatives led to the conclusion that such interventions reduce episodes of diarrhea, including a reduction in incidence of around a quarter identified from pooled results from community-based trials in LMICs (Ejemot-Nwadiaro, Ehiri, Arikpo, Meremikwu, & Critchley, 2015). The 22 trials meeting the inclusion criteria were of variable quality and a there was only one study from sub-Saharan Africa published over twenty years ago (Haggerty et al, 1994). The current study was developed to explore the feasibility and effectiveness of a simple educational intervention on the topic of basic hygiene, delivered in rural Rwanda, Africa.

**Methods**

***Overview***

Approval was obtained from the Rwanda National Ethics Committee in January 2015; data collection and delivery of the intervention were conducted between February and September 2015. This was a controlled pilot and feasibility study; the sample size of two districts was based on practicality for a pilot-level study rather than using a power calculation. Randomization was used to determine which district would receive the intervention, but blinding was not possible due to the type of intervention. The two districts selected were Gicumbi and Rulindo, Northern Province, Rwanda. People living in villages in these districts generally have to walk considerable distances to collect piped water, which then requires purification such as boiling before drinking. To minimize any impact of confounding factors, the two districts were purposively (rather than randomly) selected for comparability in terms of rural setting, population density and lack of previous exposure to education involving the intervention DVDs. Difficulty of travel for people living in villages suggested a low likelihood of between-district contamination due to sharing of the messages in the intervention. Nineteen health centers in each of the two districts were identified as venues for showing the DVDs; numbers served by these health centers were 346,276 (Gicumbi) and 288,452 (Rulindo).

The overall aims of the study were to explore the effectiveness of the intervention in terms of impact on morbidity and mortality and to assess the feasibility of evaluating and implementing this type of educational intervention in a LMIC such as Rwanda. The primary outcome measure was change in morbidity linked to sub-optimal hygiene, based on the number of recorded cases of diseases such as diarrhea and worm infestation. We also sought to explore whether we could identify any changes relating to morbidity. A small qualitative component was included in the study design, to explore feasibility and contribute to the evaluation of impact.

***Quantitative data collection and intervention delivery***

A small team of fieldworkers was recruited and trained in Rwanda. Review of the information reported in *Health Center and Dispensary Monthly HMIS Report* forms was used to finalize a standardized data collection form. The report form is completed by health centers and returned to district offices. In order to focus on incident cases, we selected items categorized on the form as ‘new’. We included categories relevant to basic hygiene including water and sanitation (Table 1). Aggregated data were extracted at district offices, with no links to individual cases. Baseline data were collected for a three-month period (November 2014 to January 2015) before the start of the intervention. The same data were collected for a follow-up period comprising the final three months during which the intervention was implemented (June to August 2015). Random samples of baseline and follow-up data for both districts were checked for accuracy and further checks and corrections were made where indicated. ***[Table 1 near here]***

At the end of the baseline data collection period, one district (Gicumbi) was randomly allocated (using the Microsoft Excel RAND function) to receive the intervention, with the other (Rulindo) as control. The intervention was delivered over a period of just over 6 months (towards the end of February 2015 to the end of August 2015.) The intervention comprised education sessions using an interactive DVD developed by Thare Machi Education (<http://www.tme.org.uk>), a small not-for-profit organization based in the UK (registered charity no 1080131). TME’s aims include providing basic education in developing countries, using simple interactive DVDs in local languages, on topics mainly related to health and wellbeing. The DVDs require no reading or writing ability and are designed to be easily understood by people with limited health literacy and educational skills. For our study, the Kinyarwanda language version of the Basic Hygiene DVD was used (Table 2). Education sessions were delivered using a projector or a laptop computer, depending on the venue and electricity supply. Fieldworkers kept a record of the number of people who attended sessions, using close estimates for large numbers. After the sessions, health centers were provided with one or more copies of the DVD, which they could continue to use if they wished, but information regarding continued use was not formally collected. ***[Table 2 near here]***

***Feasibility testing***

At the end of the study, qualitative feedback was collected as follows from a small purposive sample: a focus group discussion was conducted with three fieldworkers; informal interviews were carried out with three people involved in healthcare provision and co-ordination in Gicumbi; and feedback was invited at a training session for community health workers (lay members of village communities, approximately 100 attending). This information was collected verbally, with detailed note-taking, by the principal investigator from the UK, with interpretation where required. Feedback was supplemented by observations noted and discussions that took place between the principal investigators during the conduct of the study.

***Analysis***

Changes in numbers of incident cases recorded as diarrhea and worm infection were calculated for the two districts, by comparing baseline and follow-up data. Percentages for (positive or negative) changes, as a proportion of the number of cases at baseline, were also determined. A chi-squared test was used to compare the incidence of recorded cases in the intervention and control districts, for the combined age groups studied, for the two time periods. A one-tailed p-value was determined as there was no expectation that the intervention would significantly increase morbidity. Microsoft Excel was used for the quantitative analysis. Analysis of qualitative data involved identifying themes and classifying data within these themes for further consideration.

**Results**

***Quantitative findings***

During the intervention period, the DVD was viewed by over 47,000 people at sessions delivered by the research team. Initial review of the data identified very low numbers of cases recorded as food poisoning, so analysis was restricted to impact on diarrhea and dysentery and worms and parasites. At baseline, similar numbers of cases of infection with intestinal worms and parasites were identified in the two study districts, in the combined age groups for which data were collected (Gicumbi 4995; Rulindo 5002). Much lower numbers of cases were recorded as diarrhea and dysentery (Gicumbi 1274; Rulindo 1949) (Table 3). There were no deaths recorded as being the result of diarrhea and dysentery in either of the time periods for which data were collected. For diarrhea and dysentery, combined results for adults, children and infants indicated a decrease from 1274 to 1171 cases (8%) in the Gicumbi (intervention), but a difference of only 5 cases in the Rulindo (control). Comparison of numbers of cases in the two districts in the two time periods indicated borderline non-significance (χ2 = 2.51, p= 0.0720). For worms and parasites, comparison of rates of change between baseline and follow-up revealed a much greater between-district difference. In Rulindo, there was an overall reduction from 5002 to 4356 cases (13%), whilst in Gicumbi, the number of cases fell from 4995 to 3069 (39%). Comparison of results relating to worms and parasites in the two districts indicated a high level of significance (χ2 = 127.68, p=<0.0001). (Table 3). ***[Table 3 near here]***

***Qualitative findings***

Qualitative data could be grouped into three broad themes: acceptability; effectiveness; and feasibility. Since data collection involved notes rather than audio-recording, paraphrasing as opposed to presentation of direct quotations is used to illustrate key findings. In relation to acceptability, high levels of engagement were observed in those attending the viewings; the interactive DVD format and the simple messages appeared to be very well received. In the focus group, one fieldworker described how, after viewing the DVD, some of the men turned to the women to ask if they had been listening carefully. People consistently stayed for the full session and often asked the fieldworkers to return. Fieldworkers indicated that their own experience had been rewarding, due to the positive reactions of those who viewed the DVD.

People involved in health care provision who were interviewed indicated anecdotally that positive changes had been observed in relation to hygiene practice and cases of related diseases. One, who was involved in community health worker training, described how the DVD had been a useful training aid, strengthening these workers’ capability for teaching in their communities. This was confirmed by the community health workers who gave feedback at the training session. A question about whether they had found the DVD useful elicited an enthusiastic positive response, accompanied by broad smiles. They explained that the DVD had given them additional information about key messages that they needed to disseminate.

Carrying out the research was described and observed as feasible, but reported challenges included problems with power supply and difficulties with travel due to poor terrain and weather conditions. Fieldworkers described how visits to health centers had sometimes involved up to four hours of travel each way and they reported problems with power cuts or lack of a good electricity supply. Exploration of solutions during our interviews and discussions highlighted the potential benefits of using local personnel for evaluating or implementing the type of intervention being investigated, for example, using Information, Education and Communication sessions for showing DVDs at health centers or providing community health workers with small battery operated DVD players for showing DVDs within their villages.

**Discussion**

***Impact***

Our findings regarding high numbers of cases of intestinal worms and parasites in our study districts support previous observationsregarding the high global burden of worm infestation, including particularly high rates in sub-Saharan Africa (Brookner, 2010). The DVD used for the intervention includes messages about hygiene including the spread of infection via soil, water and food and preventive measures including hand washing, water treatment and safe disposal of feces. Such messages are highly relevant to preventing transmission of infection with worms and parasites. The interactive format of the DVD is likely to have contributed to the effectiveness of the intervention, by encouraging engagement and reinforcing messages.

We used a controlled design that would help us to assess the extent to which changes were linked to the intervention or other factors. In Rulindo (control), there was a 13% reduction in cases of worms and parasites, and it is logical to assume that this 13% was due to factors unrelated to the intervention, such as seasonal variation. In Gicumbi, where the DVDs were shown, there was a much greater (39%) overall reduction in cases. It is possible that there were unidentified confounding factors, but the two districts were purposively selected for similarity and we are not aware of any events or other interventions which are likely to have influenced numbers of cases during the intervention period. It thus seems reasonable to surmise that a reduction of 26% in the number of such cases (39% reduction, less 13% due to other factors) is likely to be linked to the impact of the intervention. Although we had been unable to obtain formal quantitative information about deaths related to intestinal worms, this issue was discussed as part of our feedback data collection from individuals involved in healthcare provision in Gicumbi. We were informed anecdotally that, in the year prior to the start of the study, there had been a small number of related deaths in young children. This suggests that there is potential for a reduction in mortality if morbidity can be reduced through education.

Comparison of changes relating to numbers of cases of diarrheal disease were non-significant and inconsistencies made findings difficult to interpret. In Gicumbi, for example, the 23% reduction in cases in adults was not matched by results for children and infants. Findings for diarrhea may, however, be influenced by types of cases recorded in these categories, including possible overlap between diarrhea and worm infestation, and also by lack of statistical power due to lower numbers of recorded cases compared to infection with worms and parasites.

Two previous studies had provided some evidence regarding the impact of TME DVDs. An evaluation in six countries showed an increase in knowledge after watching a DVD-based lesson (report available from TME). Research in the UK demonstrated significant changes in understanding and attitudes in people of south Asian origin who viewed a DVD about insulin in type 2 diabetes, produced as a collaboration between TME and the University of Leicester (Patel et al, 2015). These evaluations had provided promising evidence, but no hard outcomes relating to morbidity were included. Results from the current study suggested a clinical impact relating to cases of infection with worms and parasites, based on health center data.

There is some evidence that interventions with additional components alongside education may have greater impact. In a quasi-experimental study in Ethiopia, for example, tailored interventions including public-commitment with or without handwashing-station-promotion were more effective in terms of self-reported hand washing than education alone (Contzen, Meili, & Mosler, 2015). In comparing educational community-based handwashing interventions in LMICs, Ejemot-Nwadiaro and colleagues (2015) identified a greater impact in six trials that provided free soap compared to two that did not, but these authors drew attention to the small number of studies on which this finding was based and the difficulty of determining the relative impact of soap provision and hand washing promotion from the limited evidence available. Additional measures within an intervention are likely to have cost implications. In a study in rural Peru aimed at reducing childhood diarrhea and respiratory disease, which was unable to confirm an impact on health outcomes, an integrated package was provided including water purification bottles, solid fuel stoves and sinks with piped water, in addition to hygiene promotion (Hartinger et al, 2016). In our study, we sought to evaluate a low-cost educational approach without additional interventions such as provision of soap, which might have made it difficult to determine the effectiveness specifically of the DVD.

***Feasibility***

Qualitative findings indicated the feasibility of carrying out the type of research investigated and also of implementation in a real world setting. Feedback and observations suggested high levels of acceptability relating to the educational intervention based on an interactive DVD, but also highlighted the importance of being aware of potential challenges. For practical reasons, the intervention was delivered by a team of fieldworkers who travelled to health centers in the intervention district, but experiences and feedback suggested that using local personnel may be preferable for further evaluation and implementation of this type of intervention.

***Limitations***

It is acknowledged that this small-scale pilot study has some important limitations. Using our data collection methods and working within time and budgetary restrictions, we were unable to collect numbers specifically for deaths from infections with worms and parasites, so it was not possible to quantitatively investigate any impact on mortality from these infections. From the data collected, we were also unable to compare cases of worms and parasites in children aged under 5 years, in whom these infections are particularly common. Potential for statistical testing was restricted by the data collected, for example, lack of detailed data regarding the numbers of people in different age ranges served by the health centers. Our between-district comparisons using a chi-squared test nevertheless clearly indicated a significant result regarding changes in the incidence of infection with intestinal worms and parasites. It is further acknowledged that we cannot fully guarantee the accuracy of the data provided in health center submissions to the district offices, although observations in one health center prior to the start of the study suggested that information entered on report forms was derived from conscientious recording in paper records of clinic activity. Whilst recognizing the small scale and informality of the qualitative aspect of our study, we consider that this made a useful contribution, particularly in terms of investigating feasibility, emphasizing the usefulness of including this type of component in evaluations.

***Conclusions***

Our study has demonstrated the feasibility of evaluating and implementing a DVD-based educational intervention on the topic of basic hygiene in a LMIC in sub-Saharan Africa. A larger, cluster randomized trial including data collection from additional sources would be required in order to confidently confirm the effectiveness of the intervention and to clarify the potential for reducing diarrheal disease, but overall the results of our small-scale, low-budget study suggest that the intervention is promising in terms of a potential impact on health. Training local providers such as community health workers to show the DVDs would provide a practical method of delivery that could lead to sustained impact, although monitoring or further evaluation would be needed to confirm the effectiveness of this method of delivering the intervention.

**References**

Bieri, F.A., Gray, D.J., Williams, G.M., Raso G., Li, Y.S., Yuan, L., … McManus, D.P. Health-education package to prevent worm infections in Chinese schoolchildren. *New England Journal of Medicine*. *368*, 1603-1612.

Biran, A., Schmidt, W.P., Varadharajan, K.S., Rajaraman, D., Kumar, R., Greenland, K., … Curtis, V. (2014). Effect of a behaviour-change intervention on handwashing with soap in India (SuperAmma): a cluster-randomised trial. *Lancet Global Health*. *2*, e145-154.

Biran, A., Schmidt, W.P., Wright, R., Jones, T., Seshadri, M., Isaac, P., … Curtis V. (2009). The effect of a soap promotion and hygiene education campaign on handwashing behaviour in rural India: a cluster randomised trial. *Tropical Medicine and International Health. 14*, 1303-1314.

Brooker, S. (2010). Estimating the global distribution and disease burden of intestinal nematode infections: adding up the numbers—a review. *International Journal of Parasitology. 40*, 1137–1144.

Contzen, N., Meili, I.H., & Mosler, HJ. (2015). Changing handwashing behaviour in southern Ethiopia: a longitudinal study on infrastructural and commitment interventions. *Social Science and Medicine. 124C*, 103-114.

Curtis, V., Biran, A., Deverell, K., Hughes, C., Bellamy, K., & Drasar, B. (2003). Hygiene in the home: relating bugs and behaviour. *Social Science and Medicine. 57*, 657-672.

Ejemot-Nwadiaro, R.I., Ehiri, J.E., Arikpo, D., Meremikwu, M., & Critchley, J.A. (2015). Hand washing promotion for preventing diarrhea. *Cochrane Database of Systematic Reviews*; 9. doi: 10.1002/14651858.CD004265.pub3.

Haggerty, P.A., Muladi, K., Kirkwood, B.R., Ashworth, A., & Manunebo, M. (1994). Community-based hygiene education to reduce diarrhoeal disease in rural Zaire: impact of the intervention on diarrhoeal morbidity. *International Journal of Epidemiology.* *23(5)*, 1050-1059.

Hartinger, S.M., Lanata, C.F., Hattendorf, J., Verastegui, H., Gil, A.I., Wolf, J., & Mäusezahl, D. (2016). Improving household air, drinking water and hygiene in rural Peru: a community-randomized–controlled trial of an integrated environmental home-based intervention package to improve child health. *International Journal of Epidemiology.* doi: 10.1093/ije/dyw242

Lim, S.S., Vos, T., Flaxman, A.D., Danaei, G., Shibuya, K., Adair-Rahani, H., ... Ezzati M. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet. 380*, 2224-2260.

O’Reilly, C.E., Freeman, M.C., Ravani, M., Migele, J., Mwaki, A., Ayolo, M., … Quick, R. (2008). The impact of a schoolbased safe water and hygiene programme on knowledge and practices of students and their parents: Nyanza Province, Western Kenya. *Epidemiology and Infection. 136*, 80-91.

Patel, N., Stone, M.A., Hadjiconstantinou, M., Hiles, S., Troughton, J, Martin-Stacey, L., ... Khunti, K. (2015). Using an interactive DVD about type 2 diabetes and insulin therapy in a UK South Asian community and in patient education and healthcare provider training. *Patient Education and Counseling. 98*, 1123–1130.

Pickering, A.J., Julian, T.R., Mamuya, S., Boehm, A.B., & Davis, J. (2011). Bacterial hand contamination among Tanzanian mothers varies temporally and following household chores. *Tropical Medicine & International Health*. *16(2)*, 233-239.

Scott, B.E., Lawson, D.W., & Curtis V. (2007). Hard to handle: understanding mothers’ handwashing behaviour in Ghana. *Health Policy and Planning. 22*, 216-224.

Walker, C.L.F., Rudan., I, Liu, L., Nair, H., Theodoratou, E., Bhutta, Z.A., … Black R.E. (2013). Global burden of childhood pneumonia and diarrhoea. *Lancet. 381*, 1405-1416.

Woldemicael G. (2001). Diarrhoeal Morbidity among Young Children in Eritrea: Environmental and Socioeconomic Determinants. *Journal of Health, Population and Nutrition. 19(2)*, 83–90.

Wolf, J., Prüss-Ustün, A., Cumming, O., Bartram, J., Bonjour, S., Cairncross, S., … Higgins, J.P. (2014). Assessing the impact of drinking-water and sanitation on diarrhoeal disease in low-and middle income settings: a systematic review and meta-regression. *Tropical Medicine and International Health. 19*, 906-916.

World Health Organisation (2014). *Preventing diarrhoea through better water, sanitation and hygiene*. Geneva, Switzerland: WHO.

World Health Organisation. (2015, January, updated). *Rwanda: WHO statistical profile*. Retrieved from <http://www.who.int/gho/countries/rwa.pdf?ua=1>

World Health Organisation. (2016, November, reviewed). *Sanitation WHO Factsheet no 392*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs392/en/>

Ziegelbauer, K., Speich, B., Mäusezahl, D., Bos, R., Keiser, J., & Utzinger J. Effect of Sanitation on Soil-Transmitted Helminth Infection: Systematic Review and Meta-Analysis. *PLoS Medicine. 9(1),* e1001162.

**Table 1. Data collected for baseline and follow-up periods from health center records in intervention and control districts**

Items of data (numbers of new cases) collected and used for measuring change in morbidity and mortality:

* Dysentery / diarrhea in adults and in children aged 5-19 years (any cases recorded as: diarrhea with dehydration, diarrhea no dehydration or diarrhea bloody (dysentery))
* Food poisoning in adults and in children aged 5-19 years (any cases recorded as food poisoning)
* Worms / parasites in adults and in children aged 5-19 years (any cases recorded as: schistosomiasis, ascarislumbricoides, trichuristrichiura, hookworm, entmoeba, giardia or taenia)
* Dysentery / diarrhea in infants aged 0-4 years (cases recorded as: diarrhea with severe dehydration, diarrhea with evident signs of dehydration, diarrhea no dehydration, diarrhea bloody (dysentery), persistent diarrhea, or severe persistent diarrhea)
* Any deaths recorded for adults, children or infants, with diarrhea or dysentery given as the cause
* Any deaths recorded for adults, children or infants, with food poisoning recorded as the cause

**Table 2. Thare Machi Education Basic Hygiene DVD**

|  |
| --- |
| General format of TME DVDs:  The interactive DVDs produced by TME include a combination of information and questions, illustrated using relevant still or moving images. Questions based on the information given are used throughout the DVDs to reinforce messages; each question has a choice of two answers, one of which is selected by the person or group viewing the DVD. Where an incorrect answer is given, the message and question and is repeated and there is a ‘quiz’ at the end of the DVD to further reinforce the messages.  Summary of topics covered in the Basic Hygiene DVD:   * Germs and how they may be spread * Cleanliness, including handwashing and importance of soap * Preventing infection from human and animal feces * Importance of keeping babies and small children clean * Cleanliness when people are unwell * Safe drinking water, including purification * Food safety to prevent infection * Cleanliness within the home, including keeping bedding clean * Preventing the spread of germs through coughs and sneezes   Sample text from DVD script:  Message:  *If you are changing your baby's nappy, make sure you wash your hands afterwards. If your baby or child does a poo near the house, clean it up immediately. Always wash your hands afterwards*  Question:  *What should you do after changing a baby's nappy? Wash your hands, or start cooking?*  If correct answer selected:  *Well done! Always wash your hands after changing a baby's nappy*.  If incorrect answer selected:  *That was the wrong answer. Let’s go back and listen again.*  Note: The Kinyarwanda language version of the DVD was used |

**Table 3. Summary of changes in numbers of cases of diarrhea and worms and parasites between baseline (November 2014-January 2015) and follow-up (June-August 2015), at health centers in Gicumbi and Rulindo**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Gicumbi (intervention district)** | | | | **Rulindo (control district)** | | | |  |
| **Baseline** | **Follow-up** | **Change** | **% change** | **Baseline** | **Follow-up** | **Change** | **% change** | **P value\*** |
| Diarrhea in adults | 598 | 459 | - 139 | -23% | 795 | 527 | -268 | -34% |  |
| Diarrhea in children (5-19 yrs) | 262 | 270 | +8 | +3% | 445 | 353 | -92 | -21% |  |
| Diarrhea in infants  (0-4 yrs) | 414 | 442 | +28 | +7% | 709 | 1064 | +355 | +50% |  |
| **All diarrhea** | **1274** | **1171** | **-103** | **-8%** | **1949** | **1944** | **-5** | **0%** | **0.0720** |
| Worms and parasites in adults | 3779 | 1875 | -1904 | -50% | 3444 | 2927 | -517 | -15% |  |
| Worms and parasites in children (5-19 yrs) | 1216 | 1194 | -22 | -2% | 1558 | 1429 | -129 | -8% |  |
| **All worms and parasites** | **4995** | **3069** | **-1926** | **-39%** | **5002** | **4356** | **-646** | **-13%** | **<0.0001** |

\*Comparison of numbers of cases (all ages studied) between intervention and control districts and between time periods before and during implementation of the intervention