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PUBLIC HEALTH & PRIMARY CARE | RESEARCH ARTICLE

Edutainment and infographics for schistosomiasis health education in Ndumo area, Kwazulu-Natal, South Africa

Tafadzwa Mindu^{1*}, Muhubiri Kabuyaya¹ and Moses J. Chimbari¹

Educational interventions targeting communities which are at risk of contracting schistosomiasis infection may empower them to develop capacity to minimize the spread of the disease. We compared the effectiveness of health education interventions for schistosomiasis knowledge uptake among school-going children in Ndumo area, KwaZulu-Natal using a quasi-experimental trial. An assessment of health education interventions (edutainment and infographics) in the community's own language and socio-cultural context was done among primary school-aged children in two primary schools in Ndumo, a schistosomiasis endemic area (37%). The study involved 37 students from Munywana primary where the intervention was on infographics and 44 from Maphindela where the intervention was on edutainment. The students wrote a schistosomiasis knowledge test, 1 month before the knowledge uptake interventions were implemented. The same test was given to the two groups after the interventions. Baseline and post-intervention scores were used to test whether the interventions improved schistosomiasis knowledge levels. Paired t-test and independent t-tests were conducted to test the change in knowledge assimilation at the 5% significance level. Our findings show that health education



Tafadzwa Mindu

ABOUT THE AUTHOR

Dr Tafadzwa Mindu is a post-doctorate research fellow at the University of KwaZulu-Natal. He got his Doctor of Philosophy degree in public health specialising in schistosomiasis research uptake in 2019. His thesis for the PhD was titled "Schistosomiasis knowledge uptake: A case study of MABISA research project in Ndumo area, uMkhanyakude, KwaZulu-Natal, South Africa. He is currently part of the TIBA SA team and will be focusing his intellectual muscle in the discipline of knowledge uptake which is now his niche. Knowledge uptake is concerned with the transfer or sharing of knowledge (research findings) with communities to whom the knowledge may benefit. It involves placing research findings in public information domains accessible to communities and interacting with communities to discover how they can utilise research findings to bring about health transformation. Contact Tafadzwa on WhatsApp on +27,655,410,041. | Skype: Tafadzwa Mindu | Facebook: Tafadzwa Mindu | Email: mindutafadzwa@gmail.com/tafadzwaminidu@gmail.com

PUBLIC INTEREST STATEMENT

The aim of this study was to improve schistosomiasis research uptake by applying arts-based communication methods (edutainment and infographics) using the community's own language and socio-cultural context. The edutainment and the infographics method were suggested by school children and parents as the best communication channels for disseminating schistosomiasis knowledge to the school children who are at most risk of infection in the study area. The methods which we assessed proved to be effective in improving the children's knowledge about the disease. Results showed that the methods can be used for health education and could be used interchangeable depending on the resources available. Rural households are mostly deprived of information resources and most children there have low reading culture. Hence, using art-based educational activities such as drama, song, poetry, animation, photography, illustrations and graphic design can be effective in reaching out to all the children and delivering the messages in simplified ways.

interventions significantly improved knowledge on schistosomiasis among school children ($P < 0.001$). At post-intervention, the mean score of the whole sample increased to 15,6/35, from a baseline score of 6,5/35. However, there was no significant difference in the post-intervention mean scores of infographics and edutainment interventions. In order to improve schistosomiasis research uptake among school-aged children, health education interventions such as edutainment and infographics can be effective in making the children assimilate schistosomiasis research findings as it has been shown elsewhere. The number of participants in the intervention and high attrition rate were notable limitations of the study. Future studies may need to invest more resources and use digital-based interventions incorporating both infographics and edutainment on one platform such as a digital device.

Subjects: Education; Information Science; Arts; Health and Social Care

Keywords: health; education; edutainment; infographics; schistosomiasis; Ndumo

1. Introduction

Schistosomiasis is second only to malaria in terms of parasite-induced human morbidity and mortality (Fenwick, Webster et al. 2009). Globally, about 78 countries have reported cases of at least one type of schistosomiasis infection (Karunamoorthi et al., 2018). Schistosomiasis prevalence in South Africa is estimated to be between 7.7% and 68.3% (Johnson and Appleton, 2005; Daniel, 2009; Saathoff et al., 2004). The rates of prevalence depend on several factors such as the geographic environment, population and livelihood activities in the regions where it is endemic. The endemicity of schistosomiasis in certain areas of South Africa is dependent on the climatic and environmental factors which favour the intermediate host snail in sub-tropical areas in South Africa (Moodley et al., 2003).

Schistosomiasis, also known as snail fever, is caused by parasitic flat worms called schistosomes that infect the urinary tract or the intestines. Its symptoms include abdominal pain, diarrhoea, blood in stool and blood in urine. Schistosomiasis also causes serious pathological damages to the body which make some reproductive and other vital organs of the body to malfunction. Examples of conditions caused by schistosomiasis include bladder wall calcification, bladder stone, bladder carcinoma and hydronephrosis (Agnew-Blais et al., 2010). The disease may lead to infertility among women, it may predispose them to sexually transmitted diseases (Hegertun et al., 2013). The brain and the spinal cord may also be affected by schistosomiasis leading to cognition deficiency (Lambertucci et al., 2000).

Schistosome infections are classified as neglected tropical diseases and occur predominantly in poor rural communities (Hotez et al., 2006). Schistosomiasis contributes to the perpetuation of poverty by impairing the cognitive performance and growth of children; and reducing the work capacity and productivity of adults (Montresor et al., 2002). Influencing the thought processes that lead to development of healthy practices is the goal of health education interventions (Nutbeam, 2000). Use of educational interventions aimed at young children and women who are at risk of schistosomiasis infection as a means of disseminating knowledge on the disease can empower communities to develop capacity to minimise transmission of the disease (Asaolu and Ofoezie 2003). Health education has been successfully used alongside treatment and sanitation to reduce the burden of schistosomiasis in endemic countries such as Japan (Kobayashi et al., 2007), China (Guo et al., 2005), Tanzania (Lansdown et al., 2002) and Brazil (Gazzinelli et al., 2006).

Implementing health education interventions in communities follows three major steps: evaluating and assessing the needs of the community, developing and implementing the intervention to fill the identified gap; and evaluating the impact of the interventions used (Bartholomew et al., 1998). Improving overall schistosomiasis health literacy requires educating the affected community about the social determinants that contribute to the problem (Nutbeam, 2000). Giving community members this education enables them to make informed decisions and to change their behaviour. Behaviour change campaigns that promote knowledge and awareness of parasitic diseases are useful in controlling and reducing infections (McManus et al., 2014). Health interventions that incorporate the socio-cultural contexts of communities help to justify the need for behaviour change amongst affected communities (Rivero et al., 2017). Health education methods such as movies, plays, traditional performance, poetry, slogans and posters can promote health behaviour change (Chen et al., 2016). These interventions can be used for educating the community about the need to seek treatment, improve sanitation and use clean and safe water sources (Palmeirim, 2016).

It has been shown that classroom learning changes health-related knowledge and behaviours if applied in culturally appropriate teaching styles (Balogun et al., 2012). Dramatisation, poetry, singing and video are popular and effective methods of learning in rural communities (Keen & Todres, 2007). These can be used to communicate complex information to communities and influence human understanding and behaviour (Rossiter et al., 2008). Therefore, this study had two aims. Firstly, we sought to determine whether health education intervention aimed at school children could foster uptake of schistosomiasis research findings. Secondly, we assessed whether the use of edutainment and infographics had differential impact on knowledge uptake by school children in Ndumo area of Ingwavuma, uMkhanyakude, KwaZulu-Natal.

Research uptake is the activity used to facilitate and contribute to the use of evidence generated through research by stakeholders and the general population. Grobbelaar refers to research uptake as the processes by which knowledge generated through research finds its way to those who need it (Grobbelaar S S 2013). The findings of MABISA (Malaria and Bilharzia in Southern Africa) and TIBA SA (Tackling Infections to Benefit Africa—South Africa) indicated that the quality of lives of villagers in Ndumo area, uMkhanyakude could be improved if the knowledge about schistosomiasis was given to the community. In the project reports for both, emphasis was placed on the importance of determining the factors that contribute to successful schistosomiasis knowledge uptake by the affected community in uMkhanyakude.

2. Methodology

2.1. Study population

The study involved primary school-aged children from two primary schools: Muniwana and Maphindela primary schools located in ward 16 and 13 under the Jozini Local Municipality of uMkhanyakude district in KwaZulu-Natal, South Africa. The selected schools had the highest number of schistosomiasis infections in the two wards. A schistosomiasis prevalence of 37,5% was reported in the study area (Kabuyaya, Chimbari et al. 2017a). The area has a small town and many rural villages namely Ndumo, Makhane, Mgedula, Mbandleni. The area is located along the border of the Ndumo Reserve (Coetzee et al., 2015). The area is semi-arid and has a perennial river (pongola river) and dams which are hotspots for the transmission of schistosomiasis. The children in both schools come from socio-demographic backgrounds which are characterised by low income and poor infrastructure. The Ndumo area has high poverty levels, about 20% of the people are employed and 70% are not active economically (Manyangadze et al., 2016). It has been determined that schistosomiasis transmission in the area is heightened by socio-economic variables such as distances of households from operational piped water collection points, distance from open water sources, religion, toilet use, household places of bath and laundry (Manyangadze et al., 2016).

Our population was school children, and this is because they are the most vulnerable to schistosomiasis and they are less knowledgeable about the disease (Omoruyi & Enoruwa, 2016). The MABISA and TIBA projects implemented in the Ndumo area where the study was conducted focused on screening and treatment of school-aged children in the area. It is during these studies that the need to focus on school children was identified. The recommendations from the TIBA SA and MABISA projects indicated the need for regular mass drug administration to affected kids in the area (M. Kabuyaya et al., 2018). This of course is in tandem with educational interventions to promote good health and behaviour change. The motive to educate the children alone is premised on the assumption that children share what they have learnt in the schools with their siblings. We chose the interventions which could be both intriguing and exciting to make them eager to share the details of what they would have learnt at the schools intervention programs.

Delivering the intervention to the school-aged group can result in the children sharing the knowledge they learnt with their family members (Yuan et al., 2000). It is common for students to share with siblings and parents what got them excited at school during the day. The sharing of details about the schistosomiasis edutainment (drama, poetry, song, animation etc.) would translate to sharing of findings with family members. Equally, with the infographic's intervention, the children would go home with the printed posters and share them with parents and siblings as well. The motivation for using the kids as the target for our intervention is also based on the comments we got from an assessment study we conducted earlier in the area where we sought to determine the factors that contribute to poor uptake of schistosomiasis research findings. Parents and caregivers informed us that children had higher risk of contracting the disease and that they were not receiving any specific lessons on the disease.

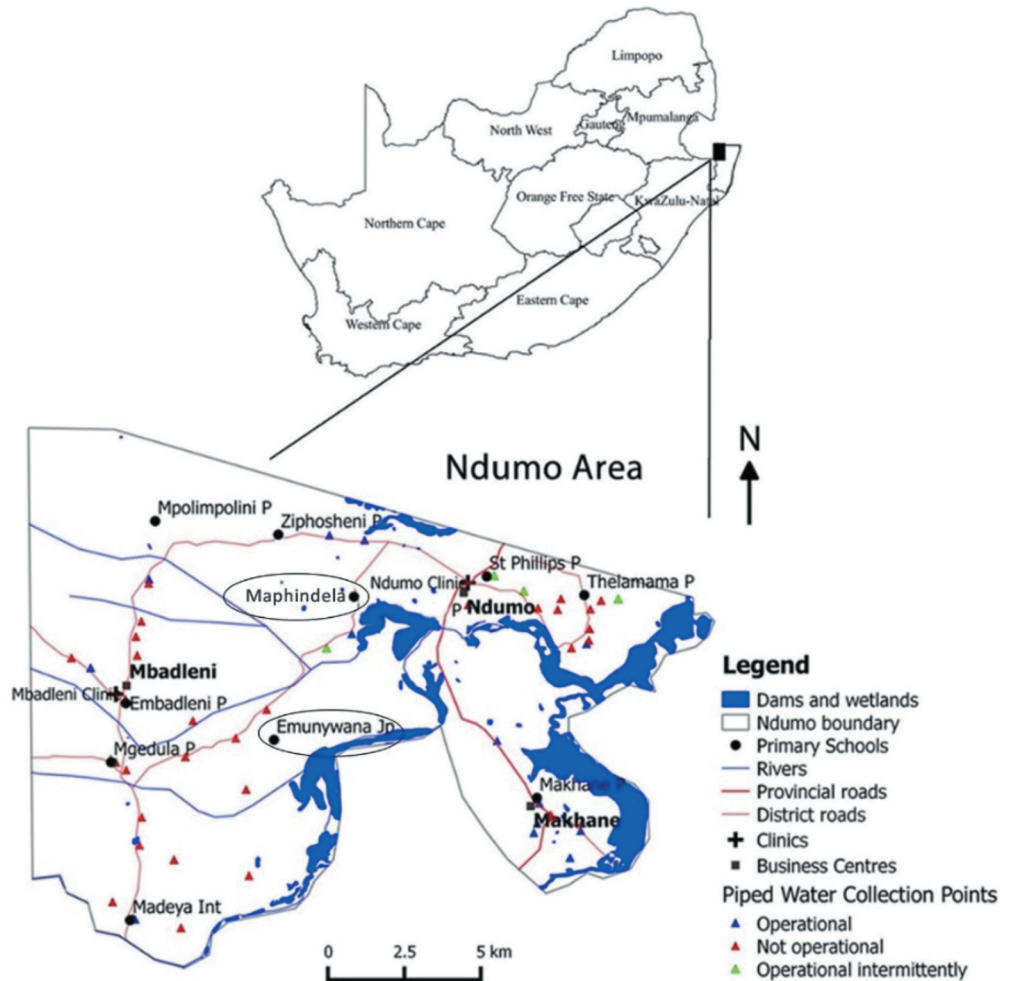
2.2. Consent

Ethical clearance for the study was obtained from the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (HSSREC; Protocol reference number HSS/0112/017 M). Consent for the pupils to participate in the study was given by signing of consent forms before the start of the baseline tests. The pupils were given consent forms to present to their parents to sign if they agreed to let them participate in the study. The children were then asked to sign assent forms agreeing to participate.

2.3. Study design

We conducted a health education intervention study among primary school children using two health education strategies (edutainment and printed infographics) to provide school children with information about schistosomiasis transmission and treatment. Our design was intended to measure the effectiveness of the two methods on improving the knowledge of participants on schistosomiasis. We relied on the baseline and post-intervention comparison to validate our hypothesis that health education strategies which use art-based forms can influence change in knowledge among primary school-aged children. This approach is common in studies which seek to measure the outcome of an intervention where the population cannot be randomised or interventions such as health education given to large population groups (Stuart et al., 2009). The emphasis in this type of study is on the effect of the intervention on a group of people without necessarily considering the population variability (Weisburd, 2010). The school children from both schools were selected using stratified random sampling by grade. At baseline we administered a test to assess schistosomiasis knowledge among participants. The test had seven questions (each question carried 5 marks making a total of 35 marks) and the total marks were used to assess the knowledge. One month after the baseline, the same test was used to assess the impact of the intervention on the knowledge change. The study design is illustrated schematically in Figure 2. One group of children in school (A) received the edutainment and the other group, school (B) only received infographics pertaining to findings from studies on schistosomiasis.

Figure 1. Map of Ndumo area showing the two primary schools selected for the intervention (M Kabuyaya et al., 2016).



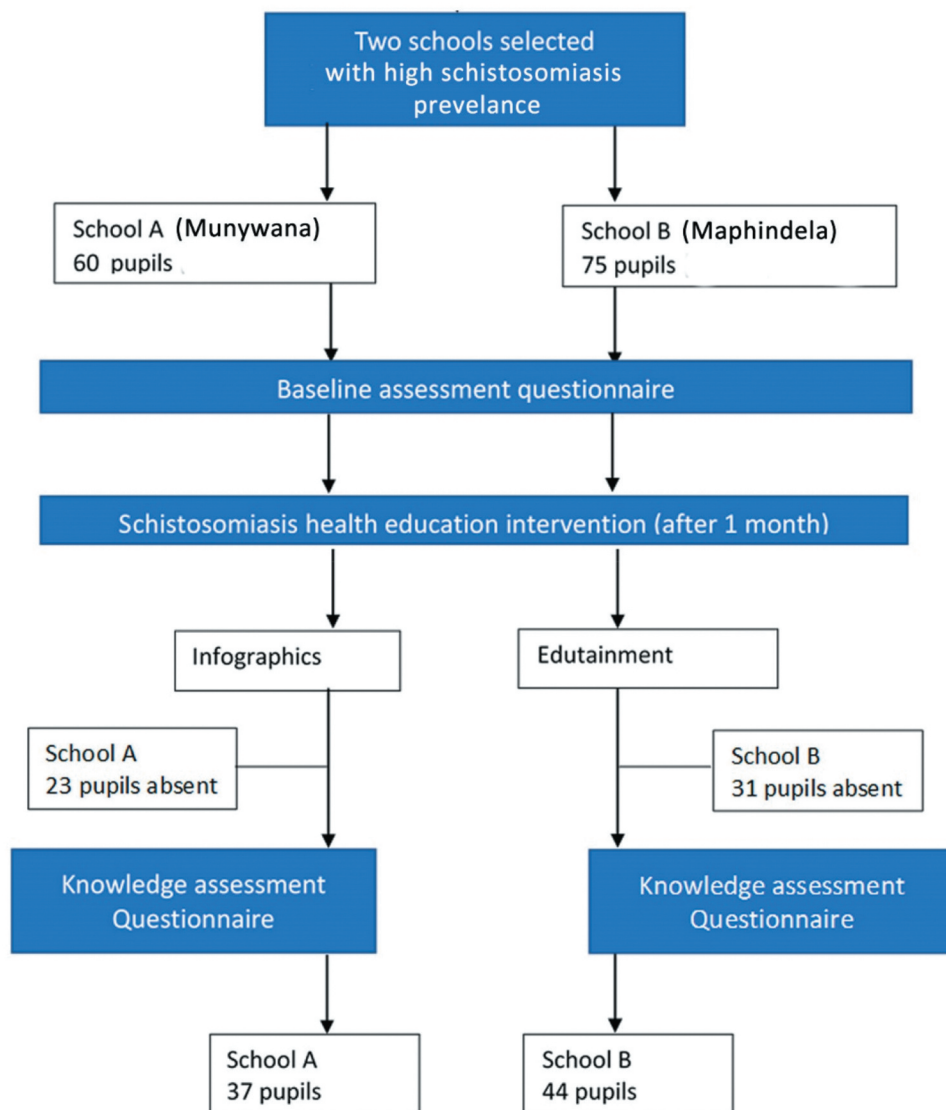
2.4. Description of the health education interventions

In the two schools, we used research findings on schistosomiasis risk factors, treatment and control (Manyangadze et al., 2016, Kabuyaya et al. 2017b; M. Kabuyaya et al., 2018) to design our education intervention material, activities and programs. Our approach was to educate pupils using stories that reflect their socio-cultural contexts as well as offering them an understanding of the relationship between people, environment and schistosomiasis. Similar content was delivered through both edutainment and infographics. The messages were meant to make the children understand/appreciate the role that they could play in reducing the schistosomiasis burden. This was achieved by making them aware of the hotspots for schistosomiasis infection in the Ndumo area (Manyangadze et al., 2016).

2.4.1. Edutainment

Edutainment is the combination of education and entertainment. It is the use of entertainment as a way of communicating important health and/or developmental issues to audiences in a manner that allows them to get pleasure and excitement while they also learn (Tuft, 2008). Edutainment can be defined as a place or process where children can enjoy learning with many mediums such as sound, video, text, and images (Wang et al., 2007). We conducted the edutainment activity using a poem, drama, song, pictures and an animated video. Eight children were selected and tasked to recite the poem and perform a drama. They received information about schistosomiasis before they could go and present the poem and drama to their peers. We used an animation video

Figure 2. Schematic flow diagram showing the stages of the intervention and the total number of participants at baseline and intervention stages.



(Hazlehurst, 2016) (Figure 3) showing how playing in the river leads to transmission of schistosomiasis, the video showed the cycle of schistosomiasis and where the problem can be prevented.

We also used a series of pictures showing places where children bath or swim and the water collection points in the area known to be hotspots for schistosomiasis infection in the study area (Figure 4). The children were requested to identify the rivers or water bodies where snails had been found. We used a simple jingle with the names of the schistosomiasis transmitting snail species found in the area where the study was done.

The children were made to sing a song on the snail types that cause schistosomiasis. The researcher led in the singing. We also gave eight children a drama script and poem on the risk factors associated with schistosomiasis infection, the symptoms for the disease and how to get treatment. The drama depicted a family whose daughter had schistosomiasis and was taken to the clinic for treatment. The poem (supplementary 1) for full poem in IsiZulu) educated on the effects of schistosomiasis on children's performance and how it can be treated. Four of the pupils selected to present the poems, performed stanzas in the poem reflecting on the community's high-risk

Figure 3. Snippets from the animated video used during the edutainment intervention to show a) infection cycle and b) how to prevent the transmission (video by: Hazlehurst, 2016).

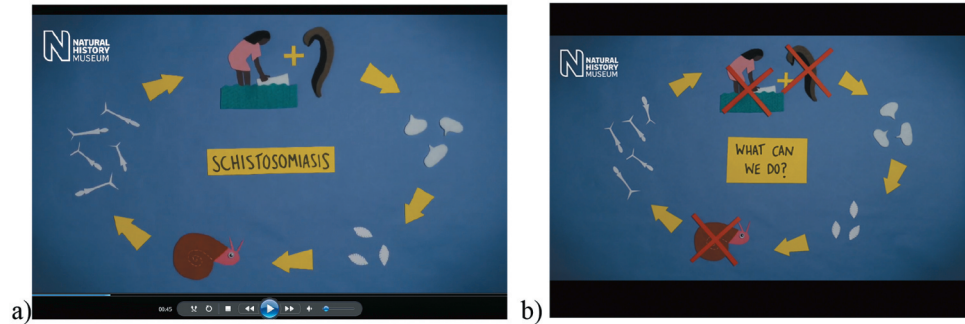


Figure 4. Some of the pictures used for the photo slide show to show infection hotspots and risk factors.



Figure 5. Some of the edutainment activities done by the researcher and the primary school learners. a) shows the researcher singing with the children and b) shows one of the students performing a poem.



activities and behaviors that lead to schistosomiasis infection. Figure 5. Shows the researcher and the pupils from Maphindela primary school (a) singing a song about the types of snails that cause schistosomiasis in the area, (b) one pupil performing a poem on schistosomiasis risk factors during the edutainment activities.

Drama, poem and song content

In the school used for the edutainment intervention we selected and trained a group of students on the effects, causes and treatment of schistosomiasis; thereafter, the researcher co-created a drama with the children. The children were eight in total and they each selected a role that they wanted to play in the drama and the poem. The poem had been written by the researcher in the community's language (isiZulu). The poem had eight themes described in detail below. Four children in the trained group opted to do the poem, and each was given two stanzas to read out. The remaining four children opted to do the drama performance.

The poem was divided into 8 stanzas, which identified the main risk factors within the community that lead to schistosomiasis transmissions as well as transmission of soil-transmitted helminths. The poem also gave best action to take in preventing and treating the diseases. The poem is supplied in the supplementary documents (supplement 1). The main messages in the stanzas are as follows: do not swim in the rivers when it is hot; do not stand in the water while you are fishing; always use the toilet to defecate; wash your hands after using the toilet; avoid doing your washing inside the river; symptoms of bilharzia; treatment of bilharzia. The themes were mainly the day to day recreational activities and household duties that young children experience which expose them to the risk of schistosomiasis infection.

The drama was written by the researcher together with the children and the researcher assisted the children to memorise the words and also to add their own flare to the performance but remaining within the context of the message which was being passed. The drama was based on a family that had a child who was ill and exhibiting the symptoms of schistosomiasis. It had four characters, a sick child suffering from schistosomiasis, the mother and father of the child and a nurse who helps the sick child. We chose role playing for the children because this is useful in teaching some complex social problems which may be affecting communities (Blatner, 2009). Drama is also a useful tool in transmitting some complex messages to audiences.

The drama included themes on symptoms, causes, and treatment. It was about a young girl who stays with her parents and has fallen ill. The mother is concerned about the health of the child, she reports to the father that their child is been feeling dizzy and has not been focusing well at school. The father thinks the child is bewitched and then decides that the family should take the girl to the sangoma (African traditional healer) for intervention. The mother and child refuse and they suggest visiting the clinic. They go to the clinic and the child is diagnosed with schistosomiasis by the clinic nurse and given treatment. The drama enables the students to recognise the symptoms and the treatment for schistosomiasis.

The song which was sung by the pupils was composed by the researcher and it was a recitation of the name of the snail species which is responsible for the transmission of schistosomiasis in the study area. The children were all made to follow after the researcher as he sang out loud the two names in a repetitional jingle. The names sang were *Balinus globus* and *Biomphalaria pfeiferi*. We chose to use the jingle method in teaching the children about the names of the snails because singing can make it easy for children to remember information (Thares, 2010). Using music to teach the children can also help them to learn new words easily (Kolb, 1996). The snail names are complicated, but we found that presenting them in song version would help them pronounce them correctly and make it easy to capture the words/names of the snails.

The performance of the drama and poem was conducted in front of an audience of about 100 children in grade seven and six at the intervention school. The children took at least 30 min to do the performances starting with reading out the poem written by the researcher and then doing the short-scripted drama after which they watched an animated video showing the schistosomiasis infection cycle and a picture slideshow showing schistosomiasis risk factors and hotspots in the area.

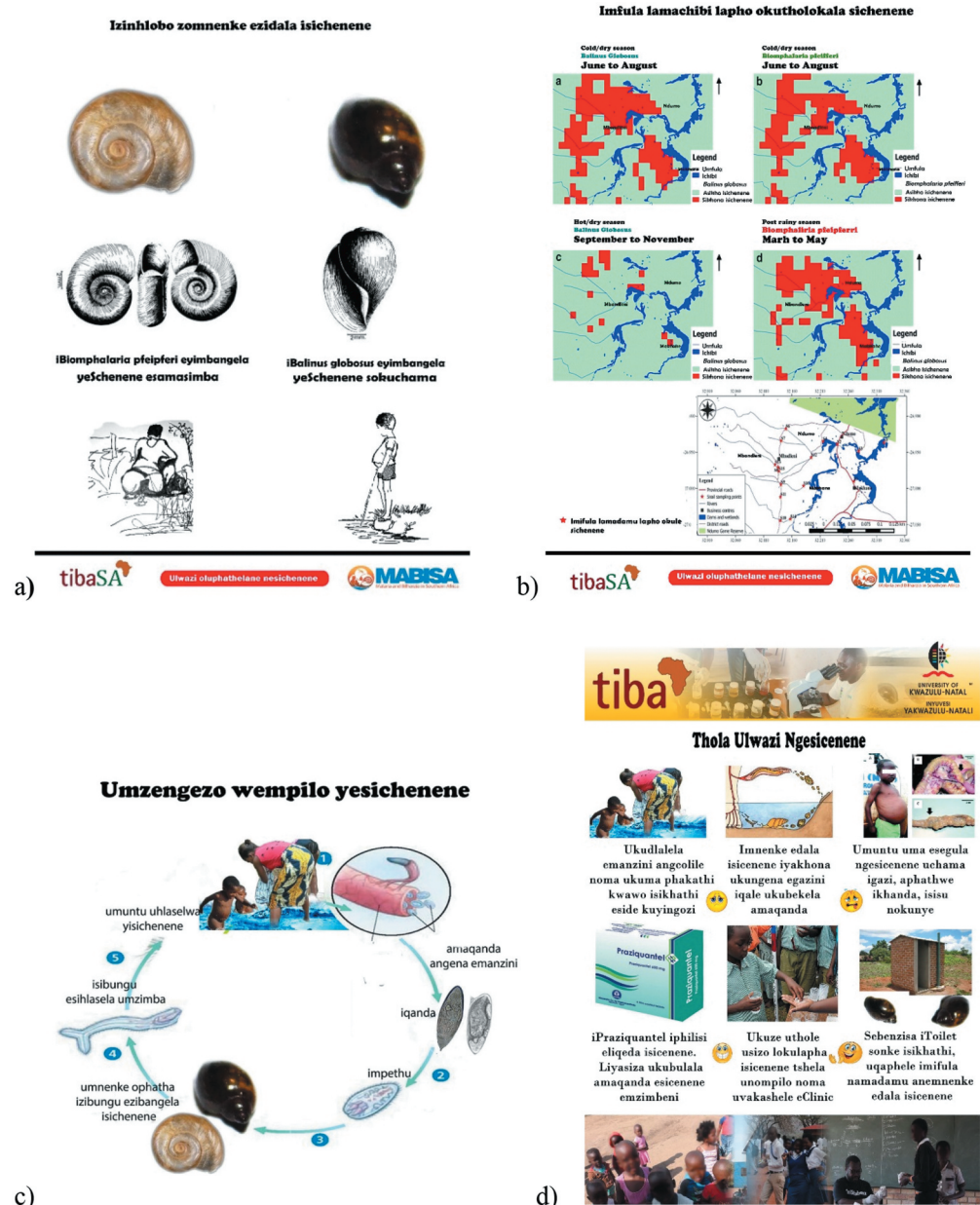
2.4.2. Infographics

Infographics are graphic visual representations of information, data or knowledge (Huang & Tan, 2007). Infographics are meant to amplify cognition by using graphics to enhance the human visual system and ability to see patterns (Siricharoen, 2013). An infographic is made creatively to group related data sets into an integrated visually attractive presentation. The positioning of each of the data sets narrates a multifaceted story (Krauss, 2005). Apart from being beautiful, engaging and easier to understand, infographics also present complex information effectively and integrate words and graphics to reveal information trends (Davidson, 2014).

Printed flyers and leaflets with information graphics (infographics) on schistosomiasis were handed out to the children. The infographics contained synthesised schistosomiasis research findings written in isiZulu and showing pictures and diagrams of transmission, treatment, prevention and control. The researcher guided the children in deciphering the information on the infographics used (Figure 6). Each of the infographics showed a set of knowledge on schistosomiasis which was meant to help the children to visualise the cause and impact of the disease.

The first infographic showed pictorial and illustrated depictions of the snails that transmit the disease. The picture showed the names of the snails against the schistosome species they transmit. *Balinus globosus* was placed above an illustration of a young boy urinating in the river to show that it causes *Schistosoma haematobium* which affects the bladder. The *Biomphalaria*

Figure 6. Infographics used show information on schistosomiasis a) poster 1 - types of snail and schistosomiasis it causes, b) poster 2 - schistosomiasis hotspots in the area, c) poster 3 - schistosomiasis life cycle, d) poster 4 - risk factors, transmission, symptoms, treatment.



pfeifferi snail was placed above a person defecating in a bush to show that it is responsible for *Schistosoma mansoni* which affects the bowel.

The second infographic showed the areas which had intense schistosomiasis infections throughout the year. The maps were drawn to represent the rivers which were hotspots for schistosomiasis transmission and the times of the year which have more transmissions taking place in each village/area. The third infographic showed the life cycle of the schistosomiasis parasite. The picture illustrated the starting point of the infection when eggs enter the river, it shows how the eggs hatch and turn into miracidia which enter the snails and come out of the snail as cercaria which infects humans who enter the water.

The last infographic showed condensed or synthesised information on the causes, symptoms, treatment and prevention of the disease. The infographics showed pictures and explanations in words describing the risk factors and prevention measures to be taken in reducing the impact of the disease.

2.5. Data analysis

In order to analyse the impact of the interventions we used a knowledge test to measure how much knowledge the children were able to extract or assimilate from the interventions which we used. Table 1 shows the different sets of knowledge that the different interventions were combined and designed to present. The survey test which we used to measure impact on the children considered knowledge improvement in the different contexts presented in the first column of the table. The survey test had a total of seven questions (the test and the answers are provided in the supplementary documents submitted with this paper, supplementary b). Each intervention (infographics/edutainment) contained knowledge and answers that the students were to use in answering the questions see Table 1.

The Statistical Package for Social Sciences (SPSS) version 25.0 was used to analyse change in knowledge from the survey test used at baseline and post-intervention. Paired t-test was used in the initial analysis to test the hypothesis that the edutainment and infographics

Table 1. Showing the content of each intervention used in each school and the survey questions used to test knowledge among the participants of the study

Edutainment— Maphindela primary school	Infographics— Munywana primary school	Key messages or knowledge communicated	Survey question used to test impact of each intervention method used.
Drama & Poem	Poster 4	Schistosomiasis risk factors, transmission, symptoms, treatment and prevention	(1) What is schistosomiasis? (2) How is schistosomiasis contracted by people? (3) What are symptoms of schistosomiasis? (4) How is schistosomiasis treated? (5) What are the risk factors for schistosomiasis?
Picture slideshow	Poster 2	Hotspots for schistosomiasis infection in the area	(1) Which water bodies in your area are hot spots for schistosomiasis?
Song	Poster 1	Type of snail and the type of schistosomiasis it causes	(1) What are the snail types responsible for the transmission of schistosomiasis?
Animation	Poster 3	Schistosomiasis life cycle	(1) Describe the life cycle of schistosomiasis

interventions did improve knowledge on schistosomiasis among participants. The researcher marked the test and allocated scores according to the depth of the answers given by the children on each question. Each question was allocated five marks and the total for the test was 35 points. Baseline and post-intervention scores for each school were compared using the t-test. We then used the independent t-test to assess whether there were differences in means between the two intervention methods at the post-test level using post-intervention scores from both interventions. Both the paired and independent t-tests were conducted at the 5% significance level.

3. Results

Out of the 135 children that enrolled into the study at baseline, only 81 participated in the interventions and completed the post-intervention test. The percentages of the age groups and grade of the participants are presented in Tables 2 and 3, respectively. The percentage of males was 42% and females 58%. Grades were between 4 and 7 and the age range was 10–16 years

Participants had limited knowledge on schistosomiasis before the health education interventions as shown by the low mean test score of 6.5 shown in Figure 7 out of a possible 35. The mean of post-intervention scores (15.6, \pm 4.77) for the whole sample was higher than at baseline (6.51, \pm 4.12) of the study (Figure 7). Findings from the paired samples test (Table 4) show that the improvement in knowledge levels was statistically significant ($t(80) = -17.374$, $p < 0.001$).

Test scores for both sub-samples increased. Mean test scores improved from 8.59 to 15.43 and 4.75 to 15.75 for the infographics and edutainment interventions, respectively. However, there was no statistically significant difference between the two health education interventions, $t(79) = -2.859$, $p = 0.089$.

Confidence intervals were wide apart at baseline showing variability in knowledge levels. Post-intervention confidence intervals however were closely related showing improvement in scores among all participants. No significant differences were observed between infographics and edutainment.

Table 2. Total percentage of age groups and grades involved in the study for both schools

Grade	Number of pupils	Percentages(%)
4	2	2
5	13	16
6	28	35
7	38	47
Total	81	100

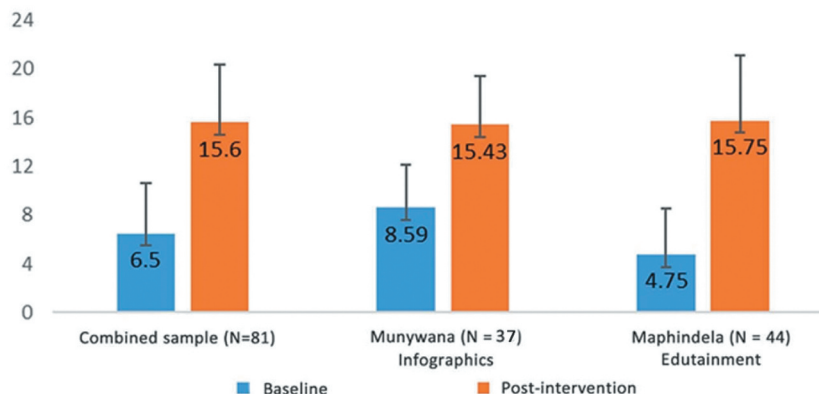
Table 3. Total percentage of age groups involved in the study for both schools

Age	Number of pupils	Percentages(%)
12	32	40
13	28	34
14	14	17
15	6	7
16	1	1
17	1	1
Total	81	100

Table 4. Paired samples test results showing standard deviation and statistical significance of the findings

Differences	Mean	Std Dev.	95% CI of the difference		t	df	sig
			Lower	Upper			
Baseline- Intervention	-9.099	4.713	-10.141	-8.057	-17.374	80	.000

Figure 7. Baseline and post-intervention sample means for the two schools showing a change in knowledge from baseline to post intervention in both schools.



The two schools had different mean scores at baseline, and at post-intervention they were comparable. This supports the hypothesis that health education interventions improve knowledge uptake. Assessment scores from the two groups of pupils in the study were recorded at baseline and post-intervention stages using the same tests to determine changes in the children’s level of knowledge on schistosomiasis.

4. Discussion

The study assessed the assimilation of schistosomiasis knowledge by school children using edutainment (drama, poetry, song, animation, photographs) and infographics (leaflets, flyers, charts, illustrations). We incorporated local language and socio-cultural context into the interventions to help participants acquire schistosomiasis health knowledge. The findings of our study revealed low knowledge among all participants at baseline. These findings corroborate with results from other studies conducted in Zimbabwe and South Africa that showed that school children had limited information on schistosomiasis causes, symptoms, prevention and control (Midzi et al., 2011, Kabuyaya et al. 2017b). This shows the need of promoting health education interventions that may influence behaviour or practice changes that may lead to the decrease of the burden of schistosomiasis amongst school children who are at high risk of contracting schistosomiasis in the study area.

4.1. Infographics

After the baseline assessment of the school children's knowledge about schistosomiasis, the use of infographic materials improved their knowledge on risk factors, treatment and control. In consistency with other findings, the use of pictures, text and data visualisation has shown to be effective in the assimilation of research findings (Scott et al., 2016). This shows that school children may easily assimilate synthesised infographic information if designed in a contextual way. To show the localisation of the hotspot of schistosomiasis infection within the community we used a diagram with annotated maps as suggested (Arcia et al., 2015) that, the use diagrams and illustrations hold the power to simplify research findings and eliminate the ambiguity of worded explanations. The simplified layout of the graphics enabled the pupils to assimilate the research findings (Velez et al.,

2014). The children were able to follow the infographics and the lecture. Using infographics to disseminate research findings has been proven to be a quick way of linking the children with research findings (Otten et al., 2015). Using pictures and flow diagrams, can enable those pupils who struggle to read or write to understand the schistosomiasis knowledge.

4.2. Edutainment

The application of edutainment is known to positively influence behaviour change in the community (Davis, 2012). Our findings showed that using drama, song and poetry effectively changed the uptake of schistosomiasis knowledge amongst school children as it has also been suggested by other researchers (Aondowase, 2013; Pauletto & Walus, 2018). Embedding schistosomiasis information within the drama, poem and song resulted in improvement in the assimilation of schistosomiasis knowledge. Using the edutainment activity which is known to offer quick behavioural change influence (Pauletto & Walus, 2018) has been reported to be beneficial for disease control among children. Edutainment can improve the reception of health messages because of its entertainment aspect on which it rides (Aondowase, 2013). It captures the imagination of children through vibrant and random characters, as well as storylines that are often captivating, imprinting messages in the subconscious memory of the pupils (Martin, 2007). When people laugh and allow their minds to be free, the message imbedded in the drama gets absorbed into the mind without any resistance (Ødegaard, 2003).

Edutainment also has the ability of engaging the audience emotionally and physically, especially during the drama, song and poetry: the audience can interact with the performers and give feedback by laughing, clapping, dancing, singing along, and responding to praises and calls. This eliminates the common passiveness that exists with conventional methods of dissemination (Caroline, 2014). In an edutainment activity, the audience engaged will have the option of interpreting the drama, song and poem in their own context; select the message they want to take home and demonstrate their reception of the message by responding through verbal and non-verbal communication cues as the edutainment activity unfolds (Caroline, 2014).

We exposed the school children to an animation video followed by the picture slide show of schistosomiasis infection hotspots in the area. In line with our study, screening of educational animation videos has proven to improve the knowledge of school children during health education activities (Raso et al., 2018). In one study animation videos were shown to lead to adherence due to their ability to capture various contexts, audiences, content and approaches, within one production (Gazzinelli et al., 2016). The incorporation of animation into school curriculums is recommended (Essé et al., 2017). This may improve the access of knowledge about complicated disease infections and the life cycles of most parasites and viruses.

If we did not have the limitation of resources such as television sets and computers in the study schools we would not have used animations. However, we are confident that the animations were a useful replacement. Future studies may need to employ interventions that involve supply of projectors, television sets or computer devices to schools where children can access these animations. We also recommend the use of printed infographics that depict animated characters in action or screen shots of the animation with captions which the children can read to follow the life cycle of schistosomiasis transmission. Other interventions could be use of print media containing educational stories in the form of comics, fiction drama and poetry including health educational messages and also trial of digital-based media which contains animated films, pictures, diagrams, recorded drama/theatre and music. Another limitation to our study was that the students we used were not followed up 6 months later to test for their ability to recall the information that they were taught on schistosomiasis. Much of this limitation is because we conducted the tests towards the end of the year and had grade sevens in the groups who left primary at the end of the year and moved to secondary school.

5. Conclusion

The post-intervention mean scores were higher than baseline mean scores showing that the health education interventions improved the probability of uptake of schistosomiasis research findings. The implementation of schistosomiasis health education interventions using edutainment or infographics may be effective for school children in rural settings such as Ndumo area.

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