

Effects of the Informed Health Choices podcast on the ability of parents of primary school children in Uganda to assess claims about treatment effects: a randomised controlled trial



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Summary

Background As part of the Informed Health Choices project, we developed a podcast called The Health Choices Programme to help improve the ability of people to assess claims about the benefits and harms of treatments. We aimed to evaluate the effects of the podcast on the ability of parents of primary school children in Uganda to assess claims about the effects of treatments.

Methods We did this randomised controlled trial in central Uganda. We recruited parents of children aged 10–12 years who were in their fifth year of school at 35 schools that were participating in a linked trial of the Informed Health Choices primary school resources. The parents were randomly allocated (1:1), via a web-based random number generator with block sizes of four and six, to listen to either the Informed Health Choices podcast (intervention group) or typical public service announcements about health issues (control group). Randomisation was stratified by parents' highest level of formal education attained (primary school, secondary school, or tertiary education) and the allocation of their children's school in the trial of the primary school resources (intervention vs control). The primary outcome, measured after listening to the entire podcast, was the mean score and the proportion of parents with passing scores on a test with two multiple choice questions for each of nine key concepts essential to assessing claims about treatments (18 questions in total). We did intention-to-treat analyses. This trial is registered with the Pan African Clinical Trial Registry, number PACTR201606001676150.

Findings We recruited parents between July 21, 2016, and Oct 7, 2016. We randomly assigned 675 parents to the podcast group (n=334) or the public service announcement group (n=341); 561 (83%) participants completed follow-up. The mean score for parents in the podcast group was 67·8% (SD 19·6) compared with 52·4% (17·6) in the control group (adjusted mean difference 15·5%, 95% CI 12·5–18·6; p<0·0001). In the podcast group, 203 (71%) of 288 parents had a predetermined passing score (≥11 of 18 correct answers) compared with 103 (38%) of 273 parents in the control group (adjusted difference 34%, 95% CI 26–41; p<0·0001). No adverse events were reported.

Interpretation Listening to the Informed Health Choices podcast led to a large improvement in the ability of parents to assess claims about the effects of treatments. Future studies should assess the long-term effects of use of the podcast, the effects on actual health choices and outcomes, and how transferable our findings are to other countries.

Funding Research Council of Norway.

Introduction

The ability to obtain, process, and understand basic health information is crucial for making sound health choices. Many people lack this ability, and commonly overestimate the benefits and underestimate the harms of treatments (any action intended to maintain or improve the health of individuals or communities),^{1–3} which can result in inappropriate use of health services and poor health outcomes.²

Provision of reliable health information in mass media, including the internet, radio, television, and print media, has the potential to affect health behaviours and health-care use.^{4,5} However, substantial barriers prevent journalists from improving the scientific quality of their reports,⁶ and studies have found major shortcomings of health stories in the media.^{7,8} Therefore, audiences must be able to appraise the reliability of claims about

treatment effects in the mass media, as elsewhere. These claims include those about the effects of drugs, surgery, and other types of modern medicine; those about lifestyle changes, such as changes to what you eat or how you exercise; those about herbal remedies and other types of traditional or alternative medicine; those about public health and environmental interventions; and those about changes in how health care is delivered, financed, and governed.

Sound health choices are especially important in low-income countries, because the less people have, the less they can afford to waste. However, few studies⁹ have investigated the effects of interventions to teach critical appraisal skills to patients or the public in any country. As part of the Informed Health Choices project, we developed a podcast called The Health Choices Programme to help fill this gap. We aimed to assess the

Published Online

May 21, 2017

[http://dx.doi.org/10.1016/S0140-6736\(17\)31225-4](http://dx.doi.org/10.1016/S0140-6736(17)31225-4)

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For more on the Informed Health Choices project see <http://www.informedhealthchoices.org/>

Research in context

Evidence before this study

Previous research has shown that people commonly overestimate the benefits and underestimate the harms of treatments, and their ability to assess claims about the effects of treatments is often limited. This problem is important in low-income countries, where people have few resources to waste. Many learning resources are available to teach critical appraisal skills to non-health professionals; however, few have been formally evaluated. Systematic reviews of strategies to improve critical thinking more broadly have found that interventions targeted at adults and strategies that focus on health, on average, have small effects. At the start of the project (June 21–22, 2013), we searched The Cochrane Library, MEDLINE (Ovid), and ERIC for any quantitative study that measured the ability of participants to assess claims about the effects of treatments. We also contacted key researchers working in related research areas. We did not include reports in languages other than English or the Scandinavian languages.

Added value of this study

To the best of our knowledge, this is the first randomised controlled trial of a podcast designed to improve the ability of non-health professionals to assess claims about treatment

effects. We evaluated the effects of a podcast designed for parents of primary school children in Uganda. After listening to the podcast, the proportion of parents with a passing score on a test that measures their ability to assess claims about treatment effect was 34% higher than parents who listened instead to a series of public service announcements on the same topics. No adverse events were reported. The podcast also improved parents' confidence in their abilities to assess such claims, but we found little evidence of any effect on their intended behaviours.

Implications of all the available evidence

It is uncertain what the long-term effects of using the podcast are; what, if any, effect it will have on actual health choices and health outcomes; or how transferable the findings of this study are to other countries. Our findings show that an intervention can improve the critical appraisal skills of lay adults in a low-income country, who have no more than primary school education. Our findings do not indicate what the effects of simply offering the podcast would be. We have also shown the potential of a strategy that could be linked to interventions to improve the abilities of children to think critically about treatment claims, so that parents and children can learn these skills together.

effects of the podcast on the ability of parents of primary school children in Uganda to assess claims about the effects of treatments.

Methods

Study design and participants

We did a randomised controlled trial in central Uganda. Ethics approval was obtained from the School of Medicine's institutional review board at Makerere University College of Health Sciences and the Uganda National Council for Science and Technology (Kampala, Uganda). The protocol is available online.¹⁰

We recruited parents (or guardians) of children aged 10–12 years in the fifth year of primary school who were participating in a linked cluster-randomised trial of the Informed Health Choices primary school resources, which are designed to teach children to assess claims about treatment effects.¹¹ Parents were recruited from both intervention and control schools. To be included parents had to understand English or Luganda and provide written consent to participate in the study. We excluded parents who were unable to hear, not contactable by telephone, health researchers, participants in the development of the podcast, or parents of children who participated in the development of the primary school resources.

We recruited a convenience sample of participants at parent meetings held at 20 intervention schools and 15 control schools. Three additional meetings at control schools were cancelled because of parents being unable

to attend at short notice. At the meetings, DS and AN provided parents with information about the podcast trial and sought their consent to participate. This information was also included in consent forms in both English and Luganda.

Randomisation and masking

Parents were randomly assigned (1:1), via a web-based random number generator with block sizes of four and six, to listen to either the Informed Health Choices podcast or a series of typical public service announcements about health issues (control group). Randomisation was stratified by parents' highest level of formal education attained (primary school, secondary school, or tertiary education) and the allocation of their children's school in the trial of the primary school resources (intervention or control). A statistician who was not a member of the research team generated the allocation sequence and, together with his team, prepared six randomisation lists (one for each combination of the two stratification variables) with unique codes. The team labelled opaque envelopes with the unique codes, inserted slips of paper with the study group allocated to each code, and sealed them.

Because parents were recruited in groups (from parents' meetings), we allocated groups of participants at the end of each day on which a meeting was held. Upon return to the trial management office, the research assistant responsible for allocation opened the next available envelope in the stratum corresponding to each

For the random number generator see <http://www.sealedenvelope.com>

For the trial protocol see <https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-016-1745-y>

parent's education level and whether the child of that parent went to a school in the intervention or control group of the primary school resources trial.¹¹

Due to the nature of the intervention, the research assistants who delivered the podcast, the principal investigators supervising them (DS and AN), and the study participants were all aware of group allocation, as was the statistician who analysed the study results. To ensure uniform performance in delivery of the podcast and the public service announcements, and in the assessment of outcomes, all study staff were trained before the start of the trial and received refresher training during the trial. We had standard operating procedures to guide interactions with participants.¹⁰

Procedures

We began by identifying key concepts that people must understand and apply when assessing claims about treatments.¹² Together with journalists in Uganda, we assessed which of the concepts are the most important for the public to understand.¹³ We prototyped, user-tested, and piloted various mass media resources for facilitating critical appraisal of claims about treatment effects, before deciding on an educational podcast for teaching nine of the concepts to parents of primary school children. The podcast complements learning resources that we developed to teach 12 of the key concepts to children in the fifth year of primary school in Uganda.¹¹ The podcast is available online (appendix 1). All of the key concepts included in the podcast were included in the primary school resources, except for one (the third concept in table 1).

We developed versions of the podcast in English and Luganda, the two most commonly used languages in Uganda. Although direct translations of some terms were impossible, the structure and content of each version were the same. We also gave parents a checklist summarising the key messages in the podcast and a song (the Informed Health Choices theme song) to reinforce the messages of the podcast (appendix 1). The podcast had 13 episodes: an introduction to the series; eight main episodes; three short recap episodes, each of which summarised two of the first six main episodes; and a conclusion. Each of the eight main episodes included a short story with an example of a treatment claim, an explanation of a key concept applied to the claim, and another example within the same story illustrating the concept. One of the episodes covered two key concepts.

We identified the examples of claims from scanning recent mass media reports and interviewing parents. The eight main episodes introduced the concepts (table 2). Each of the main episodes lasted about 5–10 min. The first main episode covered two closely related concepts. The final structure, content, and presentation was informed by an iterative, user-centred design process. This process involved user testing and consultation with stakeholders, including people in our target audience, and journalists.

Participants in the podcast group listened to the series of episodes about how to assess claims about treatment effects. Appendix 1 provides a description of the intervention using the GREET TIDieR checklist. Participants in the control group listened to typical public service announcements about the same conditions that were used in the podcast (appendix 1). We designed the announcements to be similar to typical ones heard on Ugandan radio. Participants could choose whether they wanted to listen to the podcast or the announcements in English or Luganda. The podcast and the public service announcements were produced in collaboration with a Ugandan radio producer and actors.

Research assistants helped with recruitment, delivery of the podcast, follow-up, and administration of the test used as the outcome measure. They delivered episodes of the podcast or the public service announcements to the participants over a period of 7–10 weeks. Each research assistant was allocated about 25 participants to follow-up through the duration of the study. To ensure that the participants listened to each episode (or announcement), the research assistants visited each participant once per week, delivering two episodes on portable media players.

On the basis of findings from development of the podcast, we thought that only one episode for each concept would be insufficient, so the research assistants played a recap of the previous two episodes at each visit before playing the new episodes. In addition to listening to the episodes delivered by the research assistants, we provided participants with the complete podcast and the song on MP3 players, so that they could replay them, as well as the theme song, at their convenience.

Outcomes

The primary outcome was the mean score (percentage of correct answers) on the test taken after listening to the entire podcast or all the public service announcements and the proportion of participants with a passing score. Secondary outcomes were the proportion of participants with a score indicating mastery of the concepts; for each key concept, the proportion of participants answering both questions correctly; and intended behaviours and self-efficacy.

The test included 18 multiple choice questions from the Claim Evaluation Tools database (appendix 1)—two for each of the nine key concepts (appendix 1). The questions had between two and four response options, with an overall probability of answering 37% of the questions correctly by chance alone. We developed the questions based on extensive feedback from methodological experts, health professionals, teachers, and members of the public.¹⁴ We did two Rasch analyses to validate the test.^{15,16} Because many parents did not have English as their first language and many had poor reading skills, we developed a Luganda version of the test

See Online for appendix 1

	Explanation	Implication
Claims		
Treatments might be harmful	People often exaggerate the benefits of treatments and ignore or downplay potential harms. However, few effective treatments are 100% safe.	Always consider the possibility that a treatment might have harmful effects.
Personal experiences or anecdotes (stories) are an unreliable basis for assessment of the effects of most treatments	People often believe that improvements in a health problem (eg, recovery from a disease) were due to receiving a treatment. Similarly, they might believe that an undesirable health outcome was due to receiving a treatment. However, that an individual got better after receiving a treatment does not mean that the treatment caused the improvement, or that others receiving the same treatment will also improve. The improvement (or undesirable health outcome) might have occurred even without treatment.	Claims about the effects of a treatment might be misleading if they are based on stories about how a treatment helped individual people, or if those stories attribute improvements to treatments that have not been assessed in systematic reviews of fair comparisons.
A treatment outcome might be associated with a treatment, but not caused by the treatment	The fact that a treatment outcome (ie, a potential benefit or harm) is associated with a treatment does not mean that the treatment caused the outcome. For example, people who seek and receive a treatment might be healthier and have better living conditions than those who do not seek and receive the treatment. Therefore, people receiving the treatment might appear to benefit from the treatment, but the difference in outcomes could be because of their being healthier and having better living conditions, rather than because of the treatment.	Unless other reasons for an association between an outcome and a treatment have been ruled out by a fair comparison, do not assume that the outcome was caused by the treatment.
Widely used treatments or treatments that have been used for a long time are not necessarily beneficial or safe	Treatments that have not been properly evaluated but are widely used or have been used for a long time are often assumed to work. Sometimes, however, they might be unsafe or of doubtful benefit.	Do not assume that treatments are beneficial or safe simply because they are widely used or have been used for a long time, unless these have been shown in systematic reviews of fair comparisons of treatments.
Opinions of experts or authorities do not alone provide a reliable basis for deciding on the benefits and harms of treatments	Doctors, researchers, patient organisations, and other authorities often disagree about the effects of treatments. This disagreement might be because their opinions are not always based on systematic reviews of fair comparisons of treatments.	Do not rely on the opinions of experts or other authorities about the effects of treatments, unless they clearly base their opinions on the findings of systematic reviews of fair comparisons of treatments.
Comparisons		
Evaluation of the effects of treatments requires appropriate comparisons	If a treatment is not compared with something else, it is not possible to know what would happen without the treatment, so it is difficult to attribute outcomes to the treatment.	Always ask what the comparisons are when considering claims about the effects of treatments. Claims that are not based on appropriate comparisons are not reliable.
Apart from the treatments being compared, the comparison groups need to be similar (ie, like needs to be compared with like)	If people in the treatment comparison groups differ in ways other than the treatments being compared, the apparent effects of the treatments might reflect those differences rather than actual treatment effects. Differences in the characteristics of the people in the comparison groups might result in estimates of treatment effects that appear either larger or smaller than they actually are. A method such as allocating people to different treatments by assigning them random numbers (the equivalent of flipping a coin) is the best way to ensure that the groups being compared are similar in terms of both measured and unmeasured characteristics.	Be cautious about relying on the results of non-randomised treatment comparisons (eg, if the people being compared chose which treatment they received). Be particularly cautious when you cannot be confident that the characteristics of the comparison groups were similar. If people were not randomly allocated to treatment comparison groups, ask if there were important differences between the groups that might have resulted in the estimates of treatment effects appearing either larger or smaller than they actually are.
The results of single comparisons of treatments can be misleading	A single comparison of treatments rarely provides conclusive evidence and results are often available from other comparisons of the same treatments. These other comparisons might have different results or might help to provide more reliable and precise estimates of the effects of treatments.	The results of single comparisons of treatments can be misleading.
Choices		
Treatments usually have beneficial and harmful effects	Because treatments can have harmful effects as well as beneficial effects, decisions should be informed by the balance between the benefits and harms of treatments. Costs also need to be considered.	Always consider the trade-offs between the potential benefits of treatments and the potential harms and costs of treatments.

Table 1: The nine key concepts included in the podcast¹²

to be administered orally.¹⁶ We were careful to ensure that the examples used in the questions were different from those used in the podcast, and that participants would be able to understand the language that was used without having listened to the podcast.

Eight additional multiple choice questions were included, making 26 questions in total. These questions addressed four key concepts not covered by the podcast.

They were included because the same test was used in the linked randomised trial investigating the primary school resources, and those key concepts were covered in the primary school resources.¹¹ Responses to these eight questions were not included in the primary analyses of the podcast trial, since the podcast did not cover the concepts they address. The test also included questions that assessed intended behaviours and self-efficacy

(appendix 1). In the podcast group, the test included questions that assessed satisfaction with the podcast.

We used an absolute (criterion-referenced) standard to set a passing score. Participants were counted as passing or failing depending on whether they met this prespecified criterion. We used a combination of Nedelsky's and Angoff's methods to determine the cutoff for a passing score (appendix 1). Additionally, we used the same methods to determine a second cutoff for a score that indicated mastery of the nine concepts. The criterion for passing was 11 or more of 18 questions answered correctly. The criterion for mastery was 15 or more of 18 questions answered correctly. The participants completed the tests individually after listening to all the podcast episodes or public service announcements. We will assess the effects of the podcast again after 1 year, with the same outcome measure, which will be reported separately. We will also attempt to measure effects on actual decisions, on the basis of self-report.

The research assistants kept logs, including reasons for dropping out, and recorded any unexpected adverse events. In a process evaluation that will be reported separately, we have collected in-depth qualitative data from interviews and focus group discussions regarding potential adverse effects, in addition to other potential benefits of the podcast (appendix 1).

Statistical analysis

We used the method described by Donner¹⁷ to calculate the sample size, based on calculation of odds ratios (ORs). The smallest difference between the podcast and control groups that we wanted to be able to detect in the proportion of respondents with a passing score was 10 percentage points. With the assumption that 10% of the control group would achieve a passing score (based on data from a pilot study), a statistical power of 0.90, and a two-sided p value of 0.05, we estimated that 397 participants were needed to detect an improvement of 10% in the podcast group. Studies of the effects of a primer to help people understand risk suggested that this was likely to be an adequate sample size.¹⁸ Allowing for a 20% loss to follow-up, we estimated that we would need a sample size of 497 participants.

For the primary and secondary outcomes, we used models with the stratification variables (education and allocation in the Informed Health Choices primary school trial) modelled as a fixed effect, with logistic regression for dichotomous outcomes and linear regression for continuous outcomes. Missing values were counted as wrong answers.

For intended behaviours and self-efficacy (appendix 1), we dichotomised each outcome by combining them—eg, very unlikely with unlikely and as likely with very likely—and reported the proportion in each category.

We explored whether differences existed in the effects of the podcast for parents depending on whether they

	Overview	Claim	Concept	Second example
Episode 1	Benefits and harms	Herbal medicines exist for malaria treatment that cure malaria and do not have any bad effects.	Few effective treatments are 100% safe and treatment decisions depend on the balance between the benefits and the harms.	Quinine can cure malaria. It can also give you nausea and make you vomit.
Episode 2	Comparisons	Quail eggs make you very strong.	Health researchers must compare treatments for us to be sure about their effects.	Sleeping in mosquito nets stops people from getting malaria.
Episode 3	Personal experiences	Putting cooking oil on a burn will heal it.	Someone's personal experience is not a reliable basis for claims about the effects of a treatment.	Cow dung heals burns.
Episode 4	Associations	A lot of women gain weight when they take contraceptive pills.	If there is simply an association between a treatment and something happening, that does not necessarily mean that the treatment caused it.	In the maize season, many people get malaria. So, some people say eating a lot of maize causes malaria.
Episode 5	Traditions	A herbal treatment called kyogero stops babies from getting infections.	How many people have used a treatment or how long a treatment has been used are not reliable bases for claims about the effects of treatments.	Nanyonga's soil cures HIV/AIDS.
Episode 6	Experts	Eating some hot pepper will heal ulcers.	Claims made by experts are not always right.	Eating good foods and exercising will cure HIV.
Episode 7	Fair comparisons	Group support is helpful for someone who is depressed.	Large and fair comparisons are a good basis for claims about the effects of treatments.	Antiretrovirals help people with HIV/AIDS live longer.
Episode 8	Single comparisons	Washing hands with soap does not stop children from getting diarrhoea.	Findings from just one small study are not enough to be sure about the effects of a treatment. To be more sure, health researchers must add up findings from all the fair comparisons of the same treatments.	Wearing helmets when riding motorcycles saves lives.

Episodes are available online (appendix 1).

Table 2: Main podcast episodes

had a primary, secondary, or tertiary education level. We also explored whether differences existed in the effects of the podcast for parents who had a child in a school that received the Informed Health Choices primary school resources and those whose children were in a control school; these analyses adjusted for whether the child was in an intervention school and the parents' level of formal education, respectively. We did stepwise backward regression of the full model comprising all main effects and second order terms of the explanatory variables—the parents' allocation (podcast or control), formal education level, and whether the child was in an intervention school—removing and adding one variable at a time. This process resulted in a simple model with the main effects (explanatory variables) and without interactions (which were not statistically significant). We converted ORs from the logistic regression analyses to risk differences using the control group odds as the reference, multiplying these odds by the OR to estimate the intervention group odds, and converting the control and intervention group odds to proportions to calculate difference. We calculated the adjusted standardised

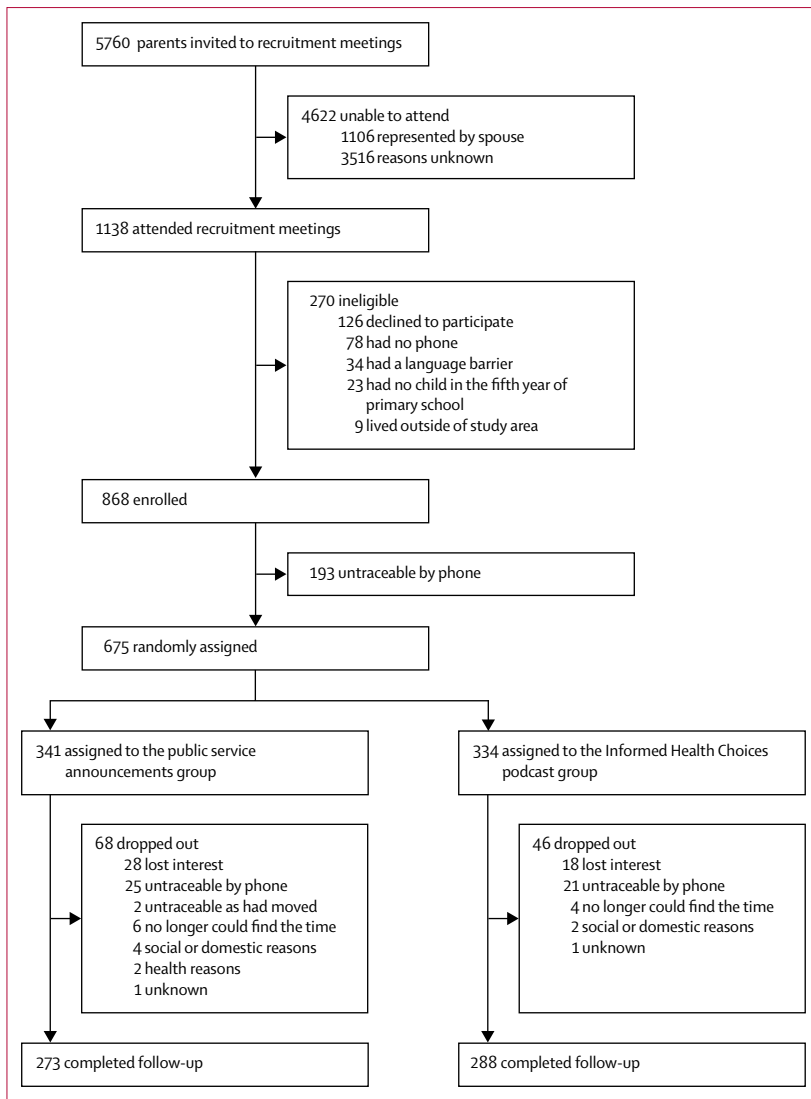


Figure 1: Trial profile

mean difference (Hedges' *g*) for comparison to effect sizes reported in meta-analyses^{19,20} of the effectiveness of other interventions to improve critical thinking.

We did intention-to-treat analyses. We did the statistical analyses with R (version 3.3.2; using packages doBy, xlsx, tables, lme4, glm2, lsmeans, and sjstats). There was no data monitoring committee. Appendix 2 provides the data files for the study. The trial was registered on June 12, 2016, in the Pan African Clinical Trial Registry, number PACTR201606001676150.

Role of the funding source

The funder of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report. The principal investigator (DS) had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

We recruited parents between July 21, 2016, and Oct 7, 2016. We randomly assigned 675 parents to listen to the podcast (*n*=334) or the public service announcements (*n*=342); 561 (83%) of the participants completed follow-up (figure 1). The reasons for dropout were similar between groups (figure 1). Parents who dropped out were similar to the parents who completed the test with respect to education and sex (table 3); however, they were less likely to have said they had training in research (16% vs 32%; table 3).

Baseline and demographic characteristics were similar between groups (table 3). Overall, 491 (88%) of the participants elected to listen in Luganda rather than English (table 3). About half the participants had no more than primary school education (table 3). About a third reported some training in research and about a quarter reported having previously participated in research (table 3); however, this outcome might not accurately reflect how many had training or experience that was relevant to the key concepts that the podcast addressed. About three-quarters of participants were women (table 3). The participants reported most commonly seeking health care at government or private for-profit facilities. Minor differences existed in where participants reported they would seek health-care advice (table 3).

The mean score for parents in the podcast group was 67.8% (SD 19.6) compared with 52.4% (17.6) in the control group (adjusted mean difference 15.5%, 95% CI 12.5–18.6; *p*<0.0001; table 4). Appendix 1 shows the distribution of test scores. In the podcast group, 203 (70%) parents had a passing score (≥ 11 out of 18 correct answers) compared with 103 (38%) parents in the control group (adjusted difference 34%, 95% CI 26–41; *p*<0.0001; table 4). More parents mastered the concepts in the podcast group than in the control group (table 4).

For each concept addressed in the podcast, the proportion of parents who answered both questions correctly was higher in the podcast group than in the control group (figure 2). For three of the four concepts that were taught in the primary school resources,¹⁶ but not in the podcast, we detected little, if any, difference between the podcast and the control groups (figure 2). For the fourth concept—that small studies in which few outcome events occur are usually not informative and the results may be misleading—more parents in the podcast group answered both questions correctly than in the control group (figure 2).

We detected little, if any, difference between the podcast and control groups in how likely they would be to find out the basis for a claim about treatment effects, find out if the claim was based on research, or agree to participate in research about an illness they might get (appendix 1). Most (73–82% of both groups combined) responded likely or very likely to all three questions (appendix 1). However, more parents in the podcast group responded that they found it easy or very easy to assess whether a claim is

See Online for appendix 2

based on a research study (adjusted difference 16%; 95% CI 7–24), where to find research-based information (15%; 8–23), how sure they can be about the results of research comparing treatments (29%; 22–37), and how relevant research comparing treatments is likely to be (10%; 3–18; appendix 1).

Most (76%) of the parents who listened to the podcast found it easy or very easy to understand (appendix 1). More than 90% had positive views of the podcast with respect to how much they had liked it, how helpful they had found it, and how much they had trusted what they learned (appendix 1). The podcast was effective across all three levels of education (appendix 1). We did not detect a clear association between level of education and the size of effect, nor did we detect a clear association between having a child in a school that used the primary school resources and the size of the effect of the podcast on parents' scores (appendix 1). Having a child in a school that used the primary school resources had little, if any, effect on the parents' test scores (appendix 1). In figure 3, we show the differences in the number of parents with passing and mastery scores compared with those differences for the children and teachers in the trial of the Informed Health Choices primary school resources. The standardised mean difference (Hedges' *g*), for comparison with other strategies to teach people to think critically, was 0·83 (95% CI 0·65–1·00). None of the parents or research assistants who delivered the podcasts reported any adverse effects.

Discussion

Listening to the Informed Health Choices podcast improved the ability of parents of primary school children in Uganda to assess claims about treatment effects. To our knowledge, this is the first randomised controlled trial to assess use of a podcast for non-formal education or health education, other than a podcast to aid weight loss.^{20–26} Systematic reviews of educational podcasts,²¹ mobile learning,²² parental involvement in education,²³ eHealth to improve health literacy,²⁴ mobile health,²⁵ interactive media for parental education,²⁶ and narrative health promotion interventions²⁷ have not identified studies that are directly comparable to ours. Although several interventions to improve the ability of non-health professionals to think critically about treatments have been assessed, most of these have focused on one concept: that treatments usually have beneficial and harmful effects that need to be considered.⁹ Other interventions designed to teach critical appraisal skills to non-health professionals include workshops, online courses, websites, books, and checklists. However, few of these have been formally evaluated.

A systematic review²⁰ that included 308 studies of strategies to teach people to broaden their critical thinking found an average effect size (Hedges' *g*) of 0·33. The average effect size for interventions targeted at graduate and adult students was 0·21, as was the average

	Control group (n=341)		Podcast group (n=334)	
	Included	Dropped out	Included	Dropped out
Completed tests	273 (80%)	68 (20%)	288 (86%)	46 (14%)
Took the test in Luganda	237 (87%)	59 (87%)	254 (88%)	42 (91%)
Education				
Primary	144 (53%)	33 (49%)	145 (50%)	22 (48%)
Secondary	68 (25%)	23 (34%)	89 (31%)	15 (33%)
Tertiary	61 (22%)	12 (18%)	54 (19%)	9 (20%)
Training in research*	84 (31%)	11 (16%)	96 (33%)	7 (15%)
Prior participation in research†	74 (27%)	11 (16%)	72 (25%)	8 (17%)
Sex				
Female	208 (76%)	54 (79%)	221 (77%)	36 (78%)
Male	65 (24%)	14 (21%)	67 (23%)	10 (22%)
Sources of health care‡				
Government health facility	163 (60%)	45 (66%)	177 (61%)	31 (67%)
Private not-for-profit health facility	25 (9%)	11 (16%)	32 (11%)	8 (17%)
Private for-profit health facility	107 (39%)	32 (47%)	93 (32%)	22 (48%)
Alternative medicine practitioners	7 (3%)	1 (1%)	8 (3%)	2 (4%)
Advice about treatments§				
Friends or relatives	77 (28%)	28 (41%)	46 (16%)	30 (65%)
Health workers	183 (67%)	60 (88%)	236 (82%)	39 (85%)
Community leaders	4 (1%)	3 (4%)	6 (2%)	2 (4%)
Radio or television programmes	31 (11%)	21 (31%)	19 (7%)	13 (28%)
Alternative medicine practitioners¶	5 (2%)	1 (1%)	8 (3%)	2 (4%)
Internet	2 (1%)	2 (3%)	3 (1%)	1 (2%)

Data are n (%). **Have you ever had any training in scientific research (statistics, epidemiology or randomized trials)?". †"Have you ever been a participant in a scientific research study?". ‡"If you or your family member are unwell, where do you commonly seek medical attention?" (select all that apply). §"If you need to make a decision on what treatments to use, where do you usually get advice?" (select all that apply). ¶For example, herbal medicine practitioners.

Table 3: Baseline and demographic characteristics

	Control group (n=273)	Podcast group (n=288)	Adjusted difference*	Adjusted odds ratio*	p value
Primary outcome					
Mean score (%)	52·4% (17·6)	67·8% (19·6)	15·5% (12·5–18·6)	..	<0·0001
Passing score†	103 (38%)	203 (70%)	34% (26–41)	4·2 (2·9–6·0)	<0·0001
Secondary outcome					
Mastery score‡	17 (6%)	91 (32%)	26% (15–39)	7·2 (4·1–12·4)†	<0·0001

Data are % (SD), % (95% CI), or n (%). *The odds ratios were adjusted for the stratification variables (education and child's study group in the Informed Health Choices primary school trial). The odds ratios have been converted to differences, with the control group as the reference. †11 or more of 18 correct answers. ‡15 or more of 18 correct answers.

Table 4: Main results

effect size for interventions in health or medical education. The effect size for our intervention (0·83) is large in comparison. However, comparisons such as these must be made cautiously because of differences in the interventions compared in these studies, the outcome measures, and the methods used.

When we compared the effects of the podcast on parents' abilities to assess claims about treatment effects with the effects of the Informed Health Choices primary school resources on their children's abilities and the

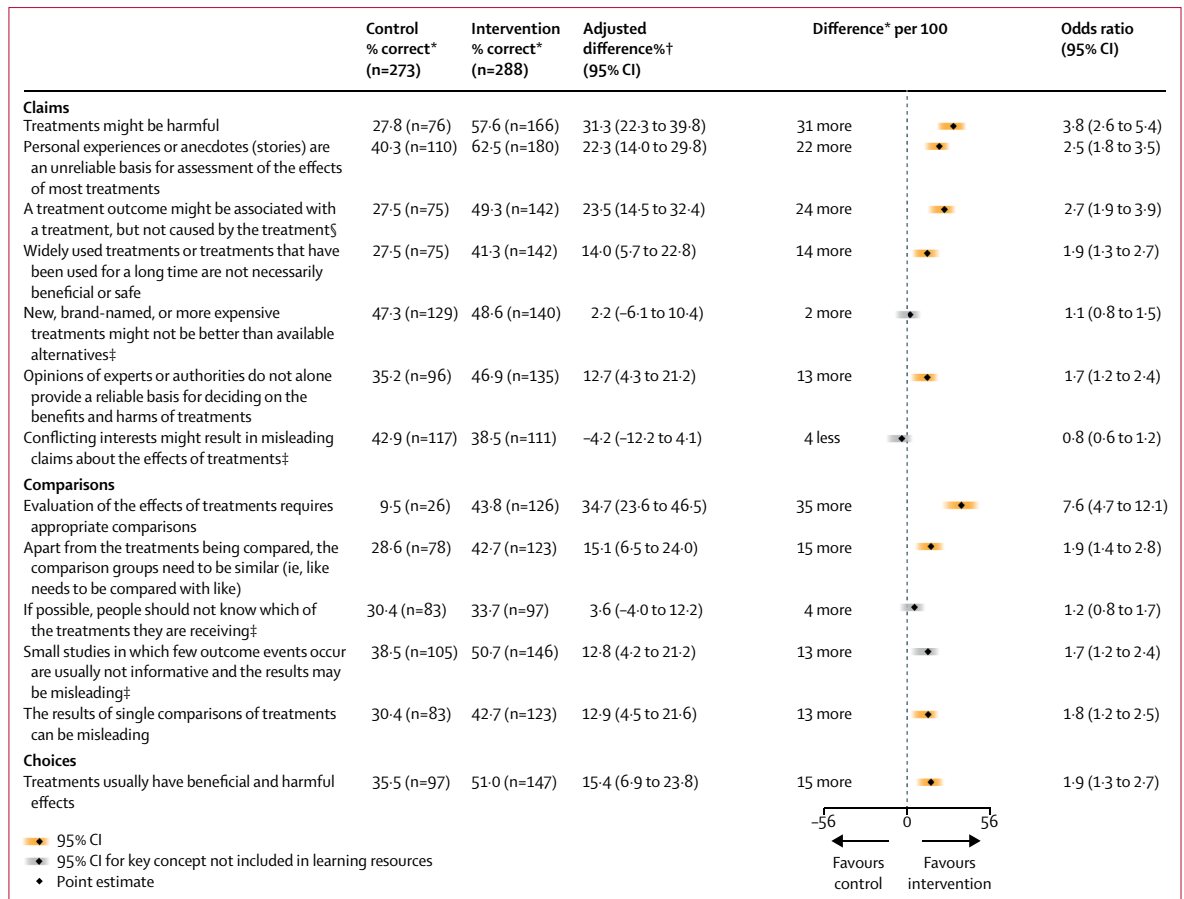


Figure 2: Results for each key concept

*There were two multiple choice questions for each concept. Proportions are the percentage of parents who answered both questions correctly. †The odds ratios were adjusted for the stratification variables (education and child’s study group in the Informed Health Choices primary school trial). The odds ratios have been converted to differences, with the control group as the reference. ‡Key concept not included in learning resources.

children’s teachers’ abilities, the relative effects were larger for the primary school resources than for the podcast. We expected this outcome, given that the primary school intervention was multifaceted, interactive, and took more time (nine lessons totalling 12 h) compared with the podcast (ten episodes totalling about 1.5 h of listening). For passing scores, the absolute effect was largest for children and smallest for teachers, whereas for mastery scores it was largest for teachers and smallest for children. The absolute effect for parents was in the middle, both for passing and mastery scores. After the intervention, the proportion of parents and children in the intervention groups with a passing score in the two trials was similar.

The same test was used in both trials, but four concepts included in the test were not included in the main results for this trial because they were addressed by the primary school resources, but not by the podcast. For three of those four concepts, the podcast had little, if any, effect, as would be expected. For the fourth concept—that small studies might be misleading—an effect was detected. Although we did not include this concept in the podcast, it ended up being explained in episodes about closely

related concepts: that apart from the treatments being compared, the comparison groups need to be similar, and that the results of a single study can be misleading.

Another difference between this trial and the trial of the primary school resources, and a limitation of the present trial, is that the trial of the primary school resources was designed to be more pragmatic, whereas the trial of the podcast was more explanatory.²⁸ To ensure that the parents listened to the podcasts, research assistants visited the parents six times and played all the episodes for the parents, in addition to giving the podcast to them on MP3 players. Furthermore, the parents in the podcast trial volunteered to participate, whereas all the children in a representative sample of schools were included in the trial of the primary school resources. Consequently, the effect estimates from this trial indicate the potential effects of the podcast among parents who choose to listen to them, not the effect of simply offering the podcast to a group of parents.

An additional difference is that we randomised individuals in this trial, whereas we randomised schools in the primary school resources trial. We did not measure the

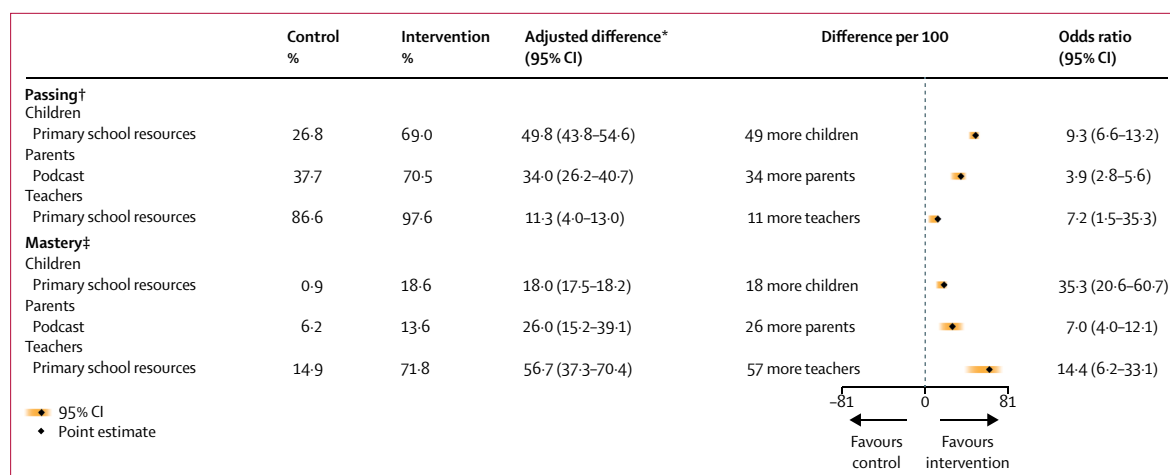


Figure 3: Comparison of passing and mastery scores for children, parents, and teachers

*The odds ratios were adjusted for the stratification variables used in each of the trials and clustering in the primary school trial. The odds ratios have been converted to differences, with the control group as the reference for the parents and the intervention schools as the reference for the children and teachers.¹¹ †A passing score for parents was 11 or more out of 18 correct answers for questions that addressed nine key concepts. A passing score for children and teachers was 13 or more out of 24 correct answers for questions that addressed 12 key concepts.¹¹ ‡A mastery score for parents was 15 or more out of 18 correct answers for questions that addressed nine key concepts. A passing score for children and teachers was more than 20 out of 24 correct answers for questions that addressed 12 key concepts.¹¹

extent to which parents in the podcast group talked with parents in the control group or shared the podcast with them, but if contamination were an issue, this would mean that the effect sizes are underestimates. Another limitation of this trial is that we both developed and evaluated the podcast. Independent evaluation in more pragmatic trials of this and similar interventions is warranted.

What the long-term effects of listening to the podcast will be are uncertain, as is whether the podcast will have an effect on actual health choices and health outcomes, and how transferable the findings of this study are to other countries. We will measure outcomes again after 1 year, including effects on actual decisions, based on self-report. We will user-test the podcast in Kenya and Rwanda in 2017, and we are developing a manual for adapting the podcast for other audiences.

The language, structure, stories, and examples of the podcast were tailored to a specific target audience—parents of primary school children in Uganda. Nonetheless, we have shown that adults in a low-income country, with a primary school education, can improve their ability to assess claims about treatment effects by listening to a podcast. More broadly, we have shown the potential of a strategy that could be delivered through primary schools to improve the critical health literacy of parents, in conjunction with teaching the same essential life skills to their children.

We believe this study is widely relevant for two reasons. Critical health literacy is essential for informed health choices, even if it is not sufficient for behavioural change. The understanding of concepts can lead to improvements in health behaviours; however, there have been few cognitive studies²⁹ of conceptual change in health, especially in adults. More importantly, regardless of whether improvements in critical health literacy alone

result in behavioural changes, these improvements are necessary for people to be able to make informed choices about their own or their children's health and for effective public involvement and accountability in health policy decisions. Similarly, even though passive dissemination of a single podcast would have a smaller effect than what we found among parents who volunteered to participate and who listened to the entire podcast, it can improve the critical health literacy skills of some. Whether this effect is sustained or not, it would be desirable to reinforce and build upon what was learned. Therefore, either way, the podcast is an important step towards addressing a major public health challenge.

Although our study was done in a low-income country, we believe the findings are relevant for high-income countries because unreliable claims about treatment effects are universal. For example, reviews of health-care news stories have found major problems, including claims that are based on anecdotes, failing to differentiate association from causation, failing to distinguish surrogate outcomes from important outcomes, misleading reporting of relative effects, and failing to consider trade-offs between benefits and harms.³⁰ Health literacy is also a major problem in high-income countries,¹ including the ability to assess information about the effects of treatments. For example, a survey of adults in Norway found that only one in five was able to differentiate association from causation, and health professionals did no better than non-health professionals (appendix 1). Unfortunately, few interventions for teaching these skills have been rigorously assessed. Beyond showing the effectiveness of a podcast for teaching parents to assess treatment claims, we have shown an approach to developing and evaluating learning resources that can, and hopefully

will, be applied to other strategies for improving people's ability to assess treatment claims and make informed health choices.

Contributors

DS and AN are the principal investigators. They drafted the protocol with help of the other investigators and were responsible for the day-to-day management of the trial. NKS and ADO had primary responsibility for overseeing the trial. All the investigators except for DTK reviewed the protocol, provided input, and agreed on this version. MO and DS had primary responsibility for developing the podcast. All the investigators contributed to the development. AA-D had primary responsibility for developing and validating the outcome measure. DS and AN had primary responsibility for data collection. ADO, SR, AA-D, and IC were principal members of the coordinating group for the trial and, together with NKS and the principal investigators, acted as the steering committee for the trial. The steering committee members were responsible for final decisions about the protocol and reporting of the results.

Declaration of interests

We declare no competing interests.

Acknowledgments

This trial was funded by the Research Council of Norway, project number 220603/H10. We thank the Global Health and Vaccination Research programme of the Research Council of Norway for supporting the project, Developing Excellence in Leadership, Training and Science (DELTA) African Academy of Science/Alliance for Accelerating Excellence in Science (AES) in Africa for supporting NKS and DS (DELTA grant DEL-15-011), and the UK National Institute for Health Research for supporting IC and the James Lind Initiative. Alun Davies, Martha Gerrity, Lena Nordheim, Peter O Okebukola, Newton Opiyo, Jonathan Sharples, Helen Wilson, and Charles Shey Wiysonge determined the cutoff scores for passing and mastery. We thank Margaret Nabatanzi, Martin Mutyaba, Esther Nakyejwe, and Solomon Segawa for their help with data management; all the research assistants who helped with recruitment, delivering the podcast, data collection, and entry; the producers and the musicians who helped with the production of the Informed Health Choices theme song and the podcast, particularly Abraham Jjuko and Christopher Kiwanuka; the Informed Health Choices advisory group; the parents and journalists who helped with the development of the Informed Health Choices podcast; and those who participated in this trial.

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