Panels, tables, and legends for figures

Effects of using the Informed Health Choices primary school resources on the ability of children in Uganda to assess the reliability of claims about treatment effects: a cluster-randomised trial

Panel 1: Twelve key concepts covered by the Informed Health Choices primary school resources*

Claims

- Treatments may be harmful
- Personal experiences or anecdotes (stories) are an unreliable basis for assessing the effects of most treatments
- Widely used treatments or treatments that have been used for a long time are not necessarily beneficial or safe
- New, brand-named, or more expensive treatments may not be better than available alternatives
- Opinions of experts or authorities do not alone provide a reliable basis for deciding on the benefits and harms of treatments
- Conflicting interests may result in misleading claims about the effects of treatments

Comparisons

- Evaluating the effects of treatments requires appropriate comparisons
- Apart from the treatments being compared, the comparison groups need to be similar (i.e. 'like needs to be compared with like')
- If possible, people should not know which of the treatments being compared they are receiving
- Small studies in which few outcome events occur are usually not informative and the results may be misleading
- The results of single comparisons of treatments can be misleading

Choices

- Treatments usually have beneficial and harmful effects

* The concepts are shown here as they are described in the key concepts list,[25] which was not designed as a learning resource, not as they were presented to the children in the primary school resources.[34]

Panel 2: Contents of the textbook and the teachers' guide

The Health Choices Book **Learning to think carefully about treatments** **A health science book for primary school children**	Teachers' Guide
Introduction	The teacher's guide includes an introduction to the project and the resources, and the following for each lesson, in addition to the embedded chapter from the textbook:
Lesson 1: Health, treatments and effects of treatments	
John and Julie learn about CLAIMS about treatments	• The objective of the lesson
Lesson 2: Someone's experience using a treatment	• A lesson preparation plan
Lesson 3: Other bad bases for claims about treatments (Part 1)	• A lesson plan
Lesson 4: Other bad bases for claims about treatments (Part 2)	• A list of materials that the teacher and children will need
John and Julie learn about COMPARISONS of treatments	• A synopsis of the story
Lesson 5: Comparisons of treatments	• Keywords in the chapter
Lesson 6: Fair comparisons of treatments	• Review questions to ask the children after reading the story
Lesson 7: Big enough fair comparisons of treatments	• Extra examples for illustrating the concepts
John and Julie learn about CHOICES about treatments	• Background about examples used in the story
Lesson 8: Advantages and disadvantages of a treatment	• Teacher instructions for the classroom activity
Review	• Answers and explanations for the activity
Lesson 9: Review of what is most important to remember from this book	• Answers and explanations for the exercises
	• Background information, examples, and keyword definitions for teachers

Panel 3: Research in context

Evidence before this study

Prior to undertaking this study, we considered: systematic reviews of other school-based interventions to teach critical appraisal of health claims and critical thinking; a systematic review of education interventions to improve learning in primary schools in low- and middle-income countries; an overview of systematic reviews of interventions to improve learning in primary and secondary schools in low- and middle-income countries; and a systematic review of interventions to teach science in primary schools. We did not find any studies that evaluated a primary school intervention to teach children to critically appraise treatment claims or make informed health choices, in any country.

Added value of this study

This is the first randomised trial to evaluate any intervention to improve the ability of primary school children anywhere to assess claims about treatments. We found a large effect: an increase of nearly 50% in the proportion of children with a passing score on a test that measures their ability to assess treatment claims. This corresponds to an effect size that was well above the average for other critical thinking interventions for any type of student in any country. No adverse events were reported. As with any school activity, the time that is used for this intervention (13 hours over a 12-week school term) must be taken away from other activities. The cost of the intervention (approximately $4 USD per child) is substantial relative to current levels of expenditures per primary school child in Uganda and other low-income countries.

Implications of all the available evidence

It is uncertain what the long-term impacts of using the Informed Health Choices primary school resources are, what if any impact it will have on actual health choices and outcomes, or how transferable the findings of this study are to other regions and countries. In addition, the cost of the intervention is small, it is a substantial cost compared to the cost of school in Uganda. Nonetheless, being able to think critically about treatment claims (and generally) has an intrinsic value. School authorities, teachers, and children in the study indicated that they consider it important. We found a large effect on critical thinking about treatment effects, which was the primary outcome. Future research should address how best to scale up use of the resources, their suitability and effects in other countries, and how to build on these resources with additional primary and secondary school resources.

Table 1: Characteristics of the participants

		Control schools	**Intervention schools**
Schools (selected from the Central region of Uganda)		N=60	N=60
Location	Rural	8 (13%)	6 (10%)
	Semi-urban	15 (25%)	14 (23%)
	Urban	37 (62%)	40 (67%)
Ownership	Public	33 (55%)	30 (50%)
	Private	27 (45%)	30 (50%)
Teachers (initially identified by head teachers)		N=74	N=76
Completed tests*		67 (91%)	85 (100%)[†]
Education[‡]	Certificate	30 (45%)	39 (46%)
	Diploma	33 (49%)	35 (41%)
	University degree	3 (4%)	10 (12%)
Main subject taught	Science	49 (73%)	68 (80%)
Sex	Women	29 (43%)	34 (40%)
Children (enrolled in year-5 at the start of the term)		N=6256	N=6383
Completed tests*		4430 (71%)	5753 (90%)
Completed tests per class[§]	Median (IQR) (Range)	60 (40 to 95) (12 to 150)	60.5 (43 to 88.5) (18 to 176)
Sex	Girls	1973 (45%)	2599 (45%)
Age	Median (IQR) (Range)	11 (10 to 12) (8 to 20)	11 (10 to 12) (8 to 18)

* Questions about the characteristics of the teachers and children were included in the test completed at the end of the school term.

[†] Head teachers were initially asked to identify teacher who taught science to children in the fifth year of primary school. However, some schools had more than one year-5 class. Six intervention schools with more than one year-5 class (with a different teacher for each class) requested that nine additional teachers be included altogether.

[‡] There was one missing value in each group for this variable.

[§] The average class size at the start of the term was 84 children in both groups.

IQR = interquartile range

Table 2: Main results - test scores

	Control schools N schools = 60 N children = 4430	Intervention schools N schools = 60 N children = 5753	Adjusted difference*	Odds ratio*	ICC
Primary outcome					
Mean score, %	Mean score: 43.1% (SD 15.2%)	Mean score: 62.4% (SD 18.8%)	**Mean difference: 20.0%** (95% CI 17.3% to 22.7%)		0.18
Passing score (≥ 13 out of 24 correct answers)	26.8 % of children (N=1186)	69.0 % of children (N=3967)	**49.8% more children** (95% CI 43.8% to 54.6%)	9.34 (95% CI 6.62 to 13.18)	0.19
Secondary outcomes					
Mastery score (≥ 20 out of 24 correct answers)	0.9% of children (N=38)	18.6% of children (N=1070)	**18.0% more children** (95% CI 17.5% to 18.2%)	35.33 (95% CI 20.58 to 60.67)	0.21
Teachers' scores	N teachers = 67	N teachers = 85			
Mean score, %	Mean score: 66.7% (SD 14.3%)	Mean score: 84.6% (SD 17.1%)	**Mean difference: 18.3%** (95% CI 12.9% to 23.3%)		
Passing score (≥ 13 out of 24 correct answers)	86.6% of teachers (N=58)	97.6% of teachers (N=83)	**11.3% more teachers** (95% CI 4.0% to 13.0%)	7.24 (95% CI 1.49 to 35.26)	
Mastery score (≥ 20 out of 24 correct answers)	14.9% of teachers (N=10)	71.8% of teachers (N=61)	**56.7% more teachers** (95% CI 37.3% to 70.4%)	14.38 (95% CI 6.24 to 33.14)	

* The adjusted difference is based on mixed models with a random effects term for the clusters and the stratification variables modelled as fixed effects, using logistic regression for dichotomous outcomes and linear regression for continuous outcomes. P < 0.00001 for all four comparisons. The odds ratios from the logistic regressions for passing scores and mastery scores have been converted to differences based on the intervention school proportions and the odds ratios calculated using the intervention schools as the reference (the inverse of the odds ratios shown here).

Table 3: Sensitivity analyses

Mean score	Adjusted difference*	Effect size[†]
Primary analysis	**20.0%** (95% CI 17.3% to 22.7%)	**1.16** (95% CI 1.00 to 1.32)
Weighted analysis	**20.0%** (95% CI 17.3% to 22.7%)	**1.08**[‡] (95% CI 0.93 to 1.22)
Lee bounds	**14.2% to 24.6%** (95% CI 13.5% to 25.5%)	
Oral examination in Luganda[§]	**15.8%** (95% CI 12.7% to 19.0%)	**0.99** (95% CI 0.79 – 1.20)
Passing score (≥ 13 out of 24 correct answers)	**Adjusted difference***	**Odds ratio**
Primary analysis	**49.8%** (95% CI 43.8% to 54.6%)	**9.34** (95% CI 6.62 to 13.18)
Weighted analysis	**50.0%** (95% CI 44.1% to 54.8%)	**9.48** (95% CI 6.70 to 13.41)

* The adjusted difference is based on mixed models with a random effects term for the clusters and the stratification variables modelled as fixed effects, using logistic regression for dichotomous outcomes and linear regression for continuous outcomes. P < 0.00001 for all the analyses. The odds ratios from the logistic regressions for passing scores have been converted to differences based on the intervention school proportions and the odds ratios calculated using the intervention schools as the reference (the inverse of the odds ratios shown here).

[†] Adjusted Hedges' g

[‡] The effect size is different from the primary analysis, despite the adjusted mean difference being the same, because of a difference in the intraclass correlation coefficient.

[§] Administered to 769 children in control schools (mean 49.7%, SD 15.6%) and 847 children in intervention schools (mean 66.3%, SD 15.7%)

Legends for figures

Figure 1: An excerpt from the comic book story in the textbook

File: Figure 1 An excerpt from the comic story in the textbook.pptx

Figure 2: Trial profile

File: Figure 2 IHC trial-profile.pptx

Figure 3: Results for each key concept

File: Figure 3 Results for each key concept.pdf

* There were two multiple-choice questions (MCQs) for each concept. The proportions are for the percent of children who answered both questions correctly.

[†] The adjusted difference is based on mixed models with a random effects term for the clusters and the stratification variables modelled as fixed effects, using logistic regression. All the p-values are less than 0.0001 after being adjusted for multiple comparisons. The odds ratios from the logistic regressions have been converted to differences based on the control school proportions and the odds ratios shown here.

[‡] Intraclass correlation coefficient

[§] This concept was not included in the learning resources or counted in the average, pass or mastery scores.