Review: A Systematic Review of Preventive Health Educational Videos Targeting Infectious Diseases in Schoolchildren

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Abstract. We conducted a systematic review of preventive health educational videos targeting infectious diseases in schoolchildren to formulate recommendations for establishing an evidence base for future studies. We included studies that evaluated interventions involving video-based health education in schools to improve knowledge and attitudes and to change behavior regarding different infections. The majority of the 11 studies we reviewed concluded that videos were well received by schools, teachers, and children, and are promising and effective health education tools, having a positive impact on knowledge and attitudes. However, there is a pressing need for more standardized, high-quality studies to draw evidence-based conclusions on the value of educational videos targeting infectious diseases. Therefore, we provide a descriptive summary of the results and make recommendations for studies using preventive educational videos targeting infectious diseases in schoolchildren on the basis of our experiences gained in a video-based cluster randomized trial.

INTRODUCTION

The value of a moving image in health education was highlighted as early as 1988 when a manual published by the World Health Organization¹ pointed out that no other media creates such lively interest as television. Television programs such as *Sesame Street*,² *Between the Lions*,³ and *Blue's Clues*,⁴ have shown the positive effects on cognitive development of young children. In the school setting, educational videos have proven effective interventions in changing student behavior^{5,6} and improving knowledge and attitudes.⁷ Furthermore, the importance of involving schools to strengthen health education has been recognized.^{8,9} The World Health Organization and other organizations have launched global school health programs (Global School Health Initiative in 1995 and Focusing Resources on Effective School Health [FRESH]), which seek to strengthen health promotion and educational activities in schools at the local, national, and global levels.¹⁰ The studies reviewed here have sought to combine education and entertainment through multimedia to inform and engage children at the same time, and assesses the public health role for preventive educational videos targeting schoolchildren.

The approach we have taken in this review is unique, being the first to systematically review school-based video interventions targeting infectious diseases. Furthermore, we have formulated informed guidelines for the evaluation of future video-based studies within the school setting. The key findings are combined with experiences we have personally gained during an intervention trial we are undertaking in China, which is assessing whether an educational video targeting soil-transmitted helminth (STH) prevention at school widens the students' knowledge and changes their behavior, resulting in fewer STH infections. Initially, the objective of this review was to assess the public health value of video-based interventions. However, a limited number of studies assessing the impact of

health educational videos for infectious diseases at school were found, and some were of poor scientific quality, making it difficult to conduct a meta-analysis. However, we provide a descriptive summary of the results and make recommendations for studies using preventive educational videos targeting infectious diseases in schoolchildren based on our own experience in China.

METHODS

Sources and selection criteria. Data for this review were identified, as of May 2012, by searching Medline, EMBASE, the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, ISI Web of Knowledge, Informit, ERIC, A+ education, EdITLib (Education and Information Technology Digital Library), CSA Illumina (Sociological Abstracts), Pro Quest Social Science Databases, Anthropology Plus Basic Search and Google. As we found that not all relevant publications appeared when searching these databases, the following journals were searched directly: *Journal of School Health*, *Health Education Research*, *Health Education Behavior*, *Journal of Epidemiology and Community Health*, *Preventive Medicine*, *BMC Public Health* and *American Journal of Health Education*. In addition to standard biomedical databases, major educational and anthropologic databases such as ERIC, A+ education, and Pro Quest Social Science Databases and educational journals were selected because they index publications that specifically relate to the reviewed topic and which might not have been covered by Medline. Video refers to audio-visual material/films in digital and analogue formats (e.g. DVD, MPEG-4, wav, wmv, and VHS videotapes). In community-based studies, the target population includes children and adults. Therefore, the method, didactic approach, and overall setting of the intervention are different, making it difficult if not impossible to compare the outcomes with school-based interventions targeting school-children only.

The reference lists of identified studies were searched for further relevant information and European and American gray literature (NTIS, OpenSIGLE) databases were also reviewed. Gray literature is defined as “that which is produced on all

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levels of government, academics, business, and industry in print and electronic formats but which is not controlled by commercial publishers".¹¹ We used the terms impact, educational, video, health, DVD, film, school, school-based child, infect*, hygiene practice, risk behavior, infection risk behavior, and behavior change for our searches. The review was carried out according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement¹² (Figure 1).

We reviewed studies that evaluated interventions involving video-based health education in schools aimed at improving knowledge, attitudes, and inducing behavior changes for a wide range of medical conditions of public health relevance. The target group included primary school and secondary school students 5–17 years of age. For simplicity and readability, the term schoolchildren is used to describe both of these types of students. The different types of study designs included randomized controlled trials (RCTs), pre-/post-test design, and quasi-experimental and observational studies (Figure 1). We noticed a considerable inconsistency in the terminology for study design. In the older publications, and publications with a social science background, the term controlled pre- post-test design instead of RCT was used.

Data extraction. Data from each study were extracted into tables, which contained the aims, sample size, design, outcome measures, and results. Quantitative and qualitative outcome measures were assessed according to the method applied in the study. The method quality of each study was assessed by testing for the following factors: randomization, inclusion of a control group, intervention design, outcome assessment, quality of results, sample size, and study design, and then categorized according to evidence-based medicine criteria¹³ (Table 1). The RCTs were additionally ranked according to the validity scale presented by Jadad and others (Table 2).¹⁴

RESULTS

Of 1,243 papers identified from our original searches reporting studies involving health educational videos, most were excluded for the following reasons: the intervention was not school-based; neither children nor infectious diseases were targeted; and the video was not used for teaching but instead for video-recorded observations, video monitoring, video games, or endoscopy. The review and selection process left us with 11 articles that met the inclusion criteria. Five of

FIGURE 1. Flow chart for selection of articles on preventive educational videos targeting schoolchildren included in the review. N.A. = not applicable.

TABLE 1
Summary of aims, design, and major outcomes of the 11 studies considered*

Study	Aims	Sample size	Design (evidence-based medicine level)	Outcome measures
Schaalma and others ²⁰	Evaluating the effects of experimental AIDS/STD curriculum compared with current AIDS/STD education in Dutch schools	2,430 (grades 9–10)	RCT (author: quasi-experimental design) (level I)	Knowledge: 13% increase in knowledge on AIDS/STD ($P < 0.001$); Attitude: 3% higher risk appraisal ($P < 0.005$), 41% more positive attitudes ($P < 0.001$), 19% more positive perceptions ($P < 0.01$); Behavior: lower student risk index (weighted, $P < 0.05$)
Yuan and others ²⁴	Test impact of video intervention on primary school students' knowledge of schistosomiasis and their compliance for treatment	1,137 schoolchildren (grade 5)	RCT (author: quasi-experimental design) (level I)	Knowledge: 83% increase ($P < 0.001$); Attitude/compliance: 67% increase in willingness to submit a fecal sample for diagnosis, 66% increase in willingness to submit a blood sample, 58% increase in willingness to take medication ($P < 0.001$), 11% increase in compliance rate for blood examination ($P < 0.001$); Behavior: no statistically significant difference in participation for schistosomiasis examination ($P > 0.1$)
Yuan and others ²³	Test the effectiveness of video and accompanying booklet on water contact and schistosomiasis infection risk behavior of primary school students	1,739 schoolchildren (grade 4)	RCT (level I)	Knowledge: 41% increase ($P < 0.001$); Attitude/compliance: not assessed; Behavior: 71.4% of water-related activities in unsafe places undertaken by control group ($P < 0.0001$). Overall 10% decrease of unsafe water contact from pre- to post intervention (P not reported)
Hu and others ²⁵	Examine the short-term effects of health education in the control of schistosomiasis, and to monitor the long-term impact on re-infection patterns	120 schoolchildren (age = 6–15 years), 206 adult females, 194 adult males	RCT (level I)	Knowledge: 92% increase ($P < 0.001$); Attitude/compliance: 80% increase in correct attitude towards chemotherapy ($P < 0.001$); Behavior: significant decrease in risky water contact (P not reported)
Husztli and others ¹⁷	Test effects of a lecture or a film on AIDS knowledge and attitudes towards practicing preventive behaviors	488 students (grade 10)	RCT (level I)	Knowledge: significant increase ($P < 0.05$); Attitude/compliance: no significant effect on attitude towards AIDS patients (P not reported). Attitudes toward practicing preventive behaviors: no significant effect (P not reported); Behavior: not assessed
Torabi and others ²²	Assessing the impact of a school-based video intervention on HIV/AIDS in Russian students	1,124 (grades 7–9)	Quasi-experimental design, no randomization (level II-1)	Knowledge: significant increase in knowledge on HIV/AIDS prevention ($P < 0.01$); Attitude: significant improvement in attitude scores ($P < 0.01$); Behavior: no significant change
Brabin and others ¹⁶	Evaluate girls' recall of film on HPV and cervical cancer	1,084 girls (age = 12–13 years)	Not indicated, no randomization (level II-1)	Knowledge: girls 16% more likely to report having received enough information ($P < 0.0001$) and 8% more likely to have wanted the vaccine ($P = 0.015$); Attitude/compliance: creasing awareness of the risks of sexual relationships ($P = 0.015$). Less reluctant to discuss the vaccine with boyfriend ($P = 0.008$). Behavior: not assessed
Stevenson and Davis ²¹	Assess impact of culturally similar and culturally dissimilar health education videos on HIV/AIDS knowledge, beliefs, and prevention.	111 African-American adolescents (age = 14–15 years)	Uncontrolled trial (level II-3)	Knowledge: increase ($P = 0.05$). Quantitative assessment not clearly described; Attitude/compliance: no impact on prevention beliefs, cultural beliefs and safer alternative options; Behavior: not assessed.
Albonico and others ¹⁵	Reduce infection intensity of <i>Ascaris lumbricoides</i> , <i>Trichuris trichiura</i> , and hookworms. Reduce prevalence of <i>Strongyloides stercoralis</i> and amebiasis	1,075 schoolchildren (age = 3–17 years)	Pre- and post-test design, no control (level II-3 or III)	Knowledge: not assessed; Attitude/compliance: not assessed. Behavior: not assessed; Prevalence: 44% decrease in intestinal parasites ($P < 0.001$); Intensity: 15%, 47%, and 68% decrease for <i>A. lumbricoides</i> , <i>T. trichiura</i> , and hookworms, respectively

(Continued)

Table 1
Continued

Study	Aims	Sample size	Design (evidence-based medicine level)	Outcome measures
Locketz and others ¹⁸	Video, providing general facts about schistosomiasis, to encourage students to improve their personal hygiene	13 elementary schools (grades 3–6)	Descriptive study (level III)	Knowledge: increase (<i>P</i> not reported); Attitude/compliance: not assessed; Behavior: no significant change in personal hygiene habits; Prevalence: reduction not significant (<i>P</i> not reported)
Lowry and others ¹⁹ (Abstract only)	Develop and evaluate animated action-adventure video on HIV/AIDS targeting schoolchildren	Not indicated	Not indicated, field evaluation (level III)	Knowledge: increase, if video followed by discussion (<i>P</i> not reported); Attitude/compliance: significant impact on attitudes towards AIDS (<i>P</i> not reported); Behavior: not assessed

* AIDS = acquired immunodeficiency syndrome; STD = sexually transmitted disease; RCT = randomized control trial; HIV = human immunodeficiency virus; HPV = human papillomavirus.

the school-based interventions targeted parasitic infections with the remainder being on sexually transmitted infections (specifically, five on human immunodeficiency virus/acquired immunodeficiency syndrome, and one on human papillomavirus. The aims, design, and main outcomes for each of these studies are summarized in Table 1.

Types of interventions. Of 11 reviewed studies, 10 were directed at increasing student knowledge and raising their awareness.^{15–24} Six studies aimed at changing behavior to prevent parasitic diseases^{18,23–25} and sexually transmitted infections.^{20,22} Seven trials tested the educational video against a control arm involving conventional teaching aids such as posters and reading materials or no treatment/intervention.^{16,18,20,22–25}

Types of videos. The educational videos used ranged from 15 to 22 minutes in duration with a median duration of 18 minutes; one outlier, however, lasted two hours. All videos targeted children and were implemented at school; one study additionally targeted adults.²⁵ In seven of the studies, the videos were developed within the research project;^{15,16,18–20,23,24} the remainder were either produced externally^{14,19} or the video production was not reported.^{21,25} In two studies, the content of the video was not described.^{15,22} With the exception of one study,²² each video was embedded in the school lesson

and was combined with other teaching methods such as class discussions, role plays, booklets, and posters.

Outcome measures. Most studies assessed quantitative measures; one non-RCT study focused additionally on qualitative outcomes.¹⁶ We summarized the results by endpoints, such as knowledge, attitude/compliance, and behavior change, that were assessed in most studies, and which focused on outcomes that were directly related to the intervention. Two studies assessed changes in disease prevalence.^{15,18} A summary of the results (Figure 2) and the main conclusions for each of the studies follows.

The video interventions increased student knowledge in all 10 studies assessing knowledge,^{16–25} of which the results from eight studies were statistically significant.^{16,18–21,23–25} In six^{16,19,20,22,24,25} of eight studies^{16,18–22,24,25} assessing attitude/compliance, the video intervention had a positive effect on attitude and compliance for treatment. Except for one study,¹⁹ where *P* values were not reported, the study results were significant. The video had no significant impact on attitude/compliance in the other two studies.^{17,21} Two^{20,23} of six^{18,20,22–25} studies assessing behavior resulted in a statistically significant change; in the remainder, behavior change was not significant^{18,22,24} or a *P* value was not reported.²⁵ Of two studies that

TABLE 2
Method quality of reviewed RCT studies ranked according to criteria defined by Jadad and others¹⁴

Rank	Study	Randomization	Randomization points	Withdrawals or dropouts*	Withdrawal or dropout points	Total points†	Limitations
1	Schaalma and others ²⁰	Yes, two-stage sampling procedure	2	Yes, reason reported	1	3	Limited validity of response to questionnaire items on sexual behavior. Short time span between baseline and follow-up (4 months).
2	Yuan and others ²³	Yes, coin toss	2	NR	0	2	Baseline 12 months before intervention. Follow-up questionnaire 3 months after intervention. <i>P</i> values were not always reported.
3	Yuan and others ²⁴	Yes, but not described	1	NR	0	1	Short intervention (2 months). Prevalence/re-infection not assessed. Timeline unclear.
4	Hu and others ²⁵	Yes, but not described	1	NR	0	1	12-year follow-up. Small sample size: only 120 schoolchildren and 200 adults
5	Husztli and others ¹⁷	Yes, but not described	1	NR	0	1	<i>P</i> values were not always reported

* NR = not reported.

† Without double-blinding criteria; maximum ranking possible = 3 points.

FIGURE 2. Effectiveness of the video-based interventions.

considered a change in prevalence,^{15,18} only one¹⁵ presented statistically significant results. Four studies demonstrated that the use of videos had a greater impact when combined with other methods such as discussions, role plays, and prevention training.^{19,22,24,25} Three papers^{18,22,23} showed that videos had a significant impact on knowledge, but limited impact on adaptive behavior. Most reviewed studies concluded that videos are promising and effective health education tools, with a positive impact on knowledge and attitudes. Overall, video-based interventions were well received by schools, teachers, and children.

Quality of the studies. Only five of the studies incorporated an RCT.^{17,20,23–25} An additional four studies did not include or report a control arm,^{15,18,19,21} and two studies with a control arm did not allocate it randomly.^{16,21} Notably, power calculations were missing in all studies, the method chosen for allocation to intervention and control was either poorly reported or not reported, and most did not adhere to CONSORT reporting standards.²⁶ Accordingly, we have assessed the quality of the studies according to evidence-based medicine criteria¹³ (Table 1). We additionally ranked the RCT studies, shown in Table 2, according to the validity scale of Jadad and others.¹⁴

DISCUSSION

This review has shown that a number of school-based video interventions have been described for use against infectious diseases. Health education, through the use of innovative educational tools, has been advocated for the control of a number of the neglected tropical diseases,^{23–25} and the prevention of sexually transmitted infections.^{16,18–22} We emphasize that the most recent study detected by our extensive search was conducted in 2010 which indicates there is a clear need for more present-day research in the area.

It is noteworthy that most of the 11 studies we reviewed in detail concluded that videos were well received by schools, teachers, and children, and are promising and effective health education tools, having a positive impact on knowledge and attitudes. We observed that educational videos entertain, engage, and inform at the same time, and these are important factors when targeting children because of their limited attention span. Furthermore, videos are more likely to induce behavior change than text-based teaching methods, a principle much discussed in the observational learning concept.²⁷ Compared with conventional teaching,

videos can display correct behavior for students such that they can learn through direct observation.²⁸ According to behavioral theories, observing correct behavior is beneficial for inducing behavior change.²⁸ The target population has to recognize that 1) they are at risk (Health Belief Model: perceived susceptibility²⁹); and 2) it is in their hands to change this situation (Social Cognitive Theory: self-efficacy²⁷). This recognition is more difficult to achieve by traditional teaching methods. Therefore, videos play an important role, especially when targeting behavior change.

Among the reviewed studies, most evaluated the impact of videos displaying real-life situations in the form of an entertaining dialogue or narrative, whereas in three studies, the videos were purely instructional, providing facts in the form of a recorded lecture.^{18,22,25} It is of note that, among these studies, only one study, which combined the video with student exercises and discussion, reported a change in behavior, although *P* values were not reported.²⁵ These latter findings confirmed the conclusions of studies targeting non-communicable diseases, showing that educational videos are more effective when combined with other methods.^{28,30,31}

Of the reviewed studies, five conducted RCTs, although only one was reported as such.²⁴ The remainder was reported as controlled pre- post-test design, or quasi-experimental design with randomization. According to definition, quasi-experimental designs lack randomization. However, if they are randomized, they could be considered an RCT. The outcomes of the five RCTs^{17,20,23–25} were of reasonable validity, whereas those from the non-RCT studies^{15,16,18,19,21,22} have to be considered carefully because the validity and generalizability of these trials is clearly limited because of reduced statistical power, lack of a control arm, poor study design, or inadequate reporting. Even with the RCTs, weaknesses in study design and reporting were evident. All RCTs randomized study participants into intervention and control groups, but none described the process of randomization or sample size calculations. Also, attrition was poorly reported; only one study²⁰ reported attrition, including precise numbers and the reasons for participant withdrawal. The non-RCT studies ranged from trials without randomization (level II-1) to descriptive studies (level III, lowest level), according to evidence-based medicine criteria¹³ (Table 1). The RCTs were additionally ranked according to the accepted validity scale¹⁴ (Table 2), but without including blinding criteria because blinding is not feasible for educational studies. Accordingly, the maximum achievable score is three points, which only one of the studies reached.²⁰ We also identified other weaknesses in study design and implementation. Two studies recruited small study populations, potentially leading to insufficient statistical power.^{21,25}

The methodological weaknesses of some of these studies, the lack of quantitative results and indicators for statistical significance in several of the trials meant we were unable to conduct a meta-analysis or to draw evidence-based conclusions. Therefore, we have presented the data from the 11 studies in descriptive form only (Table 1), and made recommendations for development of video-based interventions on the basis of own experience.

As outlined by Rosen and others³² and from our experiences of undertaking randomized controlled trials^{33,34} a carefully designed and implemented RCT is a powerful evaluation tool for the assessment of health education/promotion if the

study is rigorously designed, implemented, evaluated, and reported (Table 3). However, the study design and evaluation methods have to be chosen carefully according to the research objectives, methods and outcome measures. The RCTs may not always be the appropriate study design, but for the type of health education research evaluating innovative educational tools as outlined in this review, RCTs are appropriate and should be used, if feasible. Regardless of the study design applied, rigorous planning, implementation, and evaluation are crucial to provide internal validity to the study.

TABLE 3

Recommendations for studies using preventive educational videos targeting infectious diseases in schoolchildren

Study design:	We recommend a randomized control trial (RCT) design where appropriate because RCTs are considered the most robust form of evidence. For community and school-based interventions, a cluster randomized design is preferred because it limits contamination, simplifies the logistics of the field work, and measures direct and indirect effects of the intervention. However, for interventions targeting persons, an individual RCT is recommended. The RCTs, including cluster randomized trials, have to be rigorously planned, implemented, and reported.
Study preparation:	The study has to be carefully planned and designed, including the incorporation of sample size calculations to assess the minimal sample size required. We highly recommend including local authorities in the project-planning phase. Before study commencement, informed consent has to be obtained from parents/legal guardians, teachers, and the schools. Because teachers are crucial for the smooth implementation of the project, they should be trained for their tasks in a dedicated workshop.
Development of an educational package including the video:	The educational video should be produced professionally; hiring a professional audio-visual company and an experienced scriptwriter are essential. The costs for a professionally produced video can be considerable and have to be budgeted carefully. Sub-contracting future professionals at educational institutions (e.g., film school) or engaging the local community as protagonists can reduce the production costs significantly. Incorporating the key messages in an entertaining, engaging narrative can prove popular and effective in schoolchildren and adults. Ideally, the educational material should be developed locally to account for cultural differences. In any case, involvement of the local community and the target group during the production of the video and its pre-testing in the study area are crucial. The video should be implemented as a teaching aid, not a teaching substitute, and should be combined with other teaching methods such as class discussions or role plays. ^{24,25}
Video content:	The video should incorporate instructional messages into a real-life situation displaying correct behavior rather than depicting a stand-alone instructional message. The knowledge can be integrated into an entertaining narrative, thereby informing and entertaining at the same time. Behavioral theories ^{27,29} and our own field experiences support these recommendations. Purely instructional messages can be delivered by the teacher, whereas real-life situations require audio-visual media and have the advantage that students can identify with the displayed situation, which encourages behavior change.
Monitoring and evaluation:	For quality control purposes, it is essential that the implementation of the video and teaching activities be closely monitored during the intervention. For assessment of changes in knowledge, attitudes, and behavior practices after the intervention, standardized assessment tools in the form of questionnaires can be used. However, because our personal observations have shown that self-reported behavior and actual behavior differ considerably, we recommend carrying out direct behavior observations using a simple standardized form.
Reporting:	All procedures and results of the study should be rigorously reported adhering to Consolidated Standards of Reporting Trials guidelines ²⁶ to contribute to an evidence base for video-based interventions and to enable researchers to extract essential information for future trial design purposes.

To build up an evidence base with valid, comparable findings, a certain quality and degree of standardization in study design, study evaluation, type of control used, outcome measures and follow-up time needs to be established and maintained. On the basis of our experience, we recommend a thoroughly planned and implemented RCT design, a careful study preparation, professional development of the educational package, including the video to be used, close monitoring throughout the trial, and rigorous reporting according to the Consolidated Standards of Reporting Trials guidelines for reporting parallel group randomized trials.²⁴

To date, there are insufficient data to draw conclusions on the value of video-based educational interventions on the basis of the published literature. Therefore, further studies are needed to refine their use in the prevention of neglected tropical diseases.

Once a critical mass of appropriately designed, conducted, and reported intervention studies have been completed according to our key recommendations shown in (Table 3), a meta-analysis can be conducted to establish an evidence base for future research. The evidence base can help establish a new generation of educational videos, thereby creating powerful and cost-effective preventive tools to complement other interventions for infectious diseases such as drug treatment and/or improved sanitation.

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