

Enabling sustainable public engagement in improving health and health equity

1. Relevance relative to the call for proposals

GLOBVAC's primary objective is to support high-quality research with a potential for high impact that can contribute to sustainable improvements in health and health equity for people in low and lower-middle income countries. High quality research and sustainable improvements in health require engaging the public. This in turn, requires that people understand the importance of research and are able to make informed judgements about when to participate in research, what research to demand, what health services to use, and what health policies to support. We will contribute to achieving GLOBVAC's primary objective by conducting high quality research of strategies for enabling young people to think critically about personal health choices and health policy decisions.

Success in three of GLOBVAC's four thematic areas depends on informed decision-making about: prevention and treatment of communicable diseases; family planning, and maternal, newborn, child and adolescent health; and health systems and policy. In a democracy, empowering people to make and contribute to well-informed decisions is essential for making sustainable improvements in health and health equity. Therefore, critical thinking should be added to the vaccination schedule worldwide, and especially in low-income countries where people have the least to waste on uninformed choices.

In addition to developing and evaluating strategies for enabling young people to think critically about health choices generally, we will focus specifically on decisions in those three thematic areas. We will not just focus on what we know about the effects of relevant interventions, we will explain how we know this and how they can assess claims about the effects of interventions, so that they can make informed decisions about those and other interventions.

This research will contribute to all of GLOBVAC's secondary objectives, including increasing awareness of the need for global health research among the general public. It will strengthen the Centre for Informed Health Choices in the Global Health Cluster of the Norwegian Institute of Public Health. It will strengthen international research collaboration amongst members of the [Informed Health Choices Group](#), a network of researchers that has grown out of a previous GLOBVAC project,¹ and it will strengthen research capacity in our partner institutions in East Africa.

2. Aspects relating to the research project

Background and status of knowledge

Global health depends on the choices that people make, both personal choices and policy decisions. Good choices depend on health literacy - the ability to obtain, process and understand the health information they need to make appropriate health decisions.²⁻⁶ People with low health literacy are more likely to have poor health, to use medicines and health services incorrectly, to respond poorly to health education and to use preventive services such as vaccination less.⁶⁻¹⁰ Low health literacy is a stronger predictor of health status than age, income, employment status, education level, and ethnicity.¹¹

In particular, people need to be able to appraise and use information about the effects of healthcare interventions. Health professionals and researchers, charlatans and snake oil salesmen, governments and international organisations, journalists and advertisers, family, friends and teachers all make claims about the effects of "treatments" (interventions that might affect our health). These include claims about the effects of drugs, surgery and other types of "modern medicine"; lifestyle changes, such as changes to what you eat or how you exercise; herbal remedies and other types of "traditional" or "alternative medicine"; public health and environmental interventions; and changes in how healthcare is delivered, financed and governed.

Many claims are unreliable, and people's beliefs in unreliable claims can lead to unnecessary suffering and wasted resources.¹²⁻¹⁶ Conversely, failure to believe and act on reliable claims also leads to unnecessary suffering and inefficient use of resources.¹⁷⁻¹⁹

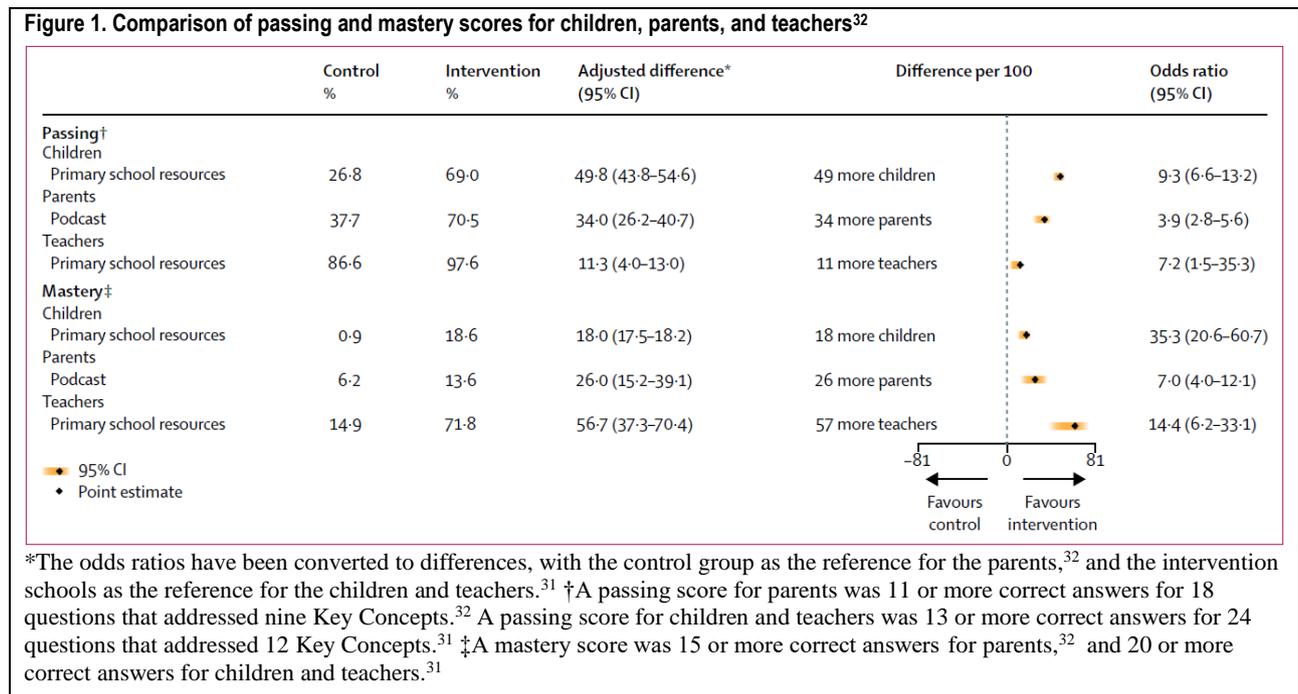
Health professionals and public health campaigns typically tell people what they should do without empowering them to assess the basis for the claims. But mistrust of researchers, research, and health professionals is common.²⁰⁻²² Moreover, experts frequently disagree and the opinions of experts are frequently not based on reliable evidence.^{23,24} Consideration of who makes a claim is not a reliable basis for assessing the trustworthiness of the claim.

The effect of education on health appears to be related to critical thinking and decision-making patterns.²⁵ However, science education tends towards rote learning rather than critical thinking. Although teaching critical thinking is widely advocated generally, and specifically for health, intentions and practice are still far

apart.²⁶⁻²⁸ Consequently, people are frequently unable to assess the trustworthiness of treatment claims or to make informed health choices.²⁹⁻³² For example, in Norway, only 20% of year-10 students are able to identify the conclusion and critically appraise a claim about a preventive intervention in a news story,²⁹ and only 20% of Norwegian adults can distinguish between association and causation.³⁰ In Uganda, only 15% of primary school teachers demonstrated mastery of basic concepts that are essential for assessing the trustworthiness of treatment claims,³¹ and less than 40% of parents demonstrated even a basic understanding and ability to apply the concepts.³² There are few resources for teaching young people how to assess treatment claims and make informed choices, and hardly any have been rigorously evaluated.^{33,34}

Democracy and well-informed policy decisions depend on a scientifically literate population. In addition, personal choices that people make about their own health affect public health and the use of resources. Some teenagers will become health professionals, researchers and policymakers. All of them are citizens. It is crucial that teenagers learn the basic skills they will need to make informed choices. Well-designed learning-resources and activities can help to ensure individuals, citizens, and future health professionals and policymakers are scientifically literate and enabled to make well-informed choices.

Supporting informed health choices in low-income countries was a 5-year project funded by GLOBVAC from 2013 to 2017.¹ In that project, we identified Key Concepts that people should understand and apply to assess healthcare claims and make informed choices.^{35,36} We designed resources to teach some of these concepts to primary school children, a podcast for their parents,^{37,38} and tools to measure their ability to apply the concepts.³⁹⁻⁴³ Randomised trials in Uganda, conducted in 120 schools with over 10,000 children, showed large improvements in the ability of children, teachers, and parents to assess treatment claims (Figure 1),^{31,32} Follow-up data show that the learning is retained for at least one year (manuscripts in process),^{44,45} and we have undertaken process evaluations to explore barriers and facilitators for scaling up use of the learning-resources, potential adverse effects, and potential additional benefits.^{46,47} Resources from that project are currently being translated and tested in other low-, middle-, and high-income countries. Building on that project, we will design and evaluate learning-resources for secondary school students in East Africa, which also will lend themselves to translation and adaptation for use in other settings.



What this project will add

Teachers and policymakers in Uganda expressed an immediate need for the learning-resources that we developed for primary schools. However, the cost of those resources is a major barrier to scaling up their use. Although the cost was only \$4 per child, that is substantial in light of government expenditure per primary school student (\$29.4) and estimates of the direct costs of primary school education in Uganda.³¹ Using digital rather than printed learning-resources would eliminate most of this cost. However, there is still limited if any access to computers of any kind in primary schools in Uganda and other low-income countries. On the other hand, there is access to computers in most secondary schools, making it feasible to develop resources which could be widely used with small marginal costs.

In this project we will build on what was learned from our previous GLOBVAC project and an effective partnership in Uganda, Kenya, and Rwanda. Although we will design the learning-resources in the context of those countries, we will design them in such a way that they can easily be adapted and translated for use in other contexts. We will prepare a guide for doing this, similar to the guide we developed for our primary school resources.⁴⁸

Focusing on young people makes it possible to assess actual health decisions taken by teenagers, something that was difficult to do with 10 to 12-year-old children. It also makes it possible to incorporate examples of actual personal choices that young people make in the learning resources, and relevant policy decisions that are meaningful to them.

At the same time, young people still have time available for learning, whereas adults have increasing demands on their time and it becomes increasingly difficult to teach them to think critically about treatment claims if they lack a foundation. They have less time to learn and must learn more at once. Moreover, erroneous beliefs, attitudes, and behaviours developed during childhood and adolescence might be resistant to change later, when they become adults.⁴⁹

Young people comprise a large proportion of the population in low-income countries, and they are the leaders of tomorrow. It is important that they are empowered, as individuals and as citizens, to make well-informed decisions. We have shown that it is possible to teach children as young as 10-years-old to assess treatment claims.³¹ Yet only eight previous studies have evaluated interventions to teach adolescents to do this, none in low-income countries, and the certainty of the evidence from those studies is very low.³⁴ By developing effective learning-resources for young people, using technology that is widely available in secondary schools, we have the potential to reach a large segment of the population, to have immediate impacts on the personal health choices that they make, and to strengthen their ability to contribute to sustainable improvements in health and health equity as they become adults.

Approaches, hypotheses and choice of method

We will develop and evaluate two sets of learning-resources to enable young people to make informed personal choices about their health (**health choices learning-resources**) and to participate as scientifically literate citizens in informed debate about health policies (**health policy learning-resources**).

In addition to building on the GLOBVAC project described above, the learning-resources will build on our previous work developing and evaluating tools to support evidence-informed decision making,⁵⁰⁻⁵⁹ and systematic reviews of ways of communicating evidence, involving users in research, and going from evidence to decisions.^{39, 60-65} This work will inform the design of the resources and the methods we will use in this project. In addition, systematic reviews of educational interventions will inform the design of the resources.^{34,39, 65-71} A key challenge highlighted by this research is designing teaching resources that are effective for all students, including socially disadvantaged students, and not just students who begin at a high academic level.⁶⁹

Methods

This project will include five work packages for each of the two sets of resources. The work packages will address the following research questions.

1. Which **Key Concepts** are most important for young people to learn in order to be able to assess the trustworthiness of claims and make choices about treatments and policies?
2. Are the **evaluation tools** that we will use to measure their ability to assess the trustworthiness of claims and make informed choices valid and reliable?
3. How might we design **learning-resources** for teachers and students that they experience positively, that are feasible to use in their setting, and that lend themselves to translation and adaptation to other contexts?
4. What are the **effects of the learning-resources**?
5. How can **use of effective learning-resources** be scaled up and adaptation and translation for use in other contexts be supported?

We will engage end users, including East African teachers, students, and policymakers, throughout the project.

Work package 1. Key Concepts

The Informed Health Choices (IHC) Key Concepts serve as standards for judgment, or principles for evaluating the trustworthiness of treatment claims, comparisons, and choices. The list is intended to be universally relevant. The concepts can help people to:

- Recognise unreliable **claims** about the effects of treatments
- Understand whether **comparisons** of treatments are fair and reliable
- Make informed **choices** about treatments

The Informed Health Choices (IHC) Key Concepts serve as the basis for developing learning-resources to help people assess claims about the effects of treatments (and other interventions) and make informed health choices. They are also the basis for a database of questions that can be used for assessing people's ability to apply the concepts. The current list has 36 concepts in three groups.⁷² A paper describing the IHC Key Concepts was published in January 2018.³⁶ The list is a "living" document, allowing modification, additions and deletions, and it is reassessed every year by a working group at the Centre for Informed Health Choices. We also conduct yearly workshops that include assessments of the sensibility of the list,^{35,73} as assessed by diverse participants. In addition to these workshops, we will conduct workshops with teachers in Uganda, Kenya, and Rwanda; and we will systematically review frameworks for critical thinking.

The objectives of this work package are to prioritise which Key Concepts to include in learning-resources for young people in secondary school, to organise those into a spiral curriculum, and to determine how best to adapt that curriculum to the national curricula in Uganda, Kenya, and Rwanda. A spiral curriculum is an approach to education that introduces the concepts to students at a young age and covers these concepts repeatedly, with increasing degrees of difficulty and reinforcement of previous learning. Designing such a curriculum begins with determining what people should know and be able to do, and outlines where they should begin and how they should progress to reach these goals. A spiral curriculum has several advantages.^{74,75} For instance, specifying developmental milestones helps teachers and students identify when milestones have been reached and builds a foundation for later stages of learning. Additionally, it helps teachers avoid the trap of trying to teach everything about a topic on the first cycle and overloading students with too much information.

There are many other frameworks that include competences, dispositions, or concepts that are relevant to thinking critically about claims, comparisons, and choices. In education, these include frameworks for teaching and learning critical thinking, scientific reasoning, epistemic cognition, causal inference, problem solving, and meta-cognition. In health, there are also frameworks for learning how to make causal inferences, as well as for health literacy, evidence-informed decision making, and evidence-based practice. For each category of frameworks there are disagreements about definitions and what is included. For example, learning to think critically is widely held as an aim of education,²⁶ but there is no agreement on the definition of "critical thinking" and there are several different frameworks (conceptual structures intended to serve as a support or guide) for teaching and learning to think critically.⁷⁶⁻⁸⁰ Similarly, there are different definitions and frameworks for scientific reasoning (and scientific literacy and scientific thinking),⁸¹⁻⁸⁴ epistemic cognition,⁸⁵ causal inference,⁸⁶ problem solving,⁸⁷ meta-cognition,⁸⁸ health literacy,^{5,89,90} evidence-informed decision making,⁵³ and evidence-based practice.⁹¹ There is also overlap across these different categories of frameworks, some of which have been grouped together as frameworks for "productive thinking".⁷⁸

We will systematically map the relationship of the IHC Key Concepts to other frameworks for teaching and learning how to think critically about claims, comparisons, and choices. We will examine similarities and differences between the IHC Key Concepts and other frameworks - particularly in the context of secondary school education - including: their purposes and definitions; the elements and domains that they include; how they have been developed and evaluated; how they have been used as the basis for curricula, teaching and learning; and assessment tools. The findings of this study will inform future efforts to further develop and improve the usefulness of the IHC Key Concepts and inform efforts to ensure that children and adolescents learn to assess treatment (and other intervention) claims and comparisons, and make informed choices.

Building on our experience with a network of primary school teachers in Uganda,⁹² we will establish networks of secondary school teachers and students in each country, and we will use focus groups to obtain their views of which of the IHC Key Concepts should be prioritised and included in the learning-resources. We will also establish national advisory groups in Uganda, Kenya, and Rwanda (including head teachers, policymakers, and other key stakeholders), and an international advisory group (including people with expertise in education and related areas). The national advisory groups will help to ensure that decisions about the concepts and the learning-resources are appropriate for the national contexts. The international advisory group will help to ensure that the resources are flexible and can easily be used or adapted for use in other contexts. With input from these networks and advisory groups, we will map the Key Concepts onto the national curricula in Uganda, Kenya, and Rwanda; and conduct market and stakeholder analyses to inform decisions about which concepts to prioritise and the design of learning-resources. The objectives of the market and stakeholder analyses will be to assess the following.

- Where the learning-resources best fit in the curriculum; by analysing relevant documents
- Who the key stakeholders are and how their interests align. How to reach the stakeholders and decision-makers, and what policymakers' priorities are, by using focus groups and in-depth interviews by telephone or face-to-face

- What the market conditions are, by assessing the appetite of the market for the resources, the budget available, the time available in a school day or week, who will deliver the lessons, indications of the support required to implement use of the resources and the features required for the resources to fit with timetables and teaching skills
- What competing learning-resources there are - specifically for teaching critical thinking skills and generally - and what opportunities there are in terms of financial resources and time, by scanning competing resources, analysing budgets and financial records, and interviewing teachers and head teachers
- How to ensure the viability of the resources that we will develop in the secondary school “market place”, based on the information that we collect to address the preceding objectives

We will prepare a guide for conducting similar analyses in other countries.

Work package 2. Evaluation tools

The primary outcome we will use to measure the effects of the learning-resources is students’ ability to understand and apply the relevant Key Concepts. We will measure this using questions from the CLAIM Evaluation Tools Database, which is a product of our previous GLOBVAC project.^{1,39-43} The database contains multiple-choice questions that assess an individual’s ability to apply the 36 Key Concepts. In addition, it includes questions that assess intended behaviours, self-efficacy, and attitudes. The database has been developed based on extensive qualitative and quantitative feedback from methodological experts, health professionals, teachers, and members of the public. Based on psychometric testing and Rasch analysis that included a diverse sample of over 1000 people, including year-5 children exposed to pilot versions of the IHC school resources, children who were not exposed, adults with very little or no exposure and adults that were familiar with the concepts. The evaluation tool was found to have high reliability (Cronbach’s alpha 0.81), and to be unidimensional (there was no evidence of sub-dimensions measuring different traits). Furthermore, there was weak or no dependence among items (no items were found to be redundant). Children who participated in the pilot scored better than other children, and most of the questions did not over- or under-discriminate, or function differently, across subgroups of participants.

For this project, we will validate tests that include questions for the prioritised IHC Key Concepts. We will undertake psychometric testing and Rasch analysis of those questions using a diverse sample of secondary school students, methodological experts, health professionals, teachers and members of the public. We will use an absolute (criterion-referenced) standard to set a passing score for the tests.⁴³ Students will be counted as “passing” or “failing”, depending on whether they meet a specified criterion. We will use a combination of Nedelsky’s and Angoff’s methods to determine the cut-off for a passing score.⁴³ We will determine a second cut-off for a score that indicates mastery of the concepts.⁴³ In addition to measuring competence, intended behaviours, self-efficacy and attitudes; we will measure effects on actual decisions, building on experience with developing questions for this purpose in the one-year follow-up of participants in our previous trials.^{44,45}

Work package 3. Learning-resources

Once the Key Concepts have been prioritised, we will develop learning-resources for those concepts in close collaboration with the end users (teachers and students) during participatory workshops and using human-centred design,^{37,38,56,93-96} an iterative process of idea generation, prototyping, piloting in classrooms, and user-testing. We will also collect feedback from the teacher and student networks and our advisory groups. We will interview experts in the prioritised thematic areas, students and teachers to identify relevant topics to use as examples in the resources.

Employing a human-centred design approach means that the precise description of what learning-resources we will make is not determined beforehand - the designed output is one of the results of the project. However, as a starting point we will build on the primary school resources that we have shown to be effective in Uganda.³¹ In addition, design of the resources will be informed by our previous work on creating understandable and useful evidence formats,^{50-52,55-58} and creating a tool to help groups make transparent evidence-informed decisions.^{53,54} We will explore using output from this work ([interactive Summary of findings](#) and [interactive Evidence to Decision frameworks](#)), in ways illustrated below.

Illustrative ideas

The **health choices learning-resources** might include scenarios about making choices that are relevant to teenagers. Such scenarios could require the students to assess claims or seek and use information to inform hypothetical decisions. Scenarios might involve role-play, in which, for example, students could play different roles (e.g. peers, parents, health professionals, media personalities). A key resource for use in scenarios would be interactive presentations of evidence from systematic reviews ([interactive Summary of Findings](#)) that students could use to understand that evidence and self-test their understanding. The learning-resources will include a library of interactive Summary of Findings for a variety of choices that are relevant to teenagers.

The **health policy learning-resources** will build on concepts students have learned about making personal health care choices, and introduce new concepts relevant for policy decisions. For instance, health choices learning-resources could be used in the first

term and the health policy learning-resources in the second term of the school year. The health policy learning-resources will include [interactive Evidence to Decision frameworks](#), with evidence to inform each of the judgements underlying a policy decision. Judgements include, for example, whether the problem is a priority, the balance between the expected benefits and harms of the options that are being considered, and whether the options are cost-effective, equitable, acceptable and feasible. These resources might include role-play, where the students are policymakers and stakeholders charged with making a decision about health policy options to address important problems in their settings. The resources will include a library of Evidence to Decision frameworks for relevant public health and health system decisions.

Idea generation, prototyping and design - Creative thinking focuses on generating and exploring new ideas, and seeking a diverse range of options, including apparently irrational directions, as these might stimulate innovative approaches. This is in contrast to critical thinking, which focuses on analysis, figuring out the answer and eliminating incorrect options. Both types of thinking are necessary for identifying and selecting appropriate options for the resources that we will develop. We will include teachers and students as well as members of our multidisciplinary research team, in co-creation of solutions,⁹⁵ through idea generation and prototyping workshops.^{56,94,96} These workshops will result in a large number of ideas and insights about the problem's space. Workshop participants will rank the ideas according to which ones they think have the most potential, and the insights judged most important. Informed by this input, a smaller group (including participants from the target groups, information designers, and researchers) will develop the ideas, combining them or building further on them to create new prototypes. These prototypes will form the basis for the next phases of user-testing and feedback.

User experience through pilot and user-testing - We will recruit secondary school teachers to pilot prototypes of the resources with their classes. We will observe lessons and take notes about the experiences of the teachers and students. In addition to our observations, we will conduct user tests of the resources with teachers and the students. User-testing is a method of formative evaluation where products are tested with users. In this project, we will use methods of user-testing that we have used for similar work, placing most emphasis on the collection and analysis of qualitative data with the aim of informing resource revision.⁵⁶ Diverse teachers and students will participate. Using a semi-structured interview guide we will guide test participants through a series of tasks and questions to explore which resources cause them problems. The interview guide will be designed to explore different facets of "user experience", including usefulness, understandability, usability, credibility, desirability, and identification.⁵⁶ Follow-up questions will cover overall impressions and suggestions for improvement.

We will review all of the notes and transcriptions from both classroom observation and user-testing. We will look primarily for barriers and facilitators related to correct understanding, ease of use and favourable reception. We will trace findings back to specific features or characteristics of the resources that appeared to cause problems or facilitate use. We will rate findings in three categories according to the severity of problems for users. We will also register things users said they liked, and their suggestions for improvement. We will triangulate these results with teachers and students, to ensure we have interpreted the data correctly and not missed major issues. These results of the pilot and user test analyses will form the basis of issues that will be considered in further idea generation workshops, with an emphasis on problems rated as serious.

Feedback - We will consult the teacher and student networks and our advisory groups by email, phone, and in workshops. Our analysis will consider issues with a high level of agreement or disagreement, issues we had not previously considered, and issues considered to be of crucial importance.

Work package 4. Effects of the learning-resources

We will use randomised trials to test the effects of the resources on the students' ability to understand and apply the Key Concepts needed to make informed personal healthcare choices and to participate in informed debate about policy decisions.

Study design - The trials (one trial of each set of resources) will be two-arm cluster-randomised trials, with an intervention group and a comparison group. We will select a diverse sample of 90 to 120 rural and urban schools (30 to 40 in each country). We will allocate the schools to the intervention or comparison group using computer-generated allocation sequences with concealed allocation.

Participants - Participants will be secondary school students from representative samples of schools in Uganda, Kenya, and Rwanda, and their teachers.

Outcome measurement - We will measure students' ability to understand and apply the IHC Key Concepts using validated tests, as described above. We will also measure hypothetical decisions, intended behaviours (with hypothetical scenarios), self-assessed ability, attitudes, and actual decisions. Outcomes will be measured at the end of the term when the learning-resources are used and again after one year. We will

monitor for any unintended effects, and measure any potential adverse effects that are identified during the design, pilot and user-testing of the resources.

Analysis and sample size calculations - We will use mixed models with a random effects term for the clusters and the stratification variables modelled as fixed effects, using generalised logistic regression for dichotomous outcomes and linear regression for continuous outcomes. Based on data from Rasch analyses and our trials in Uganda, students' understanding of the Key Concepts will likely be low.^{31,32,41,42} Using conservative estimates of the baseline level of understanding and an intraclass correlation coefficient (ICC) of 0.2,^{31,32} we estimate that 40 to 50 schools in each arm of the trial will provide more than adequate power to detect an improvement of 10% or more in the number of students with a passing score.

Work package 5. Use of the learning-resources

As described above, we will engage students, teachers, policymakers, and other key stakeholders throughout the project. We will conduct market and stakeholder analyses at the start of the project, to inform the design of the resources and help ensure their use, assuming they are found to be effective. In addition, we will conduct process evaluations in parallel with the trials,^{46,47,97} to examine the context, implementation and receipt of the resources. These evaluations will inform plans for scaling up use of the learning-resources. We will use a mixed method approach, including qualitative and quantitative methods, and will build in participatory evaluation elements with both students and teachers.⁹⁸ Multiple data sources will be used, including teacher logs, observation of teaching and use of the resources, and semi-structured interviews and focus groups with teachers, students, and other stakeholders. The participatory elements will include working with teachers and students from the pilot sites in planning the process evaluation and in collecting data from the trial sites.

To reduce the danger that the cost of the resources would prohibit their use, they will be digital and open access, allowing free use, distribution, reproduction, and further development of the work, provided the source is properly cited. We will design the resources such that they are easy to translate and adapt to other contexts, and we will prepare guides for doing this.

3. The project plan, project management, organisation and cooperation

The project's main activities and milestones are detailed in the electronic grant application form. We have a strong research team with a solid track record and many decades of experience. We have demonstrated our ability to implement the work described above and deliver results in our previous GLOBVAC project. Our approach to this project is similar to the approach we used in that project, and builds on what we learned from it. This project will build on and strengthen collaboration between the partners in our previous project.

Dr Oxman at the Centre for Informed Health Choices (CIHC) in Norway will be the scientific lead. He has experience coordinating large EU projects, including the DECIDE project, which produced the iSoF and iEtD tools. Dr Oxman and Drs Sewankambo, Nsangi, and Semakula at Makerere University in Uganda will be responsible for coordination of the project. Other senior members of the research team include Drs Austvoll-Dahlgren, Chalmers, Flottorp, Fretheim, Glenton, and Lewin at the CIHC, Dr Kaseje at the Tropical Institute of Community Health and Development in Kenya, Dr Nyirazinyoye at the University of Rwanda, and Dr Rada at the Epistemonikos Foundation in Chile.

Key concepts – The four doctoral fellows (one from each country: Uganda, Kenya, Rwanda, and Norway) will be responsible for this work, under the supervision of Drs Austvoll-Dahlgren, Chalmers, and Oxman. All of the co-investigators will contribute to this work.

Evaluation tools - Dr Austvoll-Dahlgren will have primary responsibility for this work. She will be assisted by Drs Nsangi and Semakula. The research fellows will assist with psychometric testing and data collection for the Rasch analyses. We will use a similar approach to that we have used previously.

Learning-resources - Dr Rosenbaum will supervise this work. All of the team members will contribute to development of the learning-resources. Matthew Oxman, a journalist and researcher, will be responsible for editing the learning-resources. Dr Rada, whose team implemented the interactive Summary of Findings and the interactive Evidence to Decision frameworks, will be responsible for implementing the digital learning-resources.

Effects of the learning-resources - The doctoral fellows will have primary responsibility for drafting and implementing the protocols. Drs Flottorp, Fretheim, Oxman, Sewankambo, Nsangi, and Semakula will supervise this work.

Use of the learning-resources - The doctoral fellows will have primary responsibility for drafting and implementing protocols for the process evaluations. Drs Glenton, Lewin, Nsangi, and Semakula will supervise this work.

National and international collaboration - This project builds on existing partnerships. We will work with leading researchers in education nationally and internationally. Our advisory group will include other Norwegian researchers and stakeholders with relevant expertise.

Teaching environment - Our Centre and Makerere have excellent track records supervising successful research fellows, including Drs Nsangi and Semakula. The research fellows will be able to use and learn a variety of quantitative and qualitative research methods addressing different types of questions.

Budget - See the electronic application form.

4. Key perspectives and compliance with strategic documents

Compliance with strategic documents - The project addresses GLOBVAC's primary objective and SDGs 3 (good health and well-being) and 4 (quality education), which are priorities for the Norwegian government.

Relevance and benefit to society - From a societal perspective, it is highly desirable that people make well-informed health choices and participate in well-informed dialogues about health policies, both from an economic perspective and a public health perspective.

Environmental impact - The project will use electronic communication and the learning-resources will, for the most part, be digital.

Ethical perspectives - Ethics approval will be sought for each study, in accordance with national requirements in Uganda, Kenya, Rwanda, and Norway. Informed consent will be sought from head teachers and teachers. Assent and parental consent will be sought for student interviews. Confidentiality will be assured. Equity and other ethical considerations will be a major focus of the health policy learning-resources.

Gender issues - Half of the investigators are women. We will ensure gender balance and a gender perspective in the teacher and student networks, our advisory group, and the learning-resources.

5. Dissemination and communication of results

Dissemination plan - See the electronic application form and 'Use of learning-resources' above.

Communication with users - See 'Methods' above.

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