Original Article



# Can community engagement occur online: a framework analysis of pandemic-induced changes to a project on antimicrobial resistance (AMR)

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**Background:** From a research perspective the coronavirus disease 2019 (COVID-19) pandemic impacted the ability of projects to be delivered within their planned timeframes and modalities. Anecdotal evidence suggests this was especially so for community engagement (CE) research which is heavily dependent on close engagement between stakeholders as it seeks to develop equitable partnerships and exchange knowledge on a shared concern. The COVID-19 pandemic forced many CE projects to pause, stop, or move online. However, it is unclear how these emergency modality changes affected the core values and principles of CE research, or the ability of projects to deliver their intended outputs and impacts. This study aims to fill this knowledge gap by designing and testing a framework to assess the rationale for and impact of pandemic-induced changes on a specific CE project.

**Methods:** Framework analysis is applied to a CE project which originally aimed to co-create arts-based educational materials on the topic of antimicrobial resistance (AMR) with school students and teachers in Nepal. Analyses track the rationale for moving the project online during the COVID-19 pandemic, and consider how this impacted both the outputs of the project and the core values and principles of CE research.

**Results:** Framework analysis demonstrates that CE interventions can operate online, under emergency pandemic conditions, and produce their planned outputs. However, in this example, online working reduced the numbers and diversity of participants engaged and extended the project timeframe as participants needed extra support to access online platforms. Core values of CE, including equity, sustainability, and flexibility, were compromised as online modes of engagement did not allow full co-creation to occur. However, framework analysis also revealed that there can be unintended benefits such as a greater connection between participants and other research stakeholders due to the smaller number of participants engaged.

**Conclusions:** This framework can support CE researchers to assess the rationale and impact of project modality changes resulting from emergencies. Retrospective use would allow the CE community to reflect on the impact of previous emergencies. However, the framework can also be employed to look forward and anticipate ways of reacting to future challenges which may have otherwise halted meaningful research activity.

**Keywords:** Participation; community engagement (CE); antimicrobial resistance (AMR); online; pandemic

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## Introduction

### *Background*

The coronavirus disease 2019 (COVID-19) pandemic of 2019–2023 had significant impacts on almost every aspect of human life, from health metrics (1,2) and health-seeking behaviors (3,4), to social interactions (5), development of conspiracy theories (6,7), and engagement with the natural world (8,9). COVID-19 is estimated to have claimed 6.8 million human deaths up to 12 March 2023, the date of the World Health Organisation's (WHO's) last weekly epidemiological update (10). However, final death tolls are difficult to clarify, with models needing to consider both excess deaths during the pandemic period and deaths arising post-COVID-19 infection (11). Over 760 million confirmed cases of the virus have been reported in humans and it is known to infect both wild and domestic animal species, although the numbers of infections and deaths in non-human species are not systematically recorded and tracked (12). The pandemic saw much of the world's economy grind to a halt as production in many industries ceased, travel was restricted, and formal education provision paused (13).

COVID-19 is not the only one health emergency of recent times. While the world was under the grip of an emerging viral pandemic, researchers, clinicians, and policy makers were already battling what is often defined as "the silent pandemic" of antimicrobial resistance (AMR) (14-17). AMR is a natural process by which microbes (such as bacteria) find ways to survive the treatments designed to kill them (such as antibiotics). Microbes which can survive such treatments are known as 'resistant' and can cause much longer and more difficult-to-treat infections which can even be lethal. For example, in 2019 bacterial AMR caused 1.3 million human deaths (15). This high burden of AMR infections is not simply a biological issue. The reason AMR is becoming more common is due to the misuse of antimicrobial medicines across human and animal health. Examples of misuse include taking the wrong drug or not seeking health professionals' advice before taking a drug, not completing a full dose of medication, or using antimicrobials as growth promotors in healthy livestock (18-21). All such examples of misuse mean that microbes are exposed to non-lethal doses of antimicrobials which allows them to learn ways to survive and become resistant. Equally, they are also all driven by human behavior.

### *Rationale and knowledge gap*

Over the past decade, researchers have increasingly called for a greater emphasis of work on the drivers or causes of AMR from a behavioral perspective (16,18,22,23). Unfortunately, once the COVID-19 virus became a pandemic, funding for AMR, and other non-COVID-19 emergencies such as Malaria, was paused, reduced, or became much harder to operationalize (24,25). This was especially so in terms of research with social or behavior-change aims, including awareness-raising and education campaigns, participatory action research, and community engagement (CE) (26-28).

**Highlight box**

**Key findings**
- The coronavirus disease 2019 pandemic necessitated community engagement (CE) research projects shift to online modalities rather than being delivered face-to-face.
- Online working can create challenges around the number and diversity of participant engagement with a project but can also have unintended benefits, such as a deeper connection between participants and other research stakeholders.

**What is known and what is new?**
- CE is a crucial approach within global public health, and one health research but at the same time its modality of close engagement with participants means it is often paused, or methods of engagement are significantly re-shaped in response to emergencies.
- Our framework assesses the rationale for and impact of emergency and pandemic-induced changes to CE research with a focus on the practice of moving engagement methods to online rather than face-to-face modalities.

**What is the implication, and what should change now?**
- The application of our framework to a wider range of CE projects experiencing emergency and specifically pandemic-induced changes would generate a deeper and broader understanding of the impacts of online working. This in turn would facilitate the development of best practice guidance to support CE practitioners in responding to pandemic and wider emergency situations.

In this article, the authors define CE as "*a participatory process through which equitable partnerships are developed with community stakeholders, who are enabled to identify, develop and implement community-led sustainable solutions using existing or available resources to issues that are of concern to them and to the wider global community*" (29).

CE is recognized as an essential component of global public health because it facilitates two-way knowledge exchange between researchers and patients or communities who are experiencing specific health challenges in a specific context. CE can develop effective, sustainable, and equitable solutions to health challenges which amplify the voices of those experiencing them (29-33). As such, it would seem counter-productive to pause CE research during a global pandemic, especially for topics such as AMR which crosscut many COVID-19-related issues, such as infection prevention, risk management, and vaccine hesitancy (34-36). Instead, many examples of CE research migrated to online delivery as a route to minimizing contact, cross-contamination, and compromising the overall health of participants (27,28,37-39). Unfortunately, the move to online working appears counterproductive to the core values of CE research (27,40). This is because it can be more difficult to develop rapport with, and between, participants in online sessions and to be aware of nuances in the (mis)interpretation of information (38). There are equity issues around who can partake in online interventions due to access to the internet and a reliable smart device. There can also be ethical and safeguarding issues related to engaging with participants who are physically based elsewhere. For example, disclosures of personal, and safety-related information may be more difficult (41).

The authors of this article believe CE should adhere to the seven key values outlined by Mitchell *et al.* (22): clarity, creativity, (being) evidence-led, equity, interdisciplinarity, sustainability, and flexibility. However, this same core authorship team has now experienced the challenge of conducting CE research online and during the emergency situation of the COVID-19 pandemic. One particular project, known as Tackling AMR in Schools in Nepal (TAISIN), was due to be delivered in 2020 and should have engaged a range of community actors in the co-production of an AMR education resource via interactive co-design workshops. However, the pandemic significantly impacted the timing and mode of project delivery, causing it to move predominantly online. At the completion of the project in 2022, the authors felt it was appropriate to formally reflect on what changes were made, when these occurred, how they manifested, and who they impacted. They were also interested in how the movement of research online enhanced or constrained the ability of the TAISIN project to adhere the key values of CE (22).

### *Objective*

This article presents a framework designed by the authors to explore their own move to online CE delivery during the COVID-19 pandemic. The framework is applied to the TAISN project with the aim of:

(I) Describing what changes were made during COVID-19 pandemic adjustments to CE project delivery, when they occurred and what underpinned the decisions around such changes;
(II) Considering who such changes affected, and how they impacted the fidelity of the project;
(III) Evaluating the extent to which such changes impacted on the projects' ability to adhere to the values and principles of CE as described by Mitchell *et al.* (22).

### *Study context*

This study focuses on a project known as TAISIN, due to be delivered in 2020, and funded by a Global Challenges Research Fund (GCRF)/Arts and Humanities Research Council (AHRC) follow-on grant linked to a previous GCRF/AHRC grant. The project's aim was to co-develop an educational intervention which could impact on the knowledge, attitudes, and practices of young people in relation to antimicrobial drug use in Nepal and thus contribute to wider awareness of the challenges of AMR. It was designed to use participatory methods, including the sharing of community co-produced films (produced via a previous project), focus group discussions (FGDs) and peer learning, to allow different sources of knowledge about antimicrobial use to be shared and reflected upon before all participants worked together to co-produce the final educational intervention.

### *Setting and participants*

TAISIN took place in the Chandragiri Municipality, an urban settlement on the fringes of the major city region of Kathmandu, Nepal. The research team included Nepali-based health research organization HERD International (HERDi) who led all in-country project delivery. There

**Table 1** Full details of participants involved in the TAISIN study

| Participant | Details | Number | Recruitment method |
|---|---|---|---|
| Students | 13–17-year-old students from both government and private schools in Chandragiri Municipality | 6 | Targeted recruitment by school teachers. Selected students and their parents received an online project information sheet and informed consent form. HERDi took consent over the phone (recoded via WhatsApp) from parents but students were asked to assent to their participation in each session |
| Teachers | Fully qualified adult teachers from the Chandragiri Municipality | 4 | School identified by HERDi via consultation with Mayor (elected representative) of Chandragiri Municipality. In co-ordination and consultation with school principal and school admin. Relevant school teachers were identified (i.e., health and science teachers). Teachers received an online project information sheet and consent form. HERDi took individual teacher informed consent over the phone and this was recorded via WhatsApp |
| Community participants (previous CARAN participants) | Adults engaged in a previous AHRC funded study known as the CARAN. The CARAN project ran between 2017 and 2019 in the same areas of Chandragiri and engaged community members in a PV exercise which resulted in the development of six short films on AMR | 4 | HERDi reached out to participants of the CARAN project over the phone and in person. HERDi team verbally shared project information and discussed how it links back to their own previous engagement. Participants who wished to be involved in the project called HERDi offices back to provide informed consent over the phone. This was recorded via WhatsApp |
| Pre-test session | | | |
| Students | 14–20-year-old students from the Chandragiri government-funded high school | 54 | Targeted recruitment by school head/teachers. In consultation with school authorities, mayor, and community participants, it was agreed to focus the session on grades 9–10. As is usual for school-based engagement in Nepal, HERDi took informed consent from the school on behalf of participants but information materials were sent home to parents, and they were given 2 weeks to withdraw their child from the session. Selected students and their parents received a project information sheet and consent form |

HERDi refers to HERD International, our Nepali-based research partner who led all in-country project management and recruitment. CARAN refers to the previously funded research project in this area from which this study directly follows on (follow-on specific funding) and from which community-level participants were recruited. TAISIN, Tackling AMR in Schools in Nepal; AMR, antimicrobial resistance; HERDi, HERD International; CARAN, Community Arts Against Antibiotic Resistance, Nepal; AHRC, Arts and Humanities Research Council; PV, participatory video.

were three distinct groups of participants engaged with this project as summarized in *Table 1*: students aged 15–18 years, teachers, and crucially, community participants from the previous AHRC/GCRF-funded study out of which TAISIN emerged: 'Community Arts Against Antibiotic Resistance, Nepal' (CARAN). CARAN ran between 2017 and 2019 in the same areas of Chandragiri and engaged members of the local community in a participatory video (PV) exercise designed to uncover community-level drivers of AMR. This resulted in the development of six short films on the topic (30,42). During the evaluation phase of the CARAN project, participants highlighted the particular role that children had in community-level health-seeking behavior and that they thought it would be useful to share their films with school children and ensure that AMR is discussed in their local schools. In response to this, the TAISIN team sought follow-on funding from GCRF/AHRC to support the co-development of AMR educational materials and ensure that CARAN participants and films would be integral to the process. Teachers, students, and

community participants (former CARAN participants) all contributed to the co-creation of the educational resources. An additional 54 students were then recruited to pre-test the final resource at the end of the co-creation phase (*Table 1*). The decision regarding the demographics of students (grades 9–10) was reached through discussion between the research team, CARAN participants, and recruited school staff. It was determined that this age group would be most keen to be involved in the co-design aspects of the original project and would have the most time to contribute as they did not have external school exams.

## Methods

### *Ethical statement*

Methods of recruitment and informed consent were specific to each participant group (*Table 1*). Due to the engagement with minors in the project all team members had completed their individual organizational safeguarding training prior to project delivery. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This project was granted ethical approval from both the University of Leeds (FAHC 19-056) and the Nepali Health and Research Council (04022020) in February 2020. Informed consent was obtained from all individual participants. Amendments were made to both applications in October 2020 to reflect the needs of the COVID-19 pandemic, and specifically the move of the project to online delivery.

This study took a mixed methods approach to understand the scope and impact of pandemic-induced changes on a CE project. Firstly, Gantt charts, ethical applications, and planning documents were reviewed to compare the planned process and timeline with that of the executed TAISIN project. Authors then created and employed a framework (*Figure 1*) firstly to identify discrete points of change between the planned and executed version of the project, and secondly to ask how these changes impacted the ability of the TAISIN project to align with the values and principles of CE as described by Mitchell *et al.* (22).

### *Data*

This analysis was applied to the entire subset of documents from the TAISIN project which includes Gantt charts, ethical applications, risk review, transcript data, observation notes, researcher reflections, quantitative knowledge scores, blogs, and meeting notes. Data encapsulate the experiences of all stakeholders (this includes everyone involved in the project: researchers, teachers, students, community participants, and funders) all sources are listed in *Table 2*.

## Results

### *Timing changes*

TAISIN was due to run from January 2020 to February 2021. During this 12-month period, the project aimed to co-develop educational activities on the topic of AMR with community members, teachers, and students in Nepal. Due to the COVID-19 pandemic, this project was paused at points and the overall duration of the project was extended so that the planning periods ran from January 2020 to April 2020, and March to May 2021 followed by the active delivery period from June to December 2021 (*Figure 2*).

### *Points of change (what and when)*

Specific points of change between the planned and delivered project are summarized in columns one and two of *Table 3*. Columns three and four reference the rationale for such change and identify the source data for this information.

There are eight specific details which changed between the original project plan and its post-pandemic delivery: (I) necessity of online working. (II) Realization that co-creation of a full education programme would no longer be possible. Consequently, focus shifted to developing a flexible resource pack on AMR which included details on how to deliver a number of interactive activities based on modes of learning which students and teachers felt were appropriate. (III) The need to provide participants with Zoom training to support online engagement. (IV) Community participants participated in the co-delivery of the AMR orientation to teachers. This step was added after initial FGDs with community members revealed that they wanted to take a more active role in the sharing of AMR knowledge; as a result, they led the section of the AMR orientation programme for teachers, which showcased the PVs, and explained why AMR was an important topic. (V) Agreement on the need to also develop a teachers' facilitation pack providing detailed AMR information which would allow teachers to better support their students to engage with the final materials. (VI) A last-minute opportunity to return to

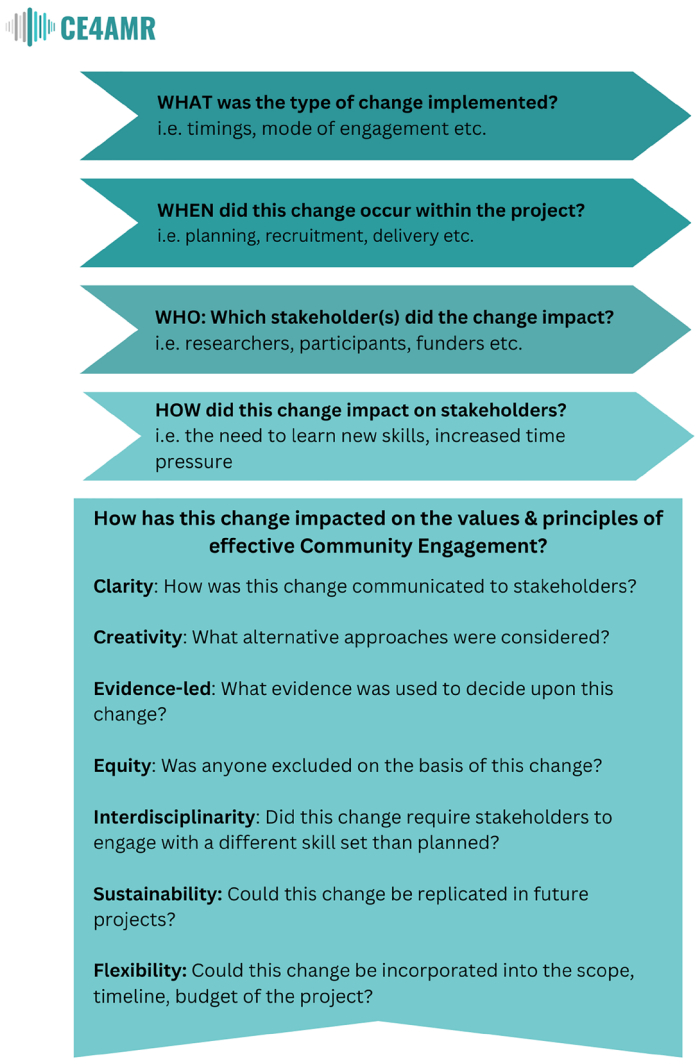


**Figure 1** The framework for analyzing points and impacts of changes within the TAISIN study. TAISIN, Tackling AMR in Schools in Nepal; AMR, antimicrobial resistance.

**Table 2** A summary of data sources used in this mixed-methods framework analysis

| Data source | Data format | Stakeholder experiences captured |
|---|---|---|
| Original Gantt chart | Quantitative (dates) | NA |
| Risk review | Mixed | All participants, researchers, and funder |
| Post-pandemic Gantt chart | Quantitative (dates) | NA |
| University of Leeds ethical approval application and amendments | Qualitative | NA |
| Nepal Health Research Council Ethical and amendments | Qualitative | NA |
| Meeting notes as COVID-19 pandemic announced | Qualitative | Researchers |
| Meeting notes as post-pandemic plans developed | Qualitative | Researchers |
| | | Funder |

**Table 2** (*continued*)

**Table 2** (*continued*)

| Data source | Data format | Stakeholder experiences captured |
|---|---|---|
| Observation notes on participant engagement | Qualitative | Community participants |
| | | Teacher participants |
| | | Student participants |
| | | Researchers |
| Reflection notes on Zoom orientation processes | Qualitative | Community participants |
| | | Teacher participants |
| | | Student participants |
| | | Researchers |
| Reflection notes on consent taking process | Qualitative | Community participants |
| | | Teacher participants |
| | | Student participants |
| Observation notes from community participant orientation | Qualitative | Community participants |
| | | Researchers |
| Observation notes from teacher orientation | Qualitative | Teacher participants |
| | | Community participants |
| | | Researchers |
| Observation notes from student orientation | Qualitative | Teacher participants |
| | | Student participants |
| | | Researchers |
| Transcripts from teacher and community AMR education discussion | Qualitative | Teacher participants |
| | | Community participants |
| Reflection notes from teacher and community AMR education discussion | Qualitative | Researchers |
| | | Community participants |
| | | Teacher participants |
| Transcripts from student AMR education discussion | Qualitative | Student participants |
| Reflection notes from student AMR education discussion | Qualitative | Researchers |
| | | Student participants |
| Meeting notes from education resource development process | Qualitative | Researchers |
| Reflection notes from feedback session with teachers | Qualitative | Researchers |
| | | Teacher participants |
| Knowledge survey from pilot test of materials in school | Quantitative | Student participants |
| Observation notes from pilot test of materials in school | Qualitative | Researchers |
| | | Teacher participants |
| | | Student participants |
| Reflection notes from pilot test of materials in school | Qualitative | Researchers |
| Observation notes from final feedback session with teachers | Qualitative | Teacher participants |
| | | Researchers |

For an explanation of participant groups please see *Table 1.* NA, not available; COVID-19, coronavirus disease 2019; AMR, antimicrobial resistance.

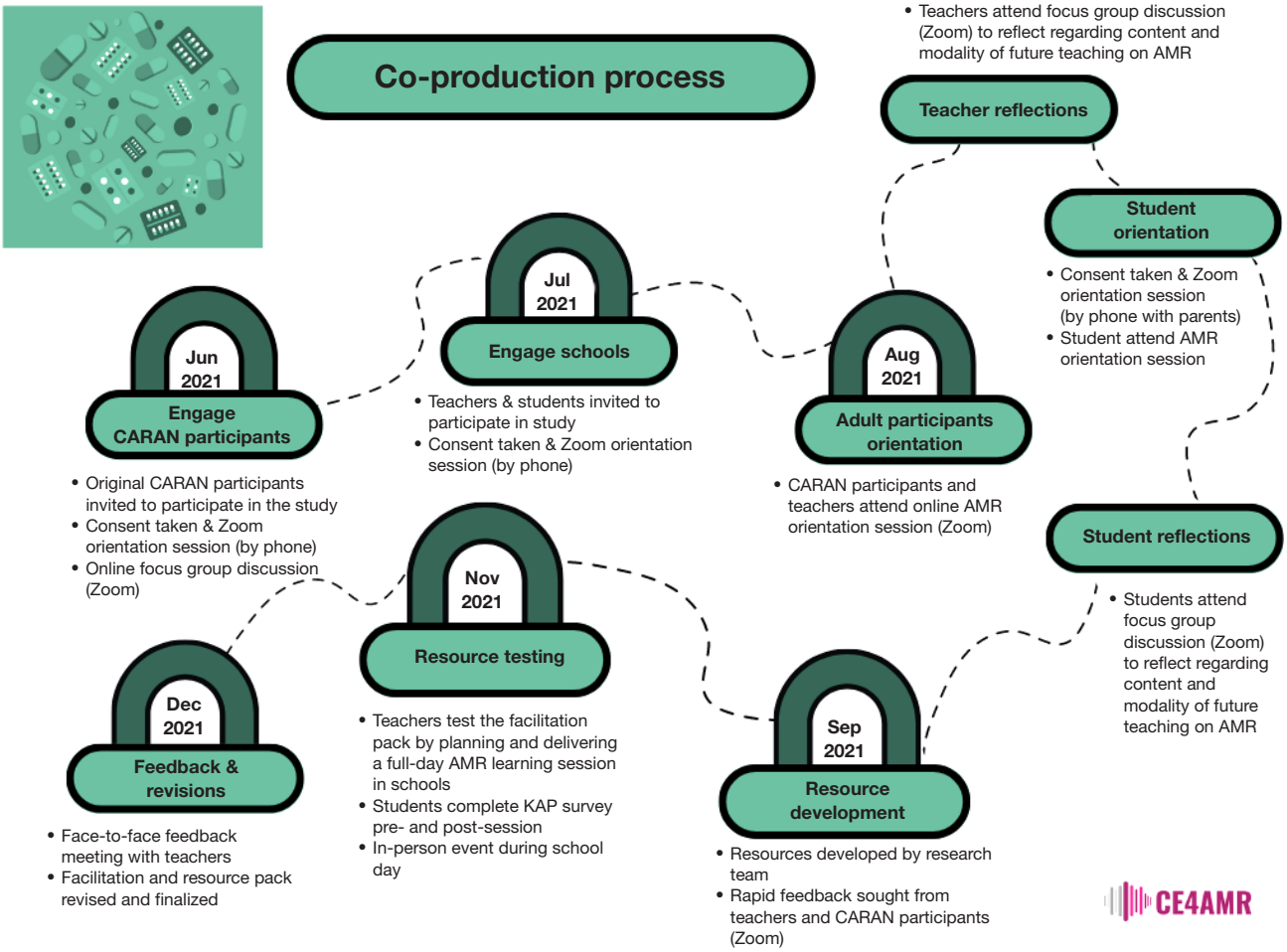


**Figure 2** The active delivery period of the modified TAISIN study. CARAN, Community Arts Against Antibiotic Resistance, Nepal; AMR, antimicrobial resistance; KAP, knowledge, attitudes, and practice; TAISIN, Tackling AMR in Schools in Nepal.

face-to-face working and test the resource pack in schools. (VII) Linked to point 6 was the late opportunity to run a face-to-face feedback session with teachers. (VIII) The lack of opportunity to conduct evaluation and feedback sessions with community and student participants.

### *Effect of changes on project fidelity*

Despite extensive changes to project timeframes, modes of delivery and output formats, there were four non-negotiable factors which were achieved in pandemic delivery. (I) Community participants from the CARAN project were integral to the development of the AMR education resources. The project's starting point remained FGD with these participants, designed to help the group understand what AMR messages they felt should be shared in schools and why. (II) The PVs produced in the CARAN project were integral to the AMR orientation session for students and teachers. These locally produced films share relatable experiences of AMR and consider how common local behaviors can drive AMR. (III) An educational output on AMR was developed and pilot tested. Although the process by which it was created was less flexible, creative, and collaborative than had been originally envisaged, all stakeholder views informed the development of the final AMR education resources and facilitation pack. (IV) Final resources were tested in a face-to-face modality in school.

**Table 3** Summary of points of change and their rationale during the TAISIN study

| Date | Decision/changes implemented | Rationale for change | Data source | Stakeholders impacted |
|---|---|---|---|---|
| Feb 2020 | Pause in participant-facing activities | COVID-19 cases rising in Nepal increasing the risks to all stakeholders at in-person gatherings | Gantt charts, risk review, and meeting notes as COVID-19 pandemic announced | Researchers, community, and school participants |
| Apr 2020 | Project paused indefinitely | Ongoing COVID-19 pandemic and formal lockdowns in Nepal and UK leading to a move to online working for research teams | Risk review, meeting notes and emails to funder | Researchers, funder all participants |
| Nov 2020 | Project re-starts with desk-based activities | | | |
| Mar 2021 | School and community participants are re-engaged | Due to the length of time from the initial engagement phase (Jan–Mar 2021) community participants and schools had to be approached again with all project details, information sheets etc. | Gantt charts, risk review, meeting notes and reflection notes | Researchers, community participants |
| Apr 2021 | Decision to move all engagement activity online | Ongoing COVID-19 pandemic and formal lockdowns in Nepal meaning face-to-face working is now unlikely for the duration of the project | Gantt charts, risk review, meeting notes and research staff reflection notes | Researchers, community, and school participants |
| May 2021 | Decision to create educational resource packs rather than an intervention | Longevity and sustainability reasons—learners can pick and choose the activities from a pack and do as much or as little as possible in their timeframe rather than attending a full day of activities as planned | Meeting notes and research staff reflection notes | Researchers, community, school participants |
| | Re-structure of budget to account for online working | Inclusion of data allowances per participant to facilitate online working | Gantt charts and meeting notes | Researchers, funder |
| Jun 2021 | Consent taking for community participants (phone) | The consent taking process was delayed until COVID-safe methods of online engagement were agreed up on and all ethical amendments were approved | Gantt charts, risk review, ethical approvals and amendments, meeting notes and research staff reflection notes | Researchers, community participants |
| | Online FGD with community participants during which they decided to co-deliver an AMR orientation session for teaching participants | Required an initial engagement session with these participants to re-engage them with the topic of AMR and facilitate discussion of how best to move the project forward via online methods | FGD transcripts, observation, and reflection notes | Researchers, community participants |
| Jun–Aug 2021 | Zoom training: for community participants (Jun); for teacher participants (Jul); for student participants (Aug) | Due to the move online the research team provided Zoom training to all participants. Community participants had already given their consent to work this way although were reminded of their right to withdraw during this training. For student and teacher participants Zoom training and consent taking process occurred together. A phone call was used to take consent and then guide people to use the Zoom platform on another device. For students a parent or guardian had to be present on the call to support students to make an informed decision as to whether they would like to continue working this way | Gantt charts, observation, and reflection notes | Researchers, community, teacher, and student participants |
| | Online consent taking for teacher participants (Jul). Consent taking for student participants (Aug) | | Gantt charts, ethical approvals and amendments, meeting notes and research staff reflection notes | Researchers, teacher, and student participants |
| Aug 2021 | Online AMR orientation session for teachers, co-led by community participants | During initial FGDs with community participants and initial engagement with teachers, it was reflected that an AMR orientation session for both teachers and community participants would be helpful to develop an understanding of AMR. Community participants previously engaged in AMR-related projects worked with HERDi team online to frame the orientation session by bringing in their knowledge and practical experience at the community | Transcripts, observation, and reflection notes, researcher blogs | Researchers, community, and teacher participants |
| | Online discussion of modes of learning for teachers | To ensure online sessions were not too content-heavy, it was decided that teachers would participate in separate online FGDs to discuss modes of engagement to be used in the final education resources | Transcripts, observation, and reflection notes | Researcher and teacher participants |
| | Realization that a teachers facilitation pack was needed to accompany AMR educational resources | Based on teacher feedback in the 'modes of learning' session it was clear that teachers wanted more detailed AMR information beyond that to be included in the student-facing materials. They felt this would enable them to better support activities in class or online | Transcripts, observation, and reflection notes | Researcher and teacher participants |
| | AMR orientation session for students<br>Online discussion of modes of learning for students | Student participants were engaged in online discussions to be firstly orientated on the topic of AMR and then to discuss ways of engaging with the AMR topic in school. It was decided to split these sessions as the AMR orientation with teachers and community members was lengthy but yielded rich information so attempting to discuss both AMR and modes of learning in one session would be too long for equitable and creative participation from students | Transcripts, observation, and reflection notes | Researcher and teacher and student participants |
| Sep 2021 | Teacher feedback session (face-to-face) | Due to a relaxation in lockdown rules, it was possible to share a draft copy of the educational resources and facilitation manual with teachers for their comment | Risk review, observation, and reflection notes, researcher blogs | Researcher and teacher participants |
| Nov 2021 | Pilot test of materials with KAP survey (face-to-face) | Teachers who co-developed the AMR facilitation pack then tested it by using it to plan an interactive session for 59 students. Students took a KAP survey before and after the session to assess the impact of the session on their AMR knowledge, attitude, and practices. The resource pack was not complete at this point | Risk review, observation and reflection notes, KAP survey data, research blogs | Researcher and teacher and student participants |
| Dec 2021 | Teacher feedback session (face-to-face) | Teachers fed back on their experience of using the facilitation pack and suggested changes. They also highlighted ideas for activities which could be incorporated into the final resource pack | Observation, and reflection notes | Researcher and teacher participants |

For full details of participants please see *Table 1*. TAISIN, Tackling AMR in Schools in Nepal; AMR, antimicrobial resistance; COVID-19, coronavirus disease 2019; FGD, focus group discussion; HERDi, HERD International; KAP, knowledge, attitudes, and practice.

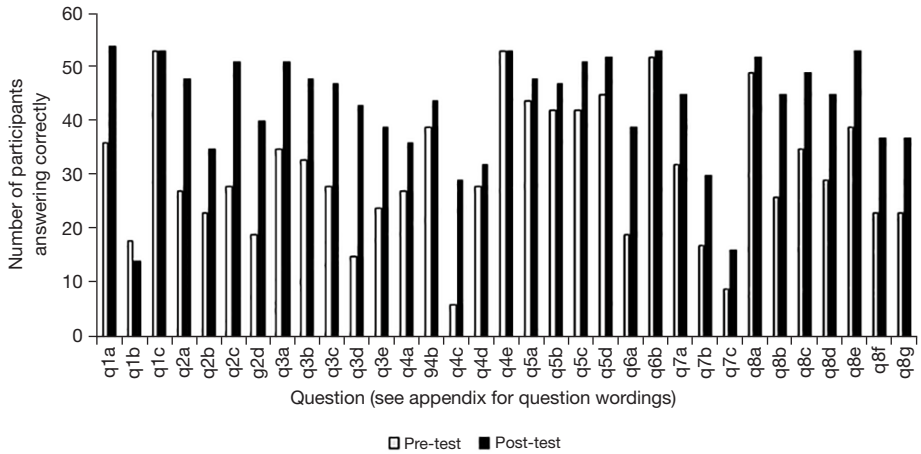


**Figure 3** Change in overall knowledge score per question, for question wordings see appendix available at https://cdn.amegroups.cn/static/public/jphe-24-81-1.docx.

### *Impacts of changes on stakeholders (who and how)*

*Table 3* demonstrates that all stakeholders (researchers, participants at community, school, teachers, student level, and funders) in the project were impacted by changes throughout the process. Given the extended project deadline allowed by the funder, the researchers in partnership with all participants were able to reframe the project to be delivered entirely online. Community participants changed their roles to co-facilitate one of the sessions and all participants had to learn to use the Zoom online platform.

Additionally, the project was still able to deliver the originally-planned knowledge-based quiz. This comprised of 32 true or false questions across eight themes (see appendix available at https://cdn.amegroups.cn/static/public/jphe-24-81-1.docx for the quiz questions). The quiz was conducted in the 'resource testing phase' in November 2021. It was completed by students both before and after the usage of the education resource. Overall, the 54 students' knowledge increased by an average of 7 points between the pre- and post-test survey (see *Figure 3*). The question with the greatest knowledge gain was 3d, in which 28 additional students correctly identified microbes as living within soil and water after the intervention. Question 2c saw an additional 23 students correctly identify that antimicrobials should be used according to dosage, while question 4c also saw an additional 23 students correctly identify parasites as a type of microbe after the intervention. Only question 1b yielded a lower knowledge score post-intervention. In this case, four fewer students correctly identified a build-up of germs in the body as a cause of AMR post-intervention.

### *The extent to which such changes and online research methods can align with the values and principles of CE (how)*

The framework in *Figure 1* was applied to the dataset to provide more detail on how the pandemic-induced changes to this project impacted participants' experiences specifically. More broadly, the framework prompts reflection on how the value and principles of effective CE have been challenged in this project.

#### Clarity

Gantt charts and meeting notes demonstrate that throughout the changes to this project, the research team communicated as quickly and clearly as possible with participants and the funder to ensure everyone was aware of why, when, and how changes to timelines and modes of delivery were occurring. Additional engagement sessions, such as exploring what online platform would suit participants, Zoom orientation sessions, and continuous follow-up through phone calls were delivered to ensure all participants understood what was expected of them, how to engage, and how to withdraw from the project. The ethos of coproduction in this project allowed participants time to speak with the research team before, during, and after each point of engagement. Participants reported how comfortable they felt within this research environment and

that the online 'training' to use Zoom etc. had helped them to clearly understand what was expected and feel prepared for the research activity.

**Creativity**

The online mode of engagement was considered to limit the creative input of all stakeholders including the researchers themselves. This was attributed to the lack of opportunity for physical interaction and expression within the online sessions. Participants were communicating across a screen and could not physically demonstrate ideas as well as they could have done in person.

There was also concern that the resulting outputs (education resource and facilitator packs) would not support creative learning in the classroom. This may again be linked to the online nature of the co-production process, because ideas could not be physically tested or demonstrated. This did have repercussions in terms of the creativity of the final co-produced resource pack. Although it included creative activities (in one session, for example, students explore how to make model microbes from clay. In another, students are guided through a role-play activity in which they create 'character traits' for a microbe based on the playing cards), more immersive ideas, such as street drama, were cut. Street drama was initially discussed by teachers as a creative form of learning that could help students engage with AMR. But as the resource pack was developed both teachers and students expressed concern that such a novel method might be difficult to deliver in classroom settings with non-specialist teachers. Indeed, when delivering the session, teachers in both schools utilized a 'newsprint' learning style, which refers to information being written on the board at the front of the class and disseminated verbally. This is a common style of teaching in Nepal and thus it seems, despite the opportunity for creativity, teachers defaulted to more familiar styles of pedagogy. In reflection notes, the research team noted that this might be linked to a lack of confidence in using the more creative methods suggested in the resource pack which in turn was attributed to a lack of face-to-face contact to test ideas and explore confidence issues prior to using the resource pack.

**Evidence-led**

All changes to the TAISIN project were underpinned by rigorous risk and evidence reviews on the part of the project team. Such processes were underpinned by evidence from the Government of Nepal and WHO plus internal guidance from the funder [UK Research and Innovation (UKRI) and specifically the GCRF/AHRC teams], The University of Leeds (funded institution) and HERDi Nepal (project partners). The academic literature on the risks or benefits of online engagement was consulted but ultimately governmental guidance based on evidence of health risks was core to our decision-making process.

Proof-of-concept testing in a school setting shows that students' knowledge of AMR did increase after using the co-produced AMR education pack. This provides evidence that the materials can generate knowledge gains. However, longer-term tests with audiences who were not involved in the co-creation of these materials are now required to determine if the increase in knowledge translates into changes in practices and behavior.

**Equity**

The move to online working was necessary from ethical, legal, and health and safety perspectives. However, it did have unintended consequences regarding equity. Only those participants with access to a smart phone, laptop, tablet, or computer were able to join activities. Thus, access to such devices became an unintended exclusion criterion. Although data packages were funded for all participants and a small number of mobile phones could be loaned out, the project budget could not support the provision of devices for all interested individuals.

**Interdisciplinarity**

All participants who could join the online mode of delivery developed an unexpected skillset in Zoom and online learning. While there were obvious equity issues with the move to online delivery, an unintended benefit was the increased computer literacy of many participants. The research team spent time explaining the Zoom platform and its functionality, and several participants recognized this as valuable for future job prospects, communication skills, and the ability to engage with other online activities.

**Sustainability**

It is likely that a move to online delivery could be replicated in future CE projects, however not without compromising on equity issues as discussed previously. Additionally, although proof-of-concept testing shows that students' knowledge of AMR does increase after using the co-produced AMR education pack, longer-term tests with fully naive audiences are required to determine if the increase in knowledge translates into sustainable changes in practices/behavior around antimicrobial use.

**Flexibility**

Unfortunately, the project budget was not flexible enough to support the provision of devices for all interested individuals to participate in activities. This degree of flexibility was near impossible to plan for given the unprecedented scale and significance of the global pandemic which had forced us to make these changes.

## Discussion

### *Summary of key findings*

Framework analysis revealed that throughout the process of the TAISIN project, researchers were primarily concerned with the health and well-being of stakeholders and adherence to national lockdown guidance in Nepal and the UK. This concern led to decisions to pause the project and then to resume online in order to minimize the risk of stakeholders contracting and spreading COVID-19. Online working created barriers to engagement. Most notably, access to internet-enabled devices became an unintended exclusion criterion in this project. This represented a significant deviation from the research team's planned delivery approach and its emphasis on co-creation. It also created challenges in meeting the values and principles of CE research which guide the authors' research group from an equity, inclusivity, and methodological perspective. However, there were also unforeseen benefits, such as enhancing connectivity between researchers and participants. For example, one-to-one training on online working allowed participants to gain extra support in terms of understanding their role in the project.

The authors hope that by sharing our framework, other researchers interested in CE may be able to assess their own online and pandemic-responsive interventions. Such findings would better prepare the CE research community to continue their research during future modality changes, including pandemics or emergency conditions that may otherwise have halted meaningful collaborations and co-production processes. The framework may also be used pre-emotively to support research teams in making decisions regarding a change in planned modality. The framework could specifically prompt teams to think about what changes could occur, when these may need to happen, who they could affect, and how.

### *Strengths and limitations*

The TAISIN project offered a unique opportunity to reflect upon the rationale for and implications of emergency, pandemic-induced changes to a CE research project. Because the project intended to collect a wealth of evaluation, observational, and reflective data from the sources listed in *Table 2*, the raw dataset for this emergency-response analysis already existed and reflected the experiences of all stakeholders during the (extended) lifespan of the project. This facilitated a detailed exploration of what and when changes were made, how they were actioned, and who they impacted. The development of a framework based on the authors' values and principles of CE research allowed further interrogation of how and why these emergency and pandemic-induced responses impacted the integrity of the research. However, the specific research questions relating to the impact of CE online arose organically as the COVID-19 pandemic persisted across the funded lifespan of the TAISIN project. As such, development of the framework was responsive rather than pre-emptive of the situation and may have led to expectation bias from researchers in relation to the findings. Every step was taken to reduce such bias, including delaying the analysis to 6 months beyond the end of the project in order to allow for critical reflection and relaxation of the emotions linked to delivering a project in such a challenging context.

TAISIN was a single, small research project which is by no means representative of the whole CE research landscape during the COVID-19 pandemic. Additionally, because TAISIN's focal topic of AMR is a challenge interlinked with the COVID-19 pandemic there was clear impetus to complete the project. Had the topic been less associated with the pandemic, the rationale to continue would likely have been weaker and thus decisions to halt the work until face-to-face engagement was possible may have been more likely. Throughout the discussion we remain mindful of this specific context, and that of the references we cite, and seek to provide balanced discussion on the rationale for moving CE research online during periods of emergency (specifically pandemic situations).

### *Reflections from the wider literature*

Challenges relating to online engagement have been noted by other research groups who discuss the benefits of experimenting with new technologies during pandemic research projects, while also being concerned about the ability to develop researcher-participant relationships (27,28,37). In the case of Sattler *et al.* (28) researchers highlight that online working allowed them to recruit a

 

wider diversity of participants. In similar vein, Howlett (37) reflects on evidence that online field work can facilitate a greater sharing of information than face-to-face data collection. However, these examples are European Union (EU)-based and thus findings may reflect the specific location of their work, linked to resource availability in terms of internet connectivity and access to smart devices. Working in low or middle-income countries presents very different challenges to moving participatory research online, including the issue of internet access as well as ethical questions around whether it is morally right to engage low-resource communities with research during times of emergency (43). In TAISIN, online barriers to engagement were considered a major concern as target communities had limited access to internet, phones, laptops or other internet-enabled devices. Nevertheless, TAISIN was able to deliver on its original aims to co-produce educational AMR materials with community members, teachers, students, and researchers in Nepal. The final output comprised a teacher's facilitation pack on AMR, a student's resource pack, and a set of playing cards. Final resources were tested in a face-to-face modality, in school, and a proof-of-concept test showed that after using the resources students' knowledge of AMR was higher than prior to usage. The authors also feel that the framework depicted in *Figure 1* represents an additional output of the project which can now be used by research teams both retrospectively to evaluate their own pandemic-induced changes but also pre-emptively to explore how modality changes could impact their project. This could be particularly useful for projects operating in settings affected by conflict, emerging one health crises, or extreme weather events, where political, health, and environmental conditions may bring about the need for sudden changes to planned activities.

### *Explanation of findings*

Findings suggest that although CE research can be delivered online, researchers often need to make a choice regarding whether to abandon a co-production process altogether or continue it in a potentially compromised fashion which inevitably excludes some members of their community. The resolution to this choice will be different for each context but may also relate to the nature of the problem being addressed by the research (as of course is usual within co-production approaches). For example, TAISIN addressed the challenge of AMR and particularly the dangers of inappropriate antibiotic use, both of which were real-time challenges during the COVID-19 pandemic. There was a global trend toward frequent over-prescribing of antibiotics to COVID-19 patients (44). Moreover, over-the-counter sales of antibiotics for illnesses they cannot treat effectively (e.g., viral infections) also increased (45). The TAISIN focal country of Nepal is a setting where over-the-counter drugs can be easily purchased without prescription and work by the authorship team during the pandemic demonstrates this behavior in both human and animal health services (21,46-48). This interlinkage with the project topic and current pandemic experience did influence the decision to continue project delivery, as the team felt that addressing AMR at community level was now more important than ever, the team ultimately feeling that the need to develop useable resources ultimately outweighed the costs of compromising some of the key values of CE and motivated all parties to continue with the research as long as the four non-negotiable factors around community involvement were upheld.

Incorporating the key values of CE from Mitchell *et al.* [2019] into the framework (*Figure 1*) allowed authors to exemplify that the values of clarity, creativity, being evidence-led and interdisciplinary were upheld within TAISIN. However, the values of equity, sustainability, and flexibility were compromised as many decisions had to be taken in a top-down fashion with funders, governments, and researchers making choices regarding modes of delivery and timings without consulting community members, schoolteachers, and students. This demonstrates just how strongly global health emergencies can influence CE interventions which hinge on the creation of equitable partnerships and two-way knowledge exchange. Such values can be fragile and easily negated in such projects. Indeed, across academic literature, the COVID-19 pandemic is believed to have had a generally negative effect on the ability of research to include elements of participation, co-creation, and knowledge exchange (28,37). As discussed, one of the major reasons for this is the move to online working, which is generally believed to create access barriers and to make it more difficult for participants and researchers to build rapport (37,39). In this example, the TAISIN project met its objectives, but its timeframe was greatly extended and participant numbers in the co-creation phases were reduced. These are interesting points to reflect on in terms of the core values of CE, as understood by the research team. For example, a longer project timespan spent with fewer participants may have increased rapport

 

between stakeholders. In TAISIN, research team members provided participants with training on how to use the Zoom online platform and so spent longer in one-to-one contact with each participant than they would have done in planned co-creation workshops. Flexibility also became a more valuable asset. Although the move to online working was essential, due to lockdowns enforced by in-country governmental regulations, the project itself proved flexible enough to withstand such changes and still produce planned outputs. This arguably intersects with the interdisciplinary and creative nature of the project team, who were able to restructure activities, develop telephone protocols for consent taking and Zoom orientations, and reimagine the project's main output. That said, due to resource constraints, flexibility could only go so far. However, the values of interdisciplinarity and creativity perhaps compensated for the limits of flexibility. The value of (being) evidence-led also clearly intersects with the value of flexibility, as the team used the dynamic and novel evidence on the risks of COVID-19 as well as online working to respond to the unprecedented working challenges they faced during project delivery.

### *Implications and actions needed*

This analysis demonstrates the complexity of decision making within CE research occurring in emergency situations, using the example of a project on the topic of AMR, active during the COVID-19 pandemic. Using a framework based on the core values and principles of CE research, we demonstrate that although the shift to online communications meant some core values of CE were challenged, they were also able to enhance relationships, and strengthen the value of clarity as participants were able to gain extra support in terms of understanding their role in the project. Future actions include the application of our framework to a wider range of projects experiencing emergency and, specifically, pandemic-induced changes in order to create a deeper and broader understanding of the impacts of online working. As discussed, CE is an important approach within global public health, and one-health research, but at the same time its modality of close engagement with participants means it is often paused, or its methods of engagement are significantly re-shaped in response to emergencies. More comprehensive understandings of such changes could thus facilitate the development of best practice guidance to support CE practitioners to respond more effectively to pandemic and wider emergency situations. Alternatively, the framework could be used to predict the impact of changes in live projects threatened by emergency situations including pandemics, and other one-health risks as well as conflict and extreme weather events. In such situations, research teams are likely to face similar pressures to the TAISIN project regarding whether or not to abandon the project or make changes to ensure a project's safety and feasibility in the new emergency context. Applying this framework could streamline decision-making by identifying potential points of conflict relating to proposed changes.

## Conclusions

This study demonstrates that CE interventions can be operated online, under emergency pandemic conditions including lockdowns, and still produce valuable outputs. However, research team members need to be mindful that moving online will shift power dynamics, and that the values of equity, sustainability, and flexibility are likely to be compromised. How a project team responds to such challenges will be context-specific and involve weighing up the potential benefits of both the co-production process and final output with the cost of engagement from a less diverse cross-section of the community. Authors hope that by sharing our framework, other CE researchers may be able to assess their online and emergency-responsive interventions. This may occur retrospectively, with a focus on generating evidence for the ability of CE research to respond to changing conditions which may otherwise have halted meaningful collaborations and co-production processes. The framework may also be used pre-emptively to guide researchers in considering the potential repercussions of modality changes in response to emergency situations. Both applications would better prepare the CE research community to continue meaningful but safe research during emergencies.

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## Footnote

*Data Sharing Statement:* Available at https://jphe.amegroups.com/article/view/10.21037/jphe-24-81/dss

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