Challenges in Research and Community Engagement During the COVID-19 Pandemic in Resource-Limited Settings: Qualitative Analysis with Epidemic Preparedness Implications

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Running Title: Research and community engagement during COVID-19 pandemic

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Abstract

Background: When WHO declared the SARS-CoV-2 respiratory virus pandemic in 2020, Uganda was unprepared to prevent and control its spread and severe impact on peoples' lives including management of COVID-19 patients. We planned to conduct a community engagement and risk communication (CERC) trial during the pandemic but before implementation we conducted a baseline study.

Methods: A community baseline face-to-face mixed-methods study with quantitative survey and qualitative research (in-depth interviews, key informant interviews, focus group discussions, and household conversations) was implemented in 15 parishes (6 and 9 in Kawempe and Nakawa divisions respectively) of Kampala Capital City Authority, Uganda. We employed a multistage sampling strategy that allocated parishes and villages based on their proportional contribution to the overall population for the planned subsequent CERC trial. The baseline study, was conducted during the pandemic from July 2020 to February 2021.

Findings: The 852 respondents with median age 32 years (IQR 25-42), majority were females (n=610, 73·05%), and household heads (n=391, 46·5%) followed by spouses of household heads (n=305, 36·1%) and children (n=68, 8%). Most were low-income earners and others middle-income workers. Some had tertiary education (n=206, 24·2%), ordinary level (n=195, 23·3%), primary education (n=201, 24·01%), and no formal education (n=142, 16%). Conducting research and community engagement had many challenges, categorized into three main interrelated domains: a) scientific process implementation challenges b) those associated with the social, cultural, and political context of the research, and c) budgetary and funding inadequacies.

Interpretation: The lessons learned from the conduct of community engagement and community research during the COVID-19 pandemic should become a cornerstone for preparedness for the next severe epidemic or pandemic. The practical application of key concepts like CE, risk communication, conventional qualitative research methods must be examined to make them more applicable and responsive during complex and dynamic infectious disease epidemics and pandemics.

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Research in context

Evidence before this study:
When WHO declared the COVID-19 pandemic in 2020, the world was unprepared to prevent such a highly transmissible respiratory infection or to manage patients and its very severe impact on peoples' lives. Until that time public health evidence pointed to the absolute need to implement community engagement (CE) to control infectious epidemics like Ebola. Similarly, the widely accepted epistemological and methodological hallmarks of disciplines that work closely with communities like the social sciences (e.g. anthropology, sociology) and public health were applied in research. Researchers had hardly any practical experience in implementing CE and research in communities during a COVID-19 like pandemic context.

Added value of this study:
This study documented and analyzed the challenges in carrying out research and CE during the COVID-19 pandemic and determined how they can be minimized in future epidemics. It also calls for action to re-think the practicalities of conducting CE and ensure quality community research as part of epidemic preparedness before the next epidemic or pandemic strikes. Moving forward researchers will be better positioned to safely engage communities and different publics in knowledge generation during an ongoing epidemic or pandemic to inform development of management and control policies and guidelines in a timely manner.

Implications of all the available evidence:
There is urgent need to review the practical application of key concepts like CE, risk communication, conventional qualitative research methods and make them more applicable and responsive during complex and dynamic infectious disease epidemics and pandemics. The research experiences from the recent COVID-19 pandemic are well utilized to inform and strengthen future epidemic and pandemic preparedness.

Introduction:

The emergence of the SARS-CoV-2 pandemic in 2020 caught Uganda like rest of the world unprepared, and the World Health Organization (WHO) declared a pandemic in March 2021.[1,2] This unforeseen global health crisis highlighted the urgent need for improved epidemic preparedness. Prior to the COVID-19 pandemic, the West African Ebola virus disease (EVD) outbreak from 2016 to 2020 underscored the pivotal role of community engagement (CE) in effective epidemic control.[3,4] However, conducting research and implementing CE during the SARS-CoV-2 pandemic, characterized by respiratory transmission, presented unique challenges, compounded by the absence of established research guidelines.[5]

Between August 2020 and February 2021, Makerere University College of Health Sciences (CHS) and the College of Humanities and Social Sciences (CHUSS) prepared to conduct a randomized community trial in Uganda to evaluate the impact of CE and risk communication during the COVID-19 pandemic. We hypothesized that community participation and ownership were vital for the success of pandemic control measures. As part of the preparation for the trial we conducted a baseline study in a sample of the anticipated intervention and control communities from July 2020 to February 2021. In this article, we share findings from the baseline pre-trial study to assess community responses to ongoing COVID-19 mitigation measures.

Methods:

Study Design:

This mixed-method formative study comprised both quantitative and qualitative components and served as the baseline for a CE and risk communication intervention in urban and peri-urban Uganda. The study aimed to address the low uptake of COVID-19 mitigation measures among vulnerable populations and prepare for a community trial to assess CE effectiveness in pandemic control.

Study Sites:

The study covered 15 parishes, including six in Kawempe division (intervention arm) and nine in Nakawa division (control arm), two divisions within Kampala Capital City Authority, Uganda.

Sampling of Parishes and Villages:

Our study design employed a multistage sampling strategy that allocated parishes and villages based on their proportional contribution to the overall population. We used sampling frames, which contained lists of parishes and villages within the two divisions

Selection of Households:

For each village or segment, we developed sampling frames and intervals for households in line with probability-based survey design principles. We targeted a total of 30 households per village for inclusion in the study.

Study Population:

The survey and qualitative interviews engaged individuals aged 18 years and above residing in urban and peri-urban areas, ensuring representation from diverse segments of the population. This encompassed health workers, COVID-19 task force members, surveillance staff, urban refugees, migrant workers, individuals with diverse livelihoods, family roles, education levels, and community roles, as well as law enforcement officials.

The survey included 852 respondents, with 610 (70·1%) being female, and nearly half of the respondents were household heads (n=391, 46·5%). Qualitative research involved in-depth interviews with 100 household heads, household conversations (n=25) in each division, and focus group discussions (n=10, five in each division).

Sampling and Participants for Qualitative Research:

For the qualitative research, we adopted a purposive sampling approach in consultation with community gatekeepers and leaders, taking into account gender and age diversity among the participants.

Figure 1: Research assistants discuss allocation of study participants during data collection

Methodology

In response to the unique challenges posed by the COVID-19 pandemic, our study employed innovative data collection methods to investigate the impact of the pandemic on communities. This article focuses on the challenges encountered during data collection, while a separate publication will explore the opportunities and innovative methodologies developed in response. Our research, conducted mainly in low-income urban settings, aimed to understand the social, psychological, and economic effects of the pandemic on individuals and communities.

Data collection

To gather comprehensive data, we adopted a cross-sectional research approach that harmonized face-to-face quantitative surveys with qualitative interviews. A team of 18 highly-trained research assistants (RAs) played a pivotal role in this process, receiving six weeks of rigorous training encompassing both survey and qualitative techniques. Notably, four of these RAs possessed backgrounds in social sciences and extensive experience in qualitative research methodologies. The development of survey instruments was a collaborative effort, incorporating a wide array of closed and open-

ended questions, iterative pretesting, and translation into both the local languages-English and Luganda.

During the survey, RAs conducted face-to-face interviews using electronic survey questionnaires, with some questions being audio-recorded with participant permission. The interviews covered a wide range of topics, including demographics, work history, COVID-19 beliefs, sources of information, socio-economic and cultural practices, and the impact of the pandemic on various aspects of life.

For qualitative data collection we employed in-depth interviews (IDIs), key informant interviews (KIIs), focus group discussions (FGDs), and household conversations (HHCs). Quality control was maintained through daily debriefs and weekly team meetings, which provided a platform to address challenges and enhance problem-solving. Our qualitative study adhered to an interpretivist framework, aimed at exploring the subjective experiences of individuals within their social contexts.[6] This approach allowed us to capture context-dependent effects of the pandemic, shedding light on the intricate interplay between individuals and their communities during these trying times.

Figure 2: A household conversation in Kawempe division

Data Management and Analysis

We digitized our data collection tool using Open Data Kit (ODK) and stored data on a cloud-based server. Descriptive statistics were derived from the survey data, and all qualitative interviews (IDIs, HHCs, FGDs) were audio-recorded, transcribed, and translated into English.

Our analytical approach drew from both grounded theory analysis and content analysis methodologies. This hybrid approach allowed us to develop robust coding frames and categories that captured the richness of the qualitative data. The coding process was conducted by three independent coders, each bringing a unique perspective to the analysis. To ensure the consistency and reliability of our findings, any discrepancies in coding were thoughtfully addressed through a consensus-building process among the coders. Additionally, an independent checker was engaged to provide guidance and resolve any remaining ambiguities, enhancing the validity of our interpretations.

Ethical Considerations

Ethical clearance was obtained from the Makerere University School of Medicine Research Ethics Committee (REC REF 2020-144) and the Uganda National Council for Science and Technology (HS858ES). Written consent was obtained from all participants, and their personal data was stored securely.

FINDINGS

Demographic Characteristics:

The study encompassed 852 respondents, revealing a median age of 32 years (IQR 25-42), with a majority being female (n=610, 73·05%). The study sample consisted mainly of household heads (n=391, 46·5%), followed by spouses of household heads (n=305, 36·1%) and children of the household head (n=68, 8%). Approximately half reported being in a stable union, including marriage or cohabiting, and a significant proportion indicated tertiary education attainment (n=206, 24·2%). This was followed by the primary education group (n=201, 24·01%) and ordinary level (n=195, 23·3%), while 16% (n=142) had no formal education. The majority of participants reported access to clean running water at home or within their community, as well as access to electricity. Further neighborhood characteristics are detailed in Table 1.

Experiences in Implementing Research and Community Engagement During the Pandemic:

Throughout the research process, spanning from project planning to results dissemination, the study team encountered both challenges and opportunities, categorized into three main interrelated domains: a) scientific process implementation challenges b) those associated with the social, cultural, and political context of the research, and c) budgetary and funding inadequacies. This paper focuses exclusively on the challenges encountered, while the opportunities have been explored in another publication currently under preparation. Notable opportunities encompass the development of innovative adaptations to conventional methodologies for conducting research and community engagement during a pandemic, as well as gaining insights into the coping mechanisms of vulnerable groups when confronted with stringent public health mitigation measures.

Challenges Related to Scientific Process Implementation:

Research Team Preparation for Community Engagement: Equipping the research team to interact with the public during a deadly airborne disease outbreak with no available preventive vaccine or treatment posed significant challenges. Each stage, from team selection to content design, demanded extensive consultation, policy and community engagement, flexibility, and creativity. Comprehensive and high-quality training covering a wide array of topics ranging from the specifics of the pandemic to study procedures, the rationale behind these procedures, strategies for engaging diverse populations, risk mitigation measures, and protocols for handling unforeseen circumstances became indispensable. Both theoretical and practical training required qualified trainers, despite a rigorous six-week training period. Surprises and unexpected challenges still arose in the field.

Methodological Challenges in Qualitative Data Collection: Qualitative data collection methods such as KII, IDIs, FGD, and HHC traditionally involve in-person, close-proximity

interactions with participants. The pandemic's strict public health and social measures posed considerable challenges to these methods. While challenges in international research are well-documented, certain difficulties were encountered even in high-income settings. Conventional FGDs or HHCs do not typically involve maintaining a six-foot distance between respondents and researchers. Bringing people together for community engagement proved challenging during a period when public health measures were stringent. Additionally, the fact that every household member was at home made it difficult to find quiet, private spaces for interviews, potentially constraining the openness of some respondents. Furthermore, the Public Health Measures (PHM) introduced confidentiality challenges, as participants had to project their voices more loudly in open spaces, inadvertently compromising privacy.

Challenges to Maintain Ethical Integrity and Scientific Rigor: Similar to many other regions, our Institutional Review Boards (IRBs) grappled with the formidable task of developing new research guidelines that effectively safeguarded the health and welfare of both community members and researchers. This challenge was further complicated by the imperative to expedite approval processes in order to keep pace with the rapidly evolving research landscape during the pandemic. IRBs also faced dilemmas regarding what was permissible and responsible conduct of research, leading to deliberations on various elements, including health insurance for research team members, the content of risk management plans, and the acceptability of photography, videography, and voice recording. The strict public health measures in place, such as physical distancing, made activities like photography, videography, and voice recording ethically complex, as they raised concerns related to invasion of privacy and participant confidentiality. Consequently, the pandemic and its associated public health measures challenged the research team's ability to fully comply with some of the ethical requirements. To overcome these challenges, it necessitated extra effort in the development and implementation of risk management plans.

Throughout the research process, our team diligently navigated the terrain to ensure ethical integrity and scientific rigor, focusing on several key aspects:

a) Upholding Participant Rights: We made it a priority to uphold participant rights, including the right to decline to answer specific questions. In instances where participants were less forthcoming during HHCs or FGDs, interviewers conducted follow-up discussions with individuals privately. The study had anticipated and prepared for such scenarios, allowing participants to engage research assistants (RAs) in a one-on-one setting and share additional information outside the group interview environment.

b) Ensuring Participant Privacy: The pandemic, in conjunction with PHM such as social distancing, amplified the challenge of preserving participant privacy during interviews. Conducting interviews while maintaining a six-foot distance between the interviewer and the participant proved particularly demanding in congested, low-income urban environments.

c) Prioritizing Researchers' Welfare and Safety: The pandemic placed considerable strain on the principle of ensuring the welfare and safety of researchers. Despite having a planned risk mitigation strategy, unanticipated challenges emerged. RAs who contracted the virus experienced unforeseen side effects related to their knowledge of their status, including psychological impacts. Those who remained unaffected had to shoulder additional workloads, placing them at risk even though we provided them with all the necessary protection facilities. This dynamic underscored the necessity of adaptability in the face of an evolving situation.

We recognized the limitations of not collaborating with community groups, such as civil society organizations, cultural leaders, and religious leaders, who possessed prior knowledge and experience working within the study communities. These groups could have swiftly harnessed their capacity and existing networks to mobilize communities. Additionally, the principle of respect for communities necessitates that researchers "respect communal values, protect and empower social institutions, and, where relevant, respect the decisions of legitimate communal authorities."[9] The government-imposed movement restrictions made it challenging to locate these leaders. Nevertheless, we made concerted efforts to engage some community leaders in their individual capacities.

Social Context Challenges:

The study unfolded amidst a dynamic social context characterized by communication and information excesses and overflow, a fluid political environment, economic strain, cultural norms and practices that carried psychological, gender, and cost related challenges for both the researchers and potential participants.

Challenges with Communication Channels: The pandemic introduced significant communication challenges, particularly concerning the channels through which information flowed. Social media and other communication platforms facilitated the spread of misinformation and disinformation, directly impacting the conduct of the study. In our study context, most participants cited mass media platforms as their primary source of information. Person-to-person communication among friends or relatives was also prevalent (n=791, 92·2%), followed by mainstream media such as television, radio, and newspapers (n=624, 73·58%), and social media (n=164, 19·34%). Notably, the majority of respondents mentioned receiving information from the president (n=339, 39·98%), relatives (n=266, 31·7%), friends (n=252, 29·72%), government officials (n=150, 17·69%), health workers (n=100, 11·79%), local leaders (n=60, 7·08%), and religious leaders (n=33, 3·89%).

Social media and word-of-mouth played significant roles in disseminating information, contributing to COVID-19 infodemics characterized by widespread misinformation and disinformation. The public often distrusted information from official government sources, viewing it as deceptive and intended solely to secure donor support. Participants occasionally veered off-topic to discuss allegations of corruption, challenging the study staff to address such issues and affecting the interview's focus. In the early stages of the

pandemic, when the public had not yet witnessed COVID-19 cases, community members found it difficult to believe in the existence of the pandemic. This widespread misinformation served as a real-time learning opportunity for the research team, prompting the development of measures to respond effectively. For the study, we relied on a WhatsApp group platform to facilitate real-time communication between the research team and community members.

Another notable aspect of communication channels was the emergence of specialized jargon among respondents with unique knowledge, such as traditional healers and sex workers. This jargon infiltrated public communication, including daily presidential speeches on pandemic updates, reflecting a shift in language and references within the community. The translation of messages into local languages also adapted to incorporate culturally relevant terminology. Therefore, the research team needed to remain attuned to new language or references related to common concepts like 'senyiga omukambwe' (a local term for COVID-19), masks, lockdown, quarantine, and curfew, as these were central to pandemic control activities. Additionally, some respondents utilized emerging language to discuss their pandemic experiences, reinforcing the importance of recognizing and accommodating evolving language and references during a pandemic.

Health Challenges:

It's important to highlight that while we had a comprehensive Risk Management Plan (RMP) in place from the outset, which was reviewed by the Research Ethics Committee (REC) before ethical approval, the pandemic led to unforeseen health challenges within the research team. Several team members contracted COVID-19, triggering the immediate implementation of the RMP. This involved halting study activities and ensuring the infected individuals received care according to Ministry of Health PHM and Uganda National Council for Science and Technology (UNCST) guidelines. The direct consequence was a reduction in available staff, as six out of 25 team members required isolation. As a precautionary measure, all research activities were suspended for eight weeks. Face-to-face activities resumed only for project staff who had tested negative for SARS-CoV-2, resulting in increased workloads for the remaining team members. The news of infections among team members adversely affected morale and motivation. Unfortunately, while the RMP effectively addressed the outbreak within the team, it did not adequately address the social and psychological impact, particularly on the infected RAs.

Psychological Effects on Study Participants:

The pandemic affected the general community's mental well-being, with some participants expressing irritation toward COVID-related information or news. They attributed this irritation to the stress of lockdowns, absence of rapid and affordable tests, and perceived inadequacies in treatment options. Such experiences heightened panic and anxiety, exacerbated by sensational and controversial media coverage of the

pandemic. Participants' anxiety related to news coverage was a notable challenge, as expressed by one respondent: "I know that the news increases my anxiety, but when I do not check it, I feel even more uncertainty."

Research challenges related to gender norms in resource constrained settings:

Our study primarily took place in low-income urban settings characterized by crowded living conditions. As a result, Household Conversations were not as private as desired. Cultural norms sometimes hindered openness among family members, particularly when discussing sensitive topics. For instance, discussions on domestic violence, income generation, or sexuality were often less informative when conducted in the presence of the household head (usually the male).

Furthermore, gender dynamics influenced the research process. Most study participants were women (n=610, 73·05%), and participants, including men, hesitated to discuss certain topics in the presence of their spouses. Gender norms appeared to limit freedom of expression within households. Some participants were more candid after the official interview had concluded and the recorder was turned off, and the RA and usually female participant were no longer within earshot. Notably, gender-based challenges arose due to situational constraints in the research setting. For instance, when a male RA interviewed a female respondent in a private setting, it sometimes resulted in harassment and potential violence toward the RA. Conversely, some respondents preferred to be interviewed by a specific gender due to perceived power imbalances. This situation sometimes led to challenges in data collection.

To address these issues, RAs received training to apply various techniques (observation, field notes, debriefs, and follow-ups) alongside the primary data collection approach, the Household Conversation. Additionally, the research team comprised both male and female RAs to conduct Household Conversations, helping to mitigate gender-based biases and provide support in handling security concerns. Both male and female RAs reported perceived verbal threats, sometimes of a sexual nature, and having a partner of the opposite sex helped manage these situations.

Operational Costs and Budgetary (Cost of Research) Challenges:

The health challenges and other unforeseen developments substantially escalated operational costs. Collectively, these factors, including unanticipated field costs and budgetary shortfalls, impacted the study timeline and led to a 50% increase in operational costs. We brought in five volunteers to support the team, but this only partially mitigated the challenges. The blended training approach, combining face-to-face and online training, extended the training period by three weeks, 60% longer than planned, to sufficiently prepare RAs for work during the evolving pandemic. The cost of personal protective equipment (PPE) surged by up to 20% from budgeting to procurement. Identifying willing and consenting participants proved slower due to public suspicion, particularly in the months leading up to national presidential elections. Interviews took longer as participants sought to express their views to government leaders, often

deviating from the main discussion points. Local guides from the communities, who possessed extensive knowledge of their environments, raised their labor costs by up to 50%, as they had no other source of daily income during lockdown. Finding suitable interview spaces became challenging due to the need for social distancing, privacy, and confidentiality in crowded, low-cost environments, with all family members present at home due to lockdown. Fuel costs rose by 30% due to a higher number of trips than initially planned. The extended data collection period by 20% necessitated hiring the team for an additional four weeks, resulting in a 30% increase in personnel costs.

Conducting research during the pandemic exposed new and unforeseen costs that were not initially anticipated and budget adjustments proved very challenging. The support of welfare and protection of team members, particularly those infected with SARS-CoV-2 during the study, involved significant expenses. The original budget did not account for the cost of COVID tests, which amounted to USD 30 per test. Additionally, the infected team members required prolonged management, including counseling which had not been budgeted for. In addition, the study could only cover immediate care expenses, constituting approximately 10% of the total required for complete care during the study period. Some team members who contracted SARS-CoV-2 faced stigma and required psychosocial support, which had not been fully anticipated or adequately costed.

Furthermore, there were costs related to time lost when potential study participants exhibited COVID symptoms or reported having the virus. Teams had to skip these households, which prolonged the time needed to reach the target sample size, impacting the study's overall cost.

The prolonged full lockdown provided opportunity for prolonged training to ensure the RAs were very well trained. The slow ethical approval process further delayed the start of data collection.

When a partial lockdown allowed some fieldwork, regular COVID testing became necessary during ongoing community viral transmission. The increased testing, coupled with restrictions on vehicle occupancy and curfews, raised transportation costs. Communication costs also escalated to facilitate virtual team meetings and daily debriefs. All these required data plans, phone calls, and in some cases, tablets and smartphones for team members without laptops. Finally, costs associated with covering tasks for researchers placed in isolation, including hiring new RAs while keeping the infected ones on pay, further strained the budget. Overtime pay was not feasible due to budget constraints.

Failure to implement CE as part of the pandemic response posed a significant challenge. The tension between the national government's desire to rapidly execute public health measures during a pandemic and the initial slow approach to mobilize and engage communities for a more effective long-term response created complications. When communities did not fully comprehend the severity of the health threat and did not

embrace the proposed interventions, it resulted in community resistance and some rejection of the recommended actions.

During our research, certain segments of society welcomed the presence of our Makerere University research team, as we provided crucial information about the pandemic. However, both the government and the research team faced high community expectations during the pandemic. Taking the necessary time to provide needed explanations and engage with the community slowed down the study progress and increased costs due to extended field work.

Discussion

Substantial challenges were encountered and lessons learned in conducting research and community engagement (CE) during the COVID-19 pandemic. Our research unfolded during a period of uncertainty and emotionally charged interactions when Uganda was preparing for presidential elections. This added a need for an extra layer of careful consideration to ensure safety measures and research rigor. Additionally, the most recent Sudan EVD outbreak in the country, though localized in three districts, from September to November 2022 also coincided with the ongoing COVID-19 pandemic. This concurrent outbreak underscored, yet again, the indispensable importance of effective CE during an epidemic or pandemic. It firmly reinforced the notion that community trust and collaboration are non-negotiable in the face of public health crises.[10] Notably, in EVD-affected communities, individuals exhibited reluctance to adhere to public health measures and even resorted to extreme actions, such as obstructing public health teams. The lack of successful CE can lead to community resistance and hinder response efforts.[11]

Gender considerations played a role in shaping research activities. Understanding gender dynamics and addressing their impact on the practicalities of data collection and engagement proved essential. Commitment to safely engaging communities and different publics in knowledge generation remains a cornerstone to the successful conduct of quality research that informs development of policy and guidelines for control and management of a pandemic in a timely manner

The cost and budgeting challenges experienced had no easy solutions and were a constant source of anxiety. The frequent emergence of gaps in the funder approved budget were a constant feature which could be explained by two major causes. First, the demand for both budgeted and new unforeseen and unbudgeted line-items was increasing rapidly. Secondly the supplies were erratic and uncertain and hence unpredictable due to country lock down, dwindling importations and within country transfer of commodities. Budget constraints and resource limitations influenced the implementation of activities, adding complexity to the research process. Budgeting principles like funding caps, flexibility of funders, acceptability of miscellaneous budget items in research need to be reconsidered in a pandemic situation given the challenges posed by a fluid and dynamic emergency like a pandemic. Adequate in-country expertise

to undertake rapid projections would be very valuable not only to inform policies and guidelines but also inform research needs during a pandemic. Extreme PHM and their potential implications should be very well considered before implementation.

There is need to adapt certain concepts like CE and risk communication to make them more responsive to complex and dynamic infectious disease outbreaks, epidemics and pandemics. Challenges in implementing CE during infectious disease outbreaks or epidemics, such as the West African EVD epidemic and the COVID-19 pandemic, have been documented in previous studies.[12,13,14,15] However, limited research has addressed the specific challenges of implementing CE in the context of COVID-19 research.[16] Given that CE is recognized as a necessary ethical practice in research, its integration into research during an epidemic or pandemic may help mitigate potential challenges and negative impacts.[17,18]

Ethical challenges that may arise when planning and implementing community research during a pandemic should not be underestimated. They demand continuous attention from the planning stage throughout the research cycle, considering their variation, breadth, depth, and the extent of their impact on the well-being of the research team, study participants, and the broader society. This was very evident on the pandemic's psychological challenges to the well-being of team members and study participants and other community members. Navigating stringent public health measures that restricted movement, association, and group gatherings, as well as ensuring social distancing, warrant further discussions as part of pandemic preparedness. In future research endeavors during severe epidemics or pandemics, these ethical dilemmas may resurface as competing tensions, balancing research interests, public expectations, and the duty to protect research team members, participants, and the wider community. Conducting research is vital for providing new knowledge for epidemic and pandemic control and management in real-time, and contributes to preparedness for future similar occurrences. It is vital that the research is adequately resourced to ensure ethical Integrity and scientific rigor are maintained. During the pandemic, maintaining rigorous research standards and ethical conduct required substantial effort, and the research team continually adapted to address these challenges.

Study Strengths and Limitations:

Our study possesses both strengths and limitations:

Strengths:

Engaging with communities during a pandemic has provided valuable insights into the benefits and challenges of conducting community engagement in such contexts. This experience has highlighted the importance of real-time feedback to inform policymakers, program staff, and local leaders during pandemic responses.

The study has prompted a reevaluation of how research during pandemics or other public health emergencies can be designed and executed differently. It underscores that social science research, even in a pandemic setting, is not without risks.

Limitations:

It remains unknown whether our study may have inadvertently harmed the study communities, raised ethical dilemmas, increased community stress, or contributed to the spread of the disease among research team members who contracted SARS-CoV-2. This necessitates consideration of new domains for educating, informing, and monitoring investigators' responsibilities during community-based research in pandemics.

The inability to share results with communities and policymakers in real-time hindered the timely utilization of study findings for actionable pandemic response. However, the study still holds scientific, methodological, and policy value in the context of research during pandemics. The lessons learned can inform epidemic and pandemic preparedness efforts.

Conclusions and Recommendations:

Despite the challenges, the scientific and policy value of knowledge generated during epidemics and pandemics remains high. Researchers must strive to innovate and adapt conventional research methods to maximize engagement, scientific rigor, and benefits even in pandemic settings. As part of pandemic preparedness, scientists and the research community should introduce innovations and adaptations to existing formative research methods, better equipping them for research, community engagement, and mitigation programs during future pandemics. Lessons learned from the COVID-19 pandemic should be well utilized towards epidemic preparedness.

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Author Contributions:

Conception: DKM, DS, NKS

Design: DKM, DS, DM, NKS
Data Acquisition: DM, ISK, DKM
All authors contributed to data analysis and interpretation; manuscript writing, review and approval of the manuscript

Potential Conflicts of Interest:

All authors have disclosed potential conflicts of interest as per ICMJE Form for Disclosure of Potential Conflicts of Interest. Any relevant conflicts have been disclosed to the editors.

Data Availability:

The data supporting the study findings are available from the corresponding author upon reasonable request, subject to privacy and ethical restrictions.

Declaration of interests: DKM was supported by the Makerere University Research and Innovations Fund (MakRIF) and the Center for Social Sciences Research on AIDS (CeSSRA), Makerere University, and the Center for AIDS Research (CFAR), Case Western Reserve University, US National Institutes of Health, DM and DS were supported by THRiVE grant, ISK was supported by CeSSRA and NKS was the PI for the MakRIF and THRiVE grants. All authors declare no competing conflict of interest. The study received ethical clearance as mentioned above.

Trial Registration:

The planned trial was registered with the Pan African Clinical Trials Registry (PACTR202010729372570).

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Neighbourhood characteristics	Frequency	%
Mostly gated structures, well planned, clean neighbourhood	87	10·27
Some gated structures, fairly well planned with fairly good sanitation, no congestion	296	34·95
Very few if any gated structures; semi-planned with some signs of congestion or poor sanitation	250	29·52
Slum dwellings with obvious signs of congestion and very poor sanitation	214	25·27

Table 1. Neighborhoods characteristics

Figure 1: Research assistants discuss allocation of study participants during data collection

Figure 2: A household conversation in Kawempe division