

Social, economic and food insecurity among people living with HIV in Kenya during coinciding public health and environmental emergencies: a mixed-methods study

Carrie Lyons ¹, Jennifer Ching,¹ Dan N Tran,² Catherine Kafu,³ Juddy Wachira,⁴ Hillary Koros,^{3,5} Maya Venkataramani,⁶ Jamil Said,⁷ Sonak D Pastakia,⁸ Omar Galárraga,⁹ Becky Genberg¹

To cite: Lyons C, Ching J, Tran DN, *et al.* Social, economic and food insecurity among people living with HIV in Kenya during coinciding public health and environmental emergencies: a mixed-methods study. *BMJ Public Health* 2024;**2**:e000836. doi:10.1136/bmjph-2023-000836

► Additional supplemental material is published online only. To view, please visit the journal online (<https://doi.org/10.1136/bmjph-2023-000836>).

Received 11 December 2023
Accepted 20 August 2024



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Carrie Lyons;
clyons8@jhu.edu

ABSTRACT

Introduction During the COVID-19 response, Kenya experienced widespread regional floods, resulting in the displacement of communities and agricultural loss. This study aimed to characterise food insecurity and other social and economic impacts of these emergencies on people living with HIV and to investigate whether and how existing microfinance activities in place before the events influenced social and economic instability.

Methods We used sequential explanatory mixed methods guided by a conceptual model. Interviewer-administered surveys (n=200) and follow-up in-depth interviews (n=40) were conducted by phone with people living with HIV in Busia and Trans Nzoia counties between October and December 2020. Socioeconomic factors (microfinance participation, income and social support) and food insecurity were examined with Poisson regression using survey data. Qualitative data were analysed using content analysis to contextualise quantitative findings.

Results Among 200 participants, 59.0% were female, median age was 45 years and 73.0% reported being severely food insecure. Microfinance participation was not associated with severe food insecurity (adjusted prevalence ratio, aPR 0.98; 95% CI 0.82, 1.18), but income loss (aPR 1.94; 95% CI 1.13, 3.30; p=0.015) and loss of social support (aPR 1.48; 95% CI 1.18, 1.84; p=0.001) were associated with severe food insecurity. Three main themes emerged: compounding effects of COVID-19 and flooding on food and economic insecurity are early indicators of upstream barriers to HIV treatment; microfinance groups may not have mitigated socioeconomic consequences of COVID-19 and flooding because of unexpected income loss and limits on gathering and displacement; and social support bolsters mental health and medication adherence among microfinance members despite lack of in-person activities.

Conclusions In the context of coinciding public health and environmental emergencies, people living with HIV in Kenya experienced widespread food insecurity. Programmatic efforts to support HIV treatment disbursement, coverage and adherence alone are not sufficient during an economic crisis affecting food

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Kenya experienced regional floods during the COVID-19 pandemic and experienced economic and social disruptions.

WHAT THIS STUDY ADDS

⇒ This study provides a more detailed understanding of the economic, social support and food security barriers to health and well-being of people living with HIV experiencing widespread public health and environmental crises, even in the context of microfinance and programmatic efforts to provide HIV treatment.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ In the context of coinciding public health and environmental emergencies, programmatic efforts would benefit from incorporating economic and food security measures to support people living with HIV.

insecurity. Integrating antiretroviral therapy (ART) dispensing efforts alongside interventions to support food security for people living with HIV could improve ART adherence and reduce mortality during widespread emergencies.

INTRODUCTION

In 2020, Kenya experienced layered structural crises that disrupted economic and social stability. Kenya reported its first case of COVID-19, the disease caused by SARS-Cov-2, on 12 March 2020.¹ In an effort to contain the spread of COVID-19 within Kenya, the government implemented several strategies focused on reducing movement and social interactions.² These measures aligned with those

being put in place across many countries and included restricted movement, a curfew, closure of learning institutions, restrictions to non-essential businesses and prohibition of large events or gatherings.² The national economy in Kenya was estimated to have reduced by more than a 5% drop in gross domestic product (GDP) alongside a depreciation of the national currency during COVID-19-related restrictions between April and June 2020.³

Alongside the COVID-19 outbreak in Kenya, severe flooding occurred in March, April and May 2020 in 36 out of 47 counties.⁴ The Kenya Red Cross Society reported over 116 000 people displaced by the floods, and more than 85 000 sheltered in displacement camps.⁴ Flooding has become more frequent in Kenya, likely driven by climate change in the region.⁵ Kenya's economy relies largely on agriculture, employing approximately 34% of the overall population and contributing to 22% of the GDP.^{6 7} Given the population relies on agriculture for both employment and consumption, flooding that disrupts formal and informal agriculture production may affect both the livelihoods and food security of individuals in the country.

Upstream superstructural crises (ie, natural disasters and infectious disease emergence) and social-structural crises (ie, agricultural, social, economic and political structures) can result in downstream community, household and individual insecurity and economic instability. These severe impacts likely have the greatest impact on undervalued and underserved populations such as people living with HIV and those engaged in the informal economy in low-income and middle-income country contexts. There is a need to understand how these structural level disruptions such as pandemics and floods impact people living with HIV to inform potential strategies for alleviating the downstream consequences of future global emergencies. In resource-limited settings, structural crises may amplify existing social conditions and impede progress towards achieving health goals, yet many ongoing interventions may provide means through which these deleterious impacts can be buffered in times of crisis.

Microfinance is an approach to support savings and income generation among a group of individuals, especially among those in limited resource settings and networks, as well as those at risk for economic instability. Microfinance has been successful in not only strengthening both individual and community economics but also food security and health outcomes.⁸ In particular, microfinance group membership has been associated with improved retention in care among people living with HIV, including among individuals in Kenya.⁹ Evidence across settings suggest that microfinance interventions may help to alleviate the impact of poverty, economic instability and food insecurity on health outcomes among people living with HIV in relatively stable economic conditions.^{9 10}

Food security is described as the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways. In Kenya, food insecurity has been increasing over the last decade, with 25.7% of the population defined as severely food insecure prior to 2020.^{4 11} Food insecurity among people living with HIV may influence well-being as well as treatment and clinical outcomes. Adequate nutrition among people living with HIV supports antiretroviral therapy (ART) adherence, efficacy and viral suppression.¹² The role of micronutrients in immune function and HIV is well established and body mass index has been associated with treatment adherence and viral suppression.¹³ Among people living with HIV, food insecurity has been associated with suboptimal ART adherence,^{14 15} decreased efficiency of ART¹⁶ and increased risk of mortality.^{17 18} There is limited knowledge on how the challenges to economic conditions and exacerbated food insecurity resulting from these crises and during COVID-19 specifically may have had an impact on HIV treatment outcomes among people living with HIV.¹⁹

The objective of this study was to characterise the social and economic consequences of two global social crises among people living with HIV in Kenya. Specifically, we aimed to understand (1) the extent to which reported socioeconomic disruption impacted food insecurity and (2) to determine whether microfinance participation prior to the two crises was associated with reductions in reported food insecurity in their immediate aftermath. We hypothesised that microfinance participation would be associated with decreased severe food insecurity following the two major crises. We examined qualitative themes emerging from interviews to understand how existing interventions were in place at the time of the emergencies related to HIV treatment outcomes.

METHODS

The study aims were carried out using a sequential explanatory mixed-methods design, with survey and in-depth interview data collection by phone.²⁰ The quantitative and qualitative methods are described in this section with reporting checklists provided in online supplemental files 1,2. Survey data were used to estimate the prevalence of food insecurity, employment disruptions and perceived social support during the months following the COVID-19 pandemic and floods. We examined the association between microfinance group participation and severe food insecurity to test our hypothesis. We also examined the associations between changes in employment and social support following the pandemic and food insecurity. Qualitative data were used to contextualise the interpretation of quantitative findings.

Quantitative and qualitative research questions and analytical approaches were developed using the conceptual model for Economic and Food Security among People Living with HIV (figure 1). This conceptual model was informed by existing conceptual frameworks

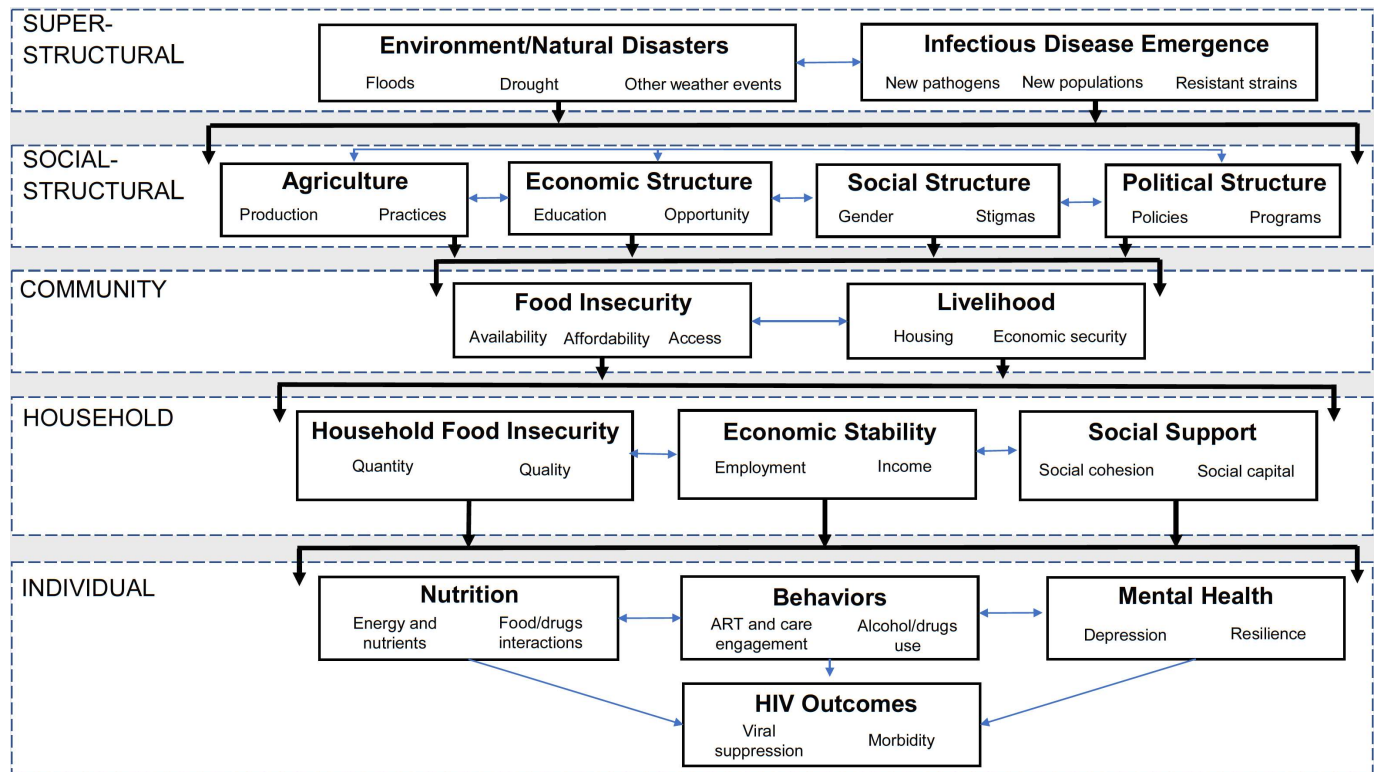


Figure 1 Conceptual model for drivers of economic and food security among people living with HIV. ART, antiretroviral therapy.

on the relationships between food security, livelihoods and HIV outcomes.^{21–23}

Quantitative data collection

This study was implemented in collaboration with the Academic Model Providing Healthcare (AMPATH) programme which provides care to more than 165 000 people living with HIV across 300+ clinical sites in 17 counties in western Kenya.^{24–26} AMPATH supports the Group Integrated Savings for Health Empowerment (GISHE) programme for income-generating opportunities through microfinance groups. GISHE is a table-banking programme and is structured according to the Village and Savings and Loan Association model,²⁷ which encourages a savings-led, group-based microfinance scheme.²⁸ This study was designed to be a rapid assessment in response to the emergence of the COVID-19 pandemic. Therefore, a sample size of 200 participants was established based on resource constraints and feasibility during COVID-19. Briefly, the study team included a convenience sample of those who were (N=100) and were not (N=100) actively participating in GISHE across two counties within the AMPATH catchment area. Those in active microfinance groups were defined as those who still considered themselves part of a microfinance group, contributed money, but may not be meeting as frequently during COVID-19; and those in inactive microfinance groups were active prior to COVID-19, but during COVID-19 completely disintegrated, not doing microfinance contributions, nor meeting at all. The list

of potential participants was conveniently informed by a simultaneous mapping and feasibility study nested within an ongoing randomised controlled trial (Harambee: Integrated Community-based HIV/NCD Care and Microfinance Groups in Kenya (ClinicalTrials.gov Identifier: NCT04417127) in Busia and Trans Nzoia counties where AMPATH has been supporting HIV care.²⁹ During this mapping process, active and inactive microfinance groups and their members were identified. The recruitment flow chart is provided in online supplemental file 3. Participants were recruited via telephone among people living with HIV who were identified from the mapping study and who were also confirmed to be in HIV care at the start of the COVID-19 pandemic by HIV retention officers in health facilities. To recruit potential participants actively participating in microfinance, study staff contacted microfinance group leaders in their respective counties and provided them with information about the study. The group leads identified potential participants, conducted initial eligibility screening and shared contact information of potential participants with study staff. For participants who were not members of active microfinance group, study staff consulted with retention officers at appropriate identified facilities to help ensure participants were still in active HIV care before our study staff contacted them for recruitment. Overall, individuals were eligible to participate if they were 18 years and older; receiving HIV care at an AMPATH clinic; on ART; willing to participate in the study; and not critically ill,

Table 1 Demographic characteristics, microfinance group membership, economic and food insecurity among people living with HIV in Kenya during the COVID-19 pandemic

Quantitative survey participants (N=200)		
Demographic characteristics	Median	IQR
Age, in years (median)	45	23–75
Age, in years	n	%
<45	90	45.0
≥45	110	55.0
Gender		
Male	82	41.0
Female	118	59.0
Marital status		
Married	127	63.5
Not current married (never married, divorced, widowed)	73	36.5
Education		
None or primary	157	78.5
Completed secondary or post-secondary	36	21.5
Microfinance group		
Active member of any microfinance groups before COVID-19		
No	81	40.5
Yes	119	59.5
Employment		
Employment sector prior to COVID-19		
Farmer	40	20.0
Daily labourer/piece work earner in agricultural or health sector	37	18.5
Wage earner in non-agriculture large business (factory operation)	2	1.0
Small business owner	60	30.0
Artisan	11	5.5
Salaried employee	12	6.0
Unemployed/not working	11	5.5
Student	2	1.0
Retiree	2	1.0
Fishing	10	5.0
Other	13	6.5
Employment status change since COVID-19		
No change	94	47.0
Negative—working less hours, lost job, or closed business	99	49.5
Positive—working more hours or got new job	6	2.50
Household income change since COVID-19		
No change	20	10.0
Gained income	1	0.5
Lost income	179	89.5
Food insecurity		
Household food insecurity (HFIAS)		
Food secure	22	11.0

Continued

Table 1 Continued

Quantitative survey participants (N=200)		
Mildly food insecure	4	2.0
Moderately food insecure	28	14.0
Severely food insecure	146	73.0
Social support		
Had someone who offered support when needed (financial, mental, social) before COVID-19		
No	6	3.0
Yes	194	97.0
Change in the support received before COVID-19 (N=194)		
No change	71	36.6
More supported	14	7.2
Less supported	109	56.2
Qualitative survey participants (N=40)		
Demographic characteristics	Median	IQR
Age, in years (median age 50; IQR 45–57)	50	45–57
Gender	n	%
Male	8	20.0
Female	32	80.0
Marital status		
Married	16	40.5
Divorced	1	2.5
Widowed	18	45.0
Single	5	12.5
Education		
None		
Primary	25	62.5
Completed secondary or postsecondary	13	32.5
Head of household		
No	6	15.0
Yes	34	85.0
Main source of income		
Farming	19	47.5
Business	15	37.5
Other	6	15.0

or cognitively impaired. Participants were determined to be on ART if the patient was documented to have been prescribed and taking the prescribed ART per the medical record system (AMPATH Medical Record System or Kenya Electronic Medical Record System). A trained interviewer administered the questionnaire over the phone to verbally consenting participants. Survey is detailed in online supplemental file 4. At the end of the session, participants were offered an inconvenience fee of KES500 (approximately US\$5) paid via Mpesa. All interviews were conducted between 23 October 2020 and 3 December 2020.

Quantitative measures

All measures were self-reported via a telephone, interviewer-administered survey. The survey contained questions related to individuals' demographic characteristics, microfinance group membership, food insecurity, employment and income and social support. Demographic characteristics included age, sex, educational attainment and marital status. To measure the experiences of individuals since the COVID-19 pandemic, participants were asked about experiences since COVID-19 social distancing measures were established on 13 March 2020 (which corresponds to approximately 6 months prior to the interview).

Household food insecurity was measured by an adapted, shortened, Household Food Insecurity Access Scale (HFIAS) (online supplemental file 5).³⁰ Microfinance group membership was the main exposure of interest. Microfinance group membership was defined as reporting being an active member of any microfinance groups before COVID-19, specifically reporting attendance in the last 6 months.

We also examined self-reported disruptions in employment which were measured as reported employment status change since COVID-19 and reporting a household income change since COVID-19. Social support was measured using a shortened and COVID-19 adapted version of the 12-item Multidimensional Scale of Perceived Social Support.^{31 32} Participants were asked if there was a person who offered them support in times of need (financial, mental and social). In addition, we specifically asked participants if this level of support had changed since COVID-19, and responses were categorised as no change, more supported and less supported.

Quantitative statistical analysis

Descriptive statistics, including distributions and proportions for demographic characteristics, employment and income, social support and food insecurity of the study sample, were calculated overall and by microfinance participation. Differences in characteristics and disruptions by microfinance participation were examined using Pearson's χ^2 tests.

The primary outcome was food insecurity. The HFIAS was used to categorise individuals and their respective households into four levels of household food insecurity (access): food secure, mildly food insecure, moderately insecure and severely food insecure.³⁰ Individuals were categorised as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently. An additional dichotomous measure was created to compare individuals who were categorised as severely food insecure and those who did not report severe food insecurity, including those who were classified as food secure, mildly food insecure, moderately insecure based on data from the HFIAS.

Household income change since COVID-19 was categorised into three categories: no change, gained income

or lost (some, most or all) income. Social support change since COVID-19 was categorised into three categories: no change, less support and more support.

We first examined the associations between our outcome (severe food insecurity) and exposures of interest (microfinance group membership, income change and social support change) using Poisson regression analysis with robust variance (online supplemental file 6). Prevalence ratios and 95% CIs were used as the measure of association and an adjusted analysis was conducted including potential confounders (age, sex, marital status and educational attainment) based on our conceptual model. Separate Poisson models were then built to assess the associations between severe food insecurity and each exposure of interest.

Qualitative methods

In-depth interviews were conducted with people living with HIV participating in microfinance groups. The inclusion criteria were age 18 years and older, living with HIV, receiving HIV care at an AMPATH clinic, having been an active member in a microfinance group prior to 13 March 2020, and willingness to participate in the study. We purposively sampled 40 people living with HIV from microfinance groups stratified by study site (20 in Trans Nzoia County and 20 in Busia County) and contacted potential participants via telephone. Interviewers conducted recruitment for the in-depth interviews with participants from the survey. In Busia, participants were recruited who were living in areas that were affected by floods and those who were not. In Trans Nzoia, participants were recruited who were residing in regions marked as high risk and low risk for COVID-19 transmission. Participants were also recruited based on active participation in microfinance groups versus inactive membership in microfinance groups. The in-depth interview guides are provided in online supplemental file 7.

Verbal consent was obtained from participants prior to the interview. Study staff described the goals of the study to the participants and left sufficient time for the study participant to ask questions. Interviews were conducted in either Swahili or English at a time convenient for the participant. Interviews were conducted by two research assistants (one female and one male) employed by AMPATH who hold bachelor's degrees and with previous training and experience in qualitative studies. Trained interviewers used a semistructured interview guide developed using the conceptual model (figure 1) with the following domains: (1) impact of COVID-19 on microfinance group activities, (2) coping mechanisms during the shutdown and (3) recommended strategies for group sustainability during the pandemic. The semistructured guide was reviewed by the research team, pilot tested prior to being administered and revised based on feedback following the pilot test.

All sessions were conducted via telephone and audio recorded. Interviews lasted approximately 45 min. All

Table 2 Microfinance group membership distribution by demographic characteristics, employment and social factors among people living with HIV in Kenya during the COVID-19 pandemic

			Microfinance group membership					
			Total (N=200)		No (N=81)		Yes (N=119)	
	n	%	n	%	n	%		
Demographic characteristics								
Age (median age 45; IQR 23–75)								
<45	90	45.00	53	65.43	37	31.09	<0.001	
≥45	110	55.00	28	34.57	82	68.91		
Gender								
Male	82	41.00	31	38.27	51	42.86	0.517	
Female	118	59.00	50	61.73	68	57.14		
Marital status								
Married	127	63.50	32	39.51	41	34.45	0.466	
Not current married (never married, divorced, widowed)	73	36.50	49	60.49	78	65.55		
Education								
None or primary	157	78.50	65	80.25	92	77.31	0.620	
Completed secondary or postsecondary	36	21.50	16	19.75	27	22.69		
Employment								
Employment status change since COVID-19								
No change	94	47.00	40	50.63	54	45.38	0.550	
Negative—working less hours, lost job, or closed business	99	34.00	38	48.1	61	51.26		
Positive—working more hours or new job	5	2.50	1	1.27	4	3.36		
Household income change since COVID-19								
No change	20	10.00	6	7.41	14	11.76	0.419	
Gained income	1	0.50	0	0.00	1	0.84		
Lost income	179	89.50	75	92.59	104	88.14		
Social support								
Had someone who offered support when needed (financial, mental, social) before COVID-19								
No	6	3.00	27	34.62	44	37.93	0.638	
Yes	194	97.00	51	65.38	72	62.07		
Change in the support received before COVID-19 (N=194)								
No change	71	36.60	27	34.62	44	37.93	0.803	
More supported	14	7.22	5	6.41	9	7.76		
Less supported	109	56.19	46	58.97	63	54.31		
Food insecurity								
Household food insecurity (HFIAS)								
Food secure	22	11.00	11	13.58	11	9.24	0.449	
Mildly food insecure access	4	2.00	2	2.47	2	1.68		
Moderately food insecure access	28	4.00	8	9.88	20	16.81		
Severely food insecure access	146	73.00	60	74.07	86	72.27		

audio and written files were deidentified using unique identifiers and stored securely. Field notes were made during and after the interviews. All audio recordings were transcribed and translated into English where necessary. All translated transcripts were double-checked for accuracy by the project manager. The transcripts were exported to NVivo V.11, a qualitative data analysis

computer software package. A coding tree was provided during the initial inductive coding process. An initial coder (HK) conducted inductive coding by labelling and grouping sections of text that spoke about distinct issues in relation to this study, then connecting these sections of text and grouping similar codes together into categories.³³ A second round of deductive coding was conducted

Table 3 Microfinance participation, employment and social factors and their association with severe food insecurity among people living with HIV in Kenya during the COVID-19 pandemic

	Total (N=200)		Severe food insecurity					
			PR	95% CI	P value	aPR*	95% CI	P value
Microfinance group								
Active member of any microfinance groups before COVID-19								
No	81	40.50	Ref			Ref		
Yes	119	59.50	0.98	0.82, 1.16	0.777	0.98	0.82, 1.18	0.859
Employment								
Employment status change since COVID-19								
No change	94	47.00	Ref			Ref		
Negative—working less hours, lost job or closed business	99	34.00	1.18	0.99, 1.41	0.070	1.18	0.99, 1.42	0.070
Positive—working more hours or new job	5	2.50	0.99	0.55, 1.79	0.986	1.14	0.68, 1.92	0.622
Household income change since COVID-19								
No change	20	10.00	Ref			Ref		
Household lost some, most or entire income	179	89.50	1.93	1.12, 3.32	0.018	1.94	1.13, 3.30	0.015
Social support								
Since COVID-19, the support received before COVID-19 changed								
No change	71	36.6	Ref			Ref		
More supported	14	7.22	1.52	1.13, 2.05	0.006	1.53	1.17, 2.00	0.002
Less supported	109	56.19	1.47	1.17, 1.83	0.001	1.48	1.18, 1.84	0.001

Income gain was not assessed due to n=1 response.

*Adjusted for age, marital status, education level, gender.

aPR, adjusted prevalence ratio.

by secondary coders (JC and DNT) using an analytical framework, developed from the initial round of coding and the study's conceptual framework, containing the main domains of interest of this study: household food insecurity, microfinance group membership, employment and social support. Phenomenological study design was used given that the objective of the study was to understand the experiences and perceptions of participants during COVID-19. The methodological orientation used was content analysis. Data saturation was discussed among study team members prior to the study and based on the team's experiences conducting interviews, it was proposed that content saturation would be achieved by conducting 20 interviews per study site. The study team did not assess saturation while the interviews were already ongoing and scheduled with participants.

Patient or public involvement

²⁴Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Survey study sample: 200 individuals participated in the quantitative survey. The median age was 45 with an IQR of 23–75 (table 1). Among participants, 59.0% were female, 63.5% were married, 78.5% had either primary or no

formal education and 72.0% identified as the heads of their household.

Severe food insecurity was highly prevalent in this study; 73.0% reported being severely food insecure, 14.0% were moderately food insecure, 2.0% were mildly food insecure and 11.0% of participants were food secure since March 2020.

Microfinance participation and prevalence of food insecurity: 60% (n=119) reported microfinance group participation prior to the pandemic. While those who participated in microfinance were older ($p<0.001$), there were no other differences when comparing those who did and did not participate in microfinance (table 2). In adjusted analysis, microfinance group membership prior to the pandemic was not associated with the prevalence of food insecurity (adjusted prevalence ratio (aPR) 0.98; 95% CI 0.82, 1.18; $p=0.859$) (table 3).

Socioeconomic disruptions and prevalence of food insecurity: Since March 2020, 53.0% of participants reported a change in their employment with the majority reporting that they were working fewer hours, lost a job or closed a business, and only 2.5% reporting an increase in hours worked or a new job (table 1). Among participants, 90% reported a household income change since the start of COVID-19, with 89.5% reporting losing income. Income loss (some, most or all) since March 2020 was associated with severe food insecurity (aPR 1.94; 95% CI 1.13, 3.30; $p=0.015$) after adjusting for age, marital status,

educational level and sex, compared with those who did not report a change in income (table 3).

Among participants, 97.0% reported having someone who offered support when needed (financial, mental, social) before COVID-19. Among the 194 who reported having social support prior to COVID-19, 36.6% reported no change in social support since COVID-19 began, 7.2% reported more support and 56.2% reported less social support since COVID-19 began. Change in social support since COVID-19 was associated with severe food insecurity, with an increased prevalence of severe insecurity among those who reported less support (aPR 1.48; 95% CI 1.18, 1.84; $p=0.001$) and among those who reported more support (aPR 1.53; 95% CI 1.17, 2.00; $p=0.002$) compared with those who reported no change in social support after adjusting for age, marital status, educational level and sex (table 3).

Qualitative study sample: A total of 40 individuals participated in the qualitative study (table 1), and no participants refused participation. Among these participants, 80.0% were female. The median age of participants was 50, and the IQR was 45–57. Among participants, 45.0% were widowed, 40.5% were married, 12.5% were single and 2.5% were divorced. Most participants (62.5%) had primary school as the highest level of educational attainment, and 32.5% had a high school education. Among participants, 85.0% were the heads of their households and the median number of people living in the household was 6 (IQR: 3.5–7.5). The main source of income among participants was farming for 47.5% (19/40) and business for 35.0% (14/40).

Qualitative themes: Three main themes emerged from this analysis. The first described how food and economic insecurity may act as upstream barriers to HIV treatment outcomes. The second centred around why microfinance groups did not play a role in mitigating the socioeconomic impacts of the pandemic and the flooding. The third theme was understanding the potential benefits of social support (mental health, medication adherence and hardships) among microfinance members. The difficulty in continued engagement in both microfinance groups and other group activities related to economic investment and social support were due to government-imposed lockdowns and fears around COVID-19 transmission, as well as displacement of members who were separated from their homes and families due to flooding. These challenges were described in the context of participants who perceived themselves as a vulnerable, immunocompromised population with a high risk of contracting severe COVID-19. Each of these themes is discussed in more detail with supporting quotes below and in online supplemental file 8. Linkages between the qualitative and quantitative themes are outlined in table 4.

Theme 1: food and economic insecurity resulting from crises are inter-related and may be upstream barriers to HIV treatment outcomes

COVID-19 and flooding had significant impacts on patients' lives and livelihoods in terms of food insecurity and disruption to income and employment. Participants described a cyclical relationship between lack of employment and lack of food. The individual, and compounding, effects of these events may be early indicators of barriers to HIV treatment outcomes.

Individuals reported that floods led to the loss of agricultural crops or gardens, which served dual purposes of providing food for the family's consumption, and for providing a source of income by selling produce at the local marketplace.

The challenge came when the floods started and the income reduced and the floods are still here. Those floods have wiped out the town where we used to do our business. People have been displaced, till now we don't know where some of the people went to... – Busia participant (inactive group)

Participants reported that floods also led to destruction of homes and displacements, making it challenging to prepare meals or to make food due to lack of resources.

Yes, when you enter the house, the water level was at your chest so we had to carry things outside the house... We really suffered during that month, we couldn't eat, you could even miss cooking oil because going to the shop was a challenge... Every place was flooded, even finding charcoal or firewood was a problem, eating was a challenge... – Busia participant (active group)

The decline in income-generating opportunities due to COVID-19-related restrictions on movement and gathering also led to a decline in participants' ability to find food for themselves and their family, which in turn further dampened their ability to seek employment in an already constricted labour market caused by the pandemic.

Hunger came in among the members, they didn't have a chance to go out to look for work so that they could do farming, getting fertilizer became difficult. There was hunger and lack of money. Yeah that's what has brought challenges in our group. – Trans Nzoia participant (active group)

Household income was affected by the emergence of COVID-19 and the associated social and economic measures to mitigate its spread. Specifically, participants described loss of income due to market closures, where businesses for agricultural products were shut down. Curfews also made physical movement to obtain food and supplies difficult.

Corona has brought us stress doctor, because ever since it started, I used to sell vegetables, but this time they are chasing people from the market so there is no selling vegetables now I am forced to take them from house to house. When you go house to house, and you have worn a mask the people you take vegetables to they refuse they say you will infect them with flu they won't even welcome you, so

Table 4 Linkage between quantitative and qualitative results describing social and economic factors among people living with HIV in Kenya during the COVID-19 pandemic

Quantitative	Qualitative explanations for quantitative statements/findings
Prevalence of food security and socioeconomic disruptions Prevalence of food insecurity and socioeconomic disruptions. Since the first case of COVID-19 was detected in Kenya on 13 March 2020, 73.0% reported being severely food insecure, 14.0% were moderately food insecure, 2.0% were mildly food insecure and 11.0% of participants were food secure. There were no differences in severe food insecurity by microfinance participation (table 1). Since 13 March 2020, 53.0% of participants reported a change in their employment. Among participants, 2.5% reported working more hours, 49.5% reported working less hours, losing a job or closing a business. Among participants, 90% reported a household income change since the start of COVID-19. Overall, 0.5% reported gaining income, 23.5% lost some income and 66.0% lost all or most of their income. Among participants, 97.0% reported having someone who offered support when needed (financial, mental, social) before COVID-19. Among the 194 who reported having social support prior to COVID-19, 36.6% reported no change in social support since COVID-19 began, 7.2% reported more support and 56.2% reported less social support since COVID-19 began. There were no differences in employment disruption or social support changes by microfinance participation (table 2). Microfinance participation was not associated with prevalence of food security Association between microfinance participation and prevalence of food insecurity. Microfinance participation and prevalence of food insecurity. 60% (n=119) reported microfinance group participation prior to the pandemic. While those who participated in microfinance were older (p<0.001), there were no other differences when comparing those who did and did not participate in microfinance (table 2). In adjusted analysis, microfinance group membership prior to the pandemic was not associated with prevalence of food insecurity (aPR 0.82, 1.18; p=0.859) (table 3).	What are the reasons for increased severe food security, employment disruption and social support disruption? What are the individual and compounding effects and how do they impact HIV treatments? See theme 1: Food and economic insecurity resulting from crises are inter-related and may be upstream barriers to HIV treatment outcomes. COVID-19 and flooding had significant impacts on patients' lives and livelihoods in terms of food insecurity and disruption to income and employment. Participants described a cyclical relationship between lack of employment and lack of food. The individual, and compounding, effects of these events maybe early indicators of barriers to HIV treatment outcomes. Why was microfinance participation not associated w/ prevalence of food security? See theme 2: Microfinance groups did not play a mitigating role in terms of socioeconomic consequences of COVID-19 and flooding because of unexpected income loss and limits on gathering and displacement. We hypothesised that microfinance participation would act as a mitigating factor during these crises and that participation would be associated with a decrease in severe food insecurity among microfinance participants. However, microfinance groups did not play a mitigating role in reducing food insecurity and other economic impacts of COVID-19 and flooding. Participants reported three potential reasons that could explain this result: unexpected income loss in the group due to unforeseen expenses, limits on physical gathering and displacement.

Continued

Table 4 Continued	
Quantitative	Qualitative explanations for quantitative statements/ findings
Loss of income was associated w/ increased prevalence of severe food security Association between socioeconomic disruptions and prevalence of food insecurity. Since March 2020, 53.0% of participants reported a change in their employment with the majority reporting that they were working fewer hours, lost a job or closed a business, and only 2.5% reporting an increase in hours worked or a new job (table 1). Among participants, 90% reported a household income change since the start of COVID-19, with 89.5% reporting losing some, most or all of their income. Severe food insecurity was associated income loss (some, most or all) since March 2020 (aPR 1.94; 95% CI 1.13, 3.30; p=0.015) after adjusting for age, marital status, educational level and sex, compared with those who did not report a change in income (table 3). Among participants, 97.0% reported having someone who offered support when needed (financial, mental, social) before COVID-19. Among the 194 who reported having social support prior to COVID-19, 36.6% reported no change in social support since COVID-19 began, 7.2% reported more support and 56.2% reported less social support since COVID-19 began. Change in social support since COVID-19 was associated with severe food insecurity, with an increased prevalence of severe insecurity among those who reported less support (aPR 1.48; 95% CI 1.18, 1.84; p=0.001) and among those who reported more support (aPR 1.53; 95% CI 1.17, 2.00; p=0.002) compared with those who reported no change in social support after adjusting for age, marital status, educational level and sex (table 3). aPR, adjusted prevalence ratio.	What did a loss of income and change in social support associate w/severe food security? In what way? See theme 3: theme 3: Social support provided benefits (ie, mental health, medication adherence, hardships) among microfinance members despite lack of meetings in person. Although microfinance group activities decreased or ceased completely during COVID-19 and the floods, qualitative data highlight the role of microfinance group in providing social support, despite limited to no interactions in a group setting. Despite attempts at remaining connected during this time, the quantitative data suggested that those in microfinance groups felt less supported during the early phase of the pandemic than those who did not participate in microfinance. Perhaps the benefit of social support is received through in-person group interactions that were not feasible during the periods of restrictions. Therefore, the benefits of microfinance may not be sustained during periods of inactivity.

you go back home with your vegetables, you throw away some you give some away to neighbors. That has given us stress, we don't have money.... – Trans Nzoia participant (inactive group)

Participants highlighted that the concurring events of COVID-19 and the regional floods contributed to lost income, economic insecurity and a challenge to livelihood.

Corona has destroyed everything here since businesses were destroyed because there is no cash flow in businesses... so many things were affected, the floods affected us, Corona also affected us. People should keep on praying to God to let us live to see next year... – Busia participant (active group)

The lack of food imposed by COVID-19-related restrictions and the floods led to patients having a difficult time adhering to their ART regimen and, along with a loss of social support, was perceived to explain discontinuation of treatment among those in their groups who died during this time.

They were sick, they didn't get food to help themselves with, we got that history during the burial, they told us they lacked food to eat, then they got to a place they stopped medication because there was no one to encourage them; they quit medication and again went to look for traditional herbs. So, they put aside this medication, so it is like when they put medication away things got worse.

Theme 2: microfinance groups did not play a mitigating role in terms of socioeconomic consequences of COVID-19 and flooding because of unexpected income loss and limits on gathering and displacement

We aimed to understand if microfinance participation would act as a mitigating factor during these crises and that participation would be associated with a decrease in severe food insecurity among microfinance participants. However, microfinance groups did not play a mitigating role in reducing food insecurity and other economic impacts of COVID-19 and flooding. Participants reported three potential reasons that could explain this result: unexpected income loss in the group due to unforeseen expenses, limits on physical gathering and displacement.

Microfinance group investments were disrupted due to widespread income loss among members resulting from the flood and COVID-19. It was clear that members were forced to use their loans or earnings on unforeseen expenses due to the pandemic and floods and that many struggled to repay their debts to the group. Therefore, investment and income-dependent activities could not persist.

Corona has been a catastrophe because since the month of March when we started saying Corona, Corona, we thought that it was something that would come and go. But during the time we were investing money in table banking, everyone came to realize that getting cash was a problem. Small Jua Kali businesses had no liquid with cash. If a person borrows a loan, he won't be able to repay because even if he

takes his goods to the market, there was a time, during the month of March, they started ... they were chasing people from the market... – Busia participant (active group)

Microfinance group activities were also disrupted by the establishment of physical distancing measures associated with COVID-19 mitigation strategies, as well as the displacement of flood-affected communities. Lack of access to masks limited in-person gathering. Microfinance members were unable to meet due to physical displacement, and savings and loaning become difficult.

...So we had COVID and floods, two challenges so we did not meet...they said people should not sit in groups, so we were not meeting. – Busia participant (active MF group)

I can't lie to you, because there is nothing, immediately we started that merry-go-round Corona came in then everyone had to remain in their houses, we never meet, but if we had continued maybe we would have remembered something else that would have helped us.— Trans Nzoia participant (inactive group)

Theme 3: social support provided benefits (ie, mental health, medication adherence, hardships) among microfinance members despite lack of meetings in person

Participants discussed how they typically provided one another with social support during their normal group activities. Prior to the pandemic, advised each other on financial activities, encouraged HIV medication adherence and provided emotional support. Participants described how they looked out for one another, especially during times of hardship or periods of long absences.

We sit together and ask each other how one is faring, someone can say 'these drugs I'm taking probably have side effects' or maybe if I go to the clinic, I feel this and this. So we educate each other, advise each other, if it's like this you ask him 'What medicine are you taking?' everyone shares their experiences with medicine. During such meetings, we educate and advise each other, so that gives you motivation, sometimes you don't come, sometimes you don't take your drugs on time, so your fellow members will encourage you to take your medicine on time... – Busia participant (active group)

Although microfinance group activities decreased or ceased completely during COVID-19 and the floods, qualitative data highlighted the role of microfinance group in providing social support, despite limited to no in-person interactions within the groups. Members strove to continue supporting each other as best as they could under the circumstances, especially for some who held leadership positions in the groups. These methods, some of which existed pre-pandemic, included contacting individuals either via phone, going door to door or speaking to members when they passed each other on the streets or in the clinic. The importance of social support and checking on each other was recognised by participants as it especially related to mental health when the worries of COVID-19, food insecurity, loss of jobs and homes, along with usual pre-pandemic burden of living with

HIV and following a daily medication regiment, could lead to overthinking, stress and depression. Even though these continued visits were not without risks, members continued to do so, although with degrees of fear and caution.

As the leader of the group, we had to follow up with these people of ours, watch them as we encourage them, maybe if you are far they think of how Corona, COVID-19 the way it is like this may be things are over. So, we had a challenge but we were trying to encourage our fellows here saying that when this is over we will be back to normal. – Trans Nzoia participant (active group)

Despite these attempts at remaining connected during this time, it was possible that it was not sufficient to prevent stress and negative mental health symptoms among members. Therefore, the social support benefits of microfinance meetings may not be sustained during periods of restricted gatherings.

The challenge I have seen there is just people being unable to meet, its better to meet and educate each other than stay at home and be in much thought, stress to fill you and develop pressure for nothing, that is now the challenge, if you stay alone you have a lot of thoughts in your head [get worried a lot]. – Trans Nzoia participant (active group)

DISCUSSION

This study explored the social and economic consequences of overlapping public health and environmental emergencies on people living with HIV in Kenya. Severe food insecurity was prevalent among participants and both income loss and decreased social support were associated with severe food insecurity. We found that income loss since March 2020 was prevalent and described as attributable to loss of crops due to regional floods as well as limited opportunities to sell through markets due to COVID-19-related restrictions. Microfinance group engagement prior to the events did not appear to mitigate these consequences for participants during widespread economic strain. Lastly, food insecurity and loss of social support were identified as potential barriers to HIV treatment adherence and outcomes among people living with HIV in this study.

Almost 90% of study participants were food insecure, with over 70% of the total sample reporting severe food insecure during the period of the COVID-19 pandemic and regional floods. Climate change extremes, such as flooding or droughts, have been shown to contribute to the prevalence of food insecurity across countries in East Africa.³⁴ Although food insecurity had been recently increasing in Kenya, the estimates from this study far exceed those of prepandemic levels.¹⁹ These findings suggest that there may have been acute increases in food insecurity specifically among people living with HIV in rural settings. Multisectoral agriculture and livelihood interventions have been shown to decrease food insecurity among people living with

HIV in the prepandemic period and may be an additional approach to alleviate food insecurity among this population.³⁵

Approximately one-third of participants reported a negative change in employment during a period of 6–9 months after the emergence of COVID-19.³⁶ Despite a relatively low level of job loss or working hour reduction compared with other populations in Kenya, more than two-thirds of the study population reported having lost most or all their income, and almost 90% reported any income loss since March 2020.³⁷ The discrepancy in change in employment versus change in income highlight that study participants may be working the comparable hours to the prepandemic period, but generating less income. Given more than 40% of the study population works in farming or fishing, and 30% work as small business owners, these results suggest the potential loss of productivity. Other farming populations in Kenya had reported that decreased transportation, movement restrictions and increased cost of agricultural supplies impacted their agricultural practices and outputs during COVID-19.³⁷ Qualitative results from this study also highlight the loss of crops from the floods, and the challenge in selling products in the market. Importantly, study participants who reported a loss of income in any amount since COVID-19 were twice as likely to be severely food insecure, highlighting the interdependence between income and food security.

Microfinance membership among study participants was not associated with any improved economic stability or food security during the initial phase of the pandemic. Despite the success of microfinance interventions among people living with HIV in other settings and contexts,¹⁰ we did not observe any differences in income changes or food security between those who were and were not engaged in microfinance groups prior to the pandemic onset. Qualitative data from this study provide insight into the potential reasons why benefits of microfinance group engagement were not observed, which focused on unexpected expenses among group members and inability to meet due to COVID-19-related restrictions. This study highlighted the limitations of microfinance groups in the context of concurrent economic strain among group members. Microfinance groups were designed to provide economic support and potentially build resilience from economic insecurity. However, this population experienced two public health emergencies and associated economic hardships: floods destroyed crops and associated income used to facilitate microfinance investments and COVID-19-associated social distancing measures. The design of the microfinance intervention does not support widespread, concurrent, economic loss among members. Rather, microfinance group membership may provide support to individuals experiencing economic strain at different, non-concurrent, time periods.²³ Other economic interventions such as unconditional cash transfers may be needed during widespread economic emergencies.^{38 39}

Although participants in this study did not appear to receive substantial economic benefits from the microfinance groups during this crisis, qualitative results highlighted that group membership may play a role in providing social support. Participants described potential non-financial benefits among microfinance group members, such as emotional support, encouragement and sharing of advice on ART. Social support is established as being associated with improved economic stability, food insecurity and HIV outcomes and has been conceptualised as an intermediate between microfinance interventions and HIV outcomes.¹⁰ Other microfinance interventions have found that social support may reduce vulnerability, enhance the adaptive capacity of households and support recovery from adverse events.⁴⁰ More than half of study participants reported less social support since COVID-19 began and aligning with other studies,⁴¹ of those individuals were more likely to experience food insecurity. Despite the attempts of those in the groups to maintain the support of one another, the quantitative findings regarding reductions in social support among the microfinance members and the association between these losses and food insecurity suggest that the mechanism of action for social support in this type of intervention is most effective when members are able to physically gather and share common space. Additional research to tease apart these mechanisms is warranted.

The global scale up and expanded access to ART has reduced morbidity and mortality among people living with HIV. In response to COVID-19-related social distancing and restrictions, Kenya implemented programmatic changes to support individuals living with HIV and continue access to ART. These changes included increasing the number of days HIV medications were dispensed and increasing the quantity of medication dispensed during a visit.⁴² Additionally, medication delivery through care groups was also implemented. Efforts such as those conducted in Kenya support the global evidence that HIV treatment coverage across eastern and southern Africa was maintained between 2020 and 2021.⁴³ However, treatment disbursement and coverage does not equate to uptake and adherence. Our study suggests that despite efforts by the health system for organisational-level changes to support treatment coverage, food insecurity remained a barrier to treatment adherence and well-being for individuals. These results highlight that even in the context of supportive HIV care and treatment programmes and structure, barriers to HIV outcomes may persist in the context of food insecurity. Future research focused on the longitudinal relationships between the variables included in this analysis is warranted to understand the casual pathways that impact food insecurity and HIV treatment outcomes in the wake of these types of crises.

There are several limitations of this study that should be considered. Several factors may have introduced selection bias into the study. Recruitment was conducted through microfinance group leaders, and therefore,

participants never engaged in microfinance groups are likely to not have been recruited into the study. Eligibility criteria for study participation were dependent on being in HIV care at an AMPATH clinic and on ART before the COVID-19 pandemic. Therefore, the study sample may not include people living with HIV who were not engaged in care prior to the pandemic. Time since HIV diagnosis may be potential confounder in the relationships assessed, however, we were unable to incorporate this into our analyses. We were unable to assess the clustering of participants and/or results by the recruiter, and therefore, the results may be subject to bias. Although some survey questions ask about changes since March 2020 (microfinance group, social support and income) other measures (food insecurity) are asked about the participants current experiences, but we are unable to know if these experiences differ from pre-COVID-19 emergence. All measures collected in this study are self-reported and may be subject to recall bias or social desirability bias.

In the context of coinciding public health and environmental emergencies, people living with HIV in Kenya experienced widespread economic challenges. Programmatic efforts to support HIV treatment disbursement, coverage and adherence alone are not sufficient during an economic crisis affecting food insecurity. Integrating ART dispensing efforts alongside interventions to support food security for people living with HIV may be an opportunity to improve ART adherence and reduce mortality during a widespread emergency.

Author affiliations

¹Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

²Department of Pharmacy Practice, Temple University School of Pharmacy, Philadelphia, Pennsylvania, USA

³Academic Model Providing Access to Healthcare, Eldoret, Kenya

⁴Behavioral Sciences, Moi University School of Medicine, Eldoret, Kenya

⁵Health Economics Research Unit, KEMRI-Wellcome Trust Research Programme, Nairobi, Kenya

⁶Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA

⁷Moi University College of Health Sciences, Eldoret, Kenya

⁸Department of Pharmacy Practice, Purdue University College of Pharmacy, West Lafayette, Indiana, USA

⁹Brown University, Providence, Rhode Island, USA

Contributors Conceptualisation of the manuscript was led by CL, BG, JC and DNT. Quantitative analysis was led by CL and qualitative analysis was led by JC and DNT. Data collection was led by CK with HK. Original writing was led by CL. Feedback on results was provided by JC, DNT, CK, JW, HK, MV, JS, SDP, OG and BG. Review and contribution to draft manuscript was done by JC, DNT, CK, JW, HK, MV, JS, SDP, OG and BG. All the authors have read, commented and agreed to the submitted version of the manuscript. CL is the guarantor of the overall content of this paper.

Funding This study was funded by the Johns Hopkins Alliance for a Healthier World Launchpad Grant (Grant/Award No: not applicable). Authors, DNT, CK, JW, JS, SDP, OG and BG, are also supported by the National Institute of Mental Health of the National Institutes of Health under award number 5R01MH118075. CL was supported by the National Institute of Mental Health (NIMH) under Award Number F31MH128079, by the National Institute of Allergy and Infectious Diseases (NIAID) Johns Hopkins HIV Epidemiology and Prevention Sciences Training Program (5T32AI102623-08), and under the Desmond Tutu Health and Human Rights Fellowship.

Disclaimer The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. The content of this work is solely the responsibility of the authors and does not necessarily represent official views of the Johns Hopkins Alliance for A Healthier World or the National Institutes of Health.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was reviewed and approved as an amendment under the parent study protocol, by the Moi University/ Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC Approval # 0003054) and Brown University (IAA #18-90). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Given high level of stigmas associated with HIV status in Kenya, we do not wish to make data publicly available for the protection of participants, even though data are deidentified. Instead, we are pleased to provide data on reasonable request.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Carrie Lyons <http://orcid.org/0000-0001-8127-0704>

REFERENCES

- Kenya situation report: un office for the coordination of humanitarian affairs (ocha).
- Wangari EN, Gichuki P, Abur AA, *et al*. Kenya's response to the COVID-19 pandemic: a balance between minimising morbidity and adverse economic impact. *AAS Open Res* 2021;4:3.
- Nechifor Vostinaru V, Ferrari E, Kihui E, *et al*. COVID-19 Impacts and Short-Term Economic Recovery in Kenya. Luxembourg: Publications Office of the European Union, 2020.
- KENYA: Floods. Flash Update No.1: United Nations Office for the Coordination of Humanitarian Affairs (OCHA). 2020.
- Greibe Andersen J, Kallestrup P, Karekezi C, *et al*. Climate change and health risks in Mukuru informal settlement in Nairobi, Kenya - knowledge, attitudes and practices among residents. *BMC Public Health* 2023;23:393.
- Employment in Agriculture - Kenya. Available: <https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?end=2022&locations=KE&start=1991&view=chart>
- Agriculture, forestry, and fishing - GDP - Kenya. Available: <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=KE>
- Bezabih T, Weiser SD, Menbere MS, *et al*. Comparison of treatment adherence outcome among PLHIV enrolled in economic strengthening program with community control. *AIDS Care* 2018;30:369-77.
- Genberg BL, Wilson-Barthes MG, Omodi V, *et al*. Microfinance, retention in care, and mortality among patients enrolled in HIV care in East Africa. *AIDS* 2021;35:1997-2005.
- Nadkarni S, Genberg B, Galarraga O. Microfinance Interventions and HIV Treatment Outcomes: A Synthesizing Conceptual Framework and Systematic Review. *AIDS Behav* 2019;23:2238-52.
- FAOI, UNICEF, WHO. The state of food security and nutrition in the world 2021. In: *Transforming Food Systems for Food Security, Improved Nutrition and Affordable Healthy Diets for All*. Rome, Italy: FAO, 2021.
- de Pee S, Semba RD. Role of nutrition in HIV infection: review of evidence for more effective programming in resource-limited settings. *Food Nutr Bull* 2010;31:S313-44.
- Ahmed M, Merga H, Jarso H. Predictors of virological treatment failure among adult HIV patients on first-line antiretroviral therapy in Woldia and Dessie hospitals, Northeast Ethiopia: a case-control study. *BMC Infect Dis* 2019;19:305.
- Singer AW, Weiser SD, McCoy SI. Does Food Insecurity Undermine Adherence to Antiretroviral Therapy? A Systematic Review. *AIDS Behav* 2015;19:1510-26.
- Young S, Wheeler AC, McCoy SI, *et al*. A review of the role of food insecurity in adherence to care and treatment among adult and pediatric populations living with HIV and AIDS. *AIDS Behav* 2014;18 Suppl 5:S505-15.
- Bartelink IH, Savic RM, Mwisigwa J, *et al*. Pharmacokinetics of lopinavir/ritonavir and efavirenz in food insecure HIV-infected pregnant and breastfeeding women in Tororo, Uganda. *J Clin Pharmacol* 2014;54:121-32.
- Feldman MB, Alexy ER, Thomas JA, *et al*. The Association Between Food Insufficiency and HIV Treatment Outcomes in a Longitudinal Analysis of HIV-Infected Individuals in New York City. *J Acquir Immune Defic Syndr* 2015;69:329-37.
- Anema A, Chan K, Chen Y, *et al*. Relationship between food insecurity and mortality among HIV-positive injection drug users receiving antiretroviral therapy in British Columbia, Canada. *PLoS One* 2013;8:e61277.
- Mamlin J, Kimaiyo S, Lewis S, *et al*. Integrating nutrition support for food-insecure patients and their dependents into an HIV care and treatment program in Western Kenya. *Am J Public Health* 2009;99:215-21.
- Ivankova NV, Creswell JW, Stick SL. Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field methods* 2006;18:3-20.
- Weiser SD, Young SL, Cohen CR, *et al*. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. *Am J Clin Nutr* 2011;94:1729S-1739S.
- Weiser SD, Hatcher AM, Hufstедler LL, *et al*. Changes in Health and Antiretroviral Adherence Among HIV-Infected Adults in Kenya: Qualitative Longitudinal Findings from a Livelihood Intervention. *AIDS Behav* 2017;21:415-27.
- Hatcher AM, Lemus Hufstедler E, Doria K, *et al*. Mechanisms and perceived mental health changes after a livelihood intervention for HIV-positive Kenyans: Longitudinal, qualitative findings. *Transcult Psychiatry* 2020;57:124-39.
- Genberg BL, Wachira J, Steingrimsson JA, *et al*. Integrated community-based HIV and non-communicable disease care within microfinance groups in Kenya: study protocol for the Harambee cluster randomised trial. *BMJ Open* 2021;11:e042662.
- Genberg BL, Naanyu V, Wachira J, *et al*. Linkage to and engagement in HIV care in western Kenya: an observational study using population-based estimates from home-based counselling and testing. *Lancet HIV* 2015;2:e20-6.
- AMPATH - where we work, Available: <https://www.ampathkenya.org/where-we-work>
- The VSLA methodology, Available: <https://www.vsla.net/the-vsla-methodology/>
- Services CR. Savings led microfinance. 2019.
- Kafu C, Wachira J, Omodi V, *et al*. Integrating community-based HIV and non-communicable disease care with microfinance groups: a feasibility study in Western Kenya. *Pilot Feasibility Stud* 2022;8:266.
- Coates J, Swindale A, Bilinsky P. *Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide*. v. 3. Washington, DC.: FHI 360/FANTA, 2007.
- Zimet GD, Powell SS, Farley GK, *et al*. Psychometric characteristics of the Multidimensional Scale of Perceived Social Support. *J Pers Assess* 1990;55:610-7.
- Niba Rawlings N, Akwah EA, Musisi J, *et al*. Perceived risks of COVID-19, attitudes towards preventive guidelines and impact of the lockdown on students in Uganda: A cross-sectional study. *PLoS One* 2022;17:e0266249.
- Gale NK, Heath G, Cameron E, *et al*. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol* 2013;13:117.
- Gebre GG, Rahut DB. Prevalence of household food insecurity in East Africa: Linking food access with climate vulnerability. *Clim Risk Manag* 2021;33:e.
- Cohen CR, Weke E, Frongillo EA, *et al*. Effect of a Multisectoral Agricultural Intervention on HIV Health Outcomes Among Adults

- in Kenya: A Cluster Randomized Clinical Trial. *JAMA Netw Open* 2022;5:e2246158.
- 36 Kavanagh NM, Marcus N, Bosire R, *et al.* Health and Economic Outcomes Associated With COVID-19 in Women at High Risk of HIV Infection in Rural Kenya. *JAMA Netw Open* 2021;4:e2113787.
 - 37 Merchant EV, Fatima T, Fatima A, *et al.* The Influence of Food Environments on Food Security Resilience during the COVID-19 Pandemic: An Examination of Urban and Rural Difference in Kenya. *Nutrients* 2022;14:2939.
 - 38 Guimarães NS, Magno L, de Paula AA, *et al.* The effects of cash transfer programmes on HIV/AIDS prevention and care outcomes: a systematic review and meta-analysis of intervention studies. *Lancet HIV* 2023;10:e394–403.
 - 39 Pega F, Pabayo R, Benny C, *et al.* Unconditional cash transfers for reducing poverty and vulnerabilities: effect on use of health services and health outcomes in low- and middle-income countries. *Cochrane Database Syst Rev* 2022;3:CD011135.
 - 40 Adger WN, Dessai S, Goulden M, *et al.* Are there social limits to adaptation to climate change? *Clim Change* 2009;93:335–54.
 - 41 Mburia-Mwalili A, Wagner KD, Kwobah EK, *et al.* Social support and the effects of the COVID-19 pandemic among a cohort of people living with HIV (PLWH) in Western Kenya. *PLOS Glob Public Health* 2023;3:e0000778.
 - 42 P. Preko SS, Abebe A, Vandy AO, *et al.* Rapid Adaptation of HIV Differentiated Service Delivery Program Design in Response to COVID-19: Results from 14 Countries in Sub-Saharan Africa. *AIDS* 2020.
 - 43 IN DANGER. UNAIDS Global AIDS Update 2022. Geneva: Joint United Nations Programme on HIV/AIDS, 2022.