ORIGINAL PAPER

Increased Depression during COVID-19 Lockdown Associated with Food Insecurity and Antiretroviral Non-Adherence among People Living with HIV in Uganda

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Abstract

The health and economic threats posed by the COVID-19 pandemic can be sources of great distress among people living with HIV, which in turn can impact the management of their HIV disease. We examined change in depression from pre- to post-lockdown restrictions and correlates of elevated depressive symptoms, including antiretroviral therapy (ART) adherence. Participants enrolled in a randomized controlled trial of an ART adherence intervention in Uganda. The month-12 follow-up assessment was fully administered just prior to the start of the pandemic-related lockdown in March 2020; at the conclusion of the lockdown three months later, we administered a mixed-methods phone-based assessment. ART adherence was electronically monitored throughout the study period, including during and after the lockdown. Depression was assessed with the 8-item Patient health questionnaire (PHQ-8), on which scores > 9 signify a positive screen for elevated depressive symptoms. A sample of 280 participants completed both the month-12 and post-lockdown assessments. Rates of elevated depressive symptoms nearly tripled from month 12 (n = 17, 6.1%) to the post-lockdown assessment (n = 50, 17.9%; McNemar test < .001). Elevated depressive symptoms at post-lockdown were associated with being female, indicators of economic struggles at month 12 (unemployment, low income, high food insecurity), and lower ART adherence during the 3-month lockdown period [mean of 71.9% (SD = 27.9) vs. 80.8% (SD = 24.1) among those not depressed; p = .041] in bivariate analysis. In multiple regression analysis, higher food insecurity [adj. OR (95% CI) = 4.64 (2.16–9.96)] and perception that the pandemic negatively impacted ART adherence [adj. OR (95% CI) = 1.96 (1.22–3.16)] remained associated with a greater likelihood of elevated depressive symptoms, when other correlates were controlled for. Qualitative data suggested that economic stressors (lack of food, work, and money) were key contributors to elevated depressive symptoms, and these stressors led to missed ART doses because of lack of food and stress induced forgetfulness. Elevated depressive symptoms significantly increased during the COVID-19 lockdown and was associated with food insecurity and reduced ART adherence. Mechanisms for identifying and treating depression and food insecurity are needed to help PLHIV cope with and mitigate the harmful effects of unexpected crises that may impede disease management and access to food.

Keywords Depression · COVID-19 · Adherence · HIV · Economic · Food insecurity · Uganda

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Introduction

For people living with HIV (PLHIV), the COVID-19 pandemic has introduced risks to their health on multiple fronts. As people with compromised immune systems, they may have heightened susceptibility to more severe effects of the novel coronavirus if infected [1, 2]. Although health care facilities and ART distribution mechanisms continued to operate (albeit with reduced staff), the lockdowns and related restrictions placed on public transportation in order to limit COVID-19 transmission made access to health care services more challenging in settings like Uganda [3, 4]. This can impede adherence and continuous access to ART [3, 5], thereby resulting in greater risks of treatment failure, drug resistance and opportunistic infections [6]. The pandemic has also impacted economic well-being by impeding ability to work, as well as buying and selling goods [7, 8].

These health and economic threats posed by the pandemic can create distress, fear and anxiety among PLHIV about how COVID-19 could impact their lives directly, as well as indirectly through its impact on family, friends, and others in their social network [9–11]. The pandemic aside, depression has been shown to be more common among PLHIV compared to the general population [12], and depression and elevated depressive symptoms among PLHIV have been associated with worse HIV care adherence and outcomes [13, 14]. While there is evidence of the influences of economic stressors on depression [15, 16], and the relationship between depression and ART adherence, in the absence of a health crisis such as COVID-19, we hypothesized that these stressors were likely to be exacerbated by the pandemic and lockdown restrictions, resulting in greater depression and a stronger association between depression and adherence.

To better understand if and how COVID-19 and the lockdown restrictions were associated with depression, we used mixed-methods to examine change in depression from pre- to post-lockdown and correlates of depression, including ART adherence. Findings from this analysis could inform policies for how to optimize mental health and disease management during unexpected crises that may exaggerate health risks and impede access to routine health care services.

Methods

Design

The BEST study (clinicaltrials.gov-NCT03494777) is an ongoing three-arm randomized controlled trial of an intervention for improving ART adherence that uses small incentives based on behavioral economic principles with the aim of improving ART medication adherence [17]. Participants assigned to one of the two intervention arms receive the intervention throughout their 24 months of study participation, and assessments are administered every 6 months; a detailed description of the intervention and study protocol is available in a prior publication [17]. At the time of Uganda's COVID lockdown in March 2020, participants had completed the month-12 wave of follow-up assessments. At the conclusion of the lockdown in June, participants were contacted via phone (between mid-June and mid-September 2020) and administered a small set of questions about their experience and thoughts related to the pandemic and its effect on their health and HIV disease management. Just prior to the post-lockdown assessment, a random subgroup was selected to be administered supplementary qualitative questions. Data from the baseline, month-12 follow-up and post-lockdown assessments, as well as electronically monitored ART adherence were used in the analyses presented in this paper. The study protocol was approved by RAND's Human Subjects Protection Committee and the Institutional Review Board of Mildmay Uganda.

Participants

All participants were active clients at Mildmay Uganda, a clinic in the capital city of Kampala that specializes in the provision of comprehensive HIV/AIDS prevention, care, and treatment services. The clinic remained open during the lockdown; however, public transportation was banned during the lockdown, which greatly impeded access to the clinic. ART prescriptions were issued every three months for stable clients (compared to every two months prior to the pandemic), which could help clients' ability to maintain an adequate supply of ART medication. Eligibility criteria included: age ≥ 18 years, on ART ≥ 2 years, and adherence problems (defined as showing lack of viral suppression at most recent assay, being sent to adherence counseling within past 6 months, or showing disease stage 3 or 4 as per WHO guidelines). Participants provided written informed consent.

Measures

Baseline and month 12 assessments were administered in-person, while the COVID-19 post-lockdown assessment was administered over the phone. Clients were paid 20,000 USh (~$6USD) to cover transportation costs after each assessment (payment for the COVID-19 phone assessment was issued at the subsequent clinic visit). Assessments were conducted in English or Luganda depending on the preference of the client.

Depression

Depression was assessed with the 8-item Patient Health Questionnaire (PHQ-8). A PHQ-8 total score > 9 has been empirically shown to correlate highly with clinical depression [18]; those who scored above this cutoff screened positive for depression and are referred to in this paper as having elevated depressive symptoms.

For the subset of participants who were randomly preselected to be administered qualitative questions, those with PHQ-8 > 9 were asked two opened-ended questions: (1) "Can you please tell me how (or why) you may have been more bothered by any of these problems?" (Interviewer was trained to probe for how COVID-19 may have impacted these problems); and (2) "Have any of these problems made it more difficult for you to take your HIV medication as prescribed?".

ART Adherence

ART adherence was measured with the use of microelectronic monitoring caps that record when the bottle cap is removed; each opening is intended to represent when the dose is ingested by the client, who are informed to remove a single dose from the bottle at the time they intend to ingest the dose.

Perceived Impact of the COVID-19 Pandemic on HIV Disease Management

Perceived impact of the COVID-19 pandemic on HIV disease management was assessed with ratings of level of agreement with two statements: "The COVID-19 pandemic impacts my ability to come to the clinic" (response options ranged from 1 'strongly disagree' to 4 'strongly agree') and "The COVID-19 pandemic impacts my ability to take ART medication as prescribed" (response options ranged from 1 'strongly increases my ability' to 5 'strongly decreased my ability').

Socio-Demographics

Socio-demographics that were assessed included age, sex, highest level of formal education (a binary variable signifying whether or not at least some secondary education was received), employment status (a binary indicator of whether the respondent was engaged in activity resulting in monetary, food or other forms of compensation), relationship status (whether or not participant was in a committed relationship), and monthly income (a binary variable signifying at least 100,000 Ush earned monthly income was used in analysis). Food insecurity was assessed with five items adapted from the Food Insecurity Experience Scale

[19] that enquires about access to food and the associated constraints on ability to obtain adequate quantity of food; response options were yes (1)/no (0) and scores of 4 or 5 were categorized as representing high food insecurity.

Analysis

Descriptive statistics were used to examine the frequency distributions of sample characteristics, and bivariate statistics were used to examine associations between variables and differences between groups (Chi square tests; independent 2-tailed t-tests), as well as change within individuals (McNemar tests and paired t-tests). A logistic regression model was used to examine correlates of elevated depressive symptoms at post-lockdown assessment; independent variables consisted of variables that were correlated with elevated depressive symptoms at level of $p < 0.10$. A linear regression model [including elevated depressive symptoms classification, time (indicator for month), and the interaction of time and elevated depressive symptoms classification as independent variables] was used to compare adherence by elevated depressive symptoms status in each month following the start of the lockdown (March 2020) until three months after the end of the lockdown (September 2020), with standard errors clustered by client.

Among the participants who were randomly selected to be asked the open-ended questions, thirteen reported symptoms signifying elevated depressive symptoms at the post-lockdown assessment; we used an inductive content analysis to identify themes that emerged from the narrative data of this subgroup of participants [20]. The phone interviews were recorded, transcribed and then translated into English. Two coders read the transcripts, extracted exemplary quotations by study topic (i.e., factors contributing to elevated depressive symptoms, and impact on adherence), and iteratively developed short phrases to represent emergent themes [21, 22]; any discrepancies in coding were reconciled by mutual agreement.

Results

Sample Characteristics

Of the 330 participants who enrolled in BEST, 280 (84.8%) completed both the month 12 follow-up and post-lockdown assessments (183 in the intervention arms and 97 in the usual care control) and thus comprise the analytic dataset for this analysis. The analytic sample and the subgroup of participants that did not complete these assessments were similar with regards to all socio-demographics, HIV disease characteristics, food insecurity and elevated depressive symptoms at baseline, with the exception that those in the

analytic sample were less likely to be employed (61.4% vs. 78.9%; chi square (df) = 4.4 (1); p = 0.035). Table 1 lists the characteristics of the analytic sample as a whole, and by elevated depressive symptoms status at the post-lockdown assessment.

Prevalence and Correlates of Elevated Depressive Symptoms

At month 12, the mean PHQ-8 score was 3.71 (SD = 3.24), and 17 participants (6.1%) had depressive symptoms signifying elevated depressive symptoms. At the post-lockdown assessment, the mean PHQ-8 score increased significantly to 5.26 (SD = 4.61; paired t-test = − 5.81, df = 279, p = 0.000), and 50 participants (17.9%) had elevated depressive symptoms, which was a significant increase (McNemar test = 0.000). We further examined depressive symptoms among those whose post-lockdown assessment took place in the early months following the end of the lockdown (June and July) compared to later months (August and September), and found that PHQ-8 scores [June/July: mean (SD) = 5.4 (4.9); August/September: mean (SD) = 5.0 (4.2); t = − 0.78, df = 275; p = 0.437] and proportion with elevated depressive symptoms (June/July: 19.5%, August/September: 15.7%; chi square = 0.67, df = 1; p = 0.412) did not differ significantly.

Among those with elevated depressive symptoms post lockdown, the most common depressive symptoms (present at least most days in the past two weeks) were difficulty sleeping (68.0%), depressed mood (60.0%), and feeling bad about oneself (54.0%), poor appetite (52.0%), and loss of interest in normally pleasurable things (50.0%).

Table 1 lists the bivariate correlates of elevated depressive symptoms at the post-lockdown assessment. Compared to those not depressed at the post-lockdown assessment, those with elevated depressive symptoms were more likely to be female and have several indicators of worse economic well-being at month 12: more unemployment and lower monthly income, and higher food insecurity. Elevated depressive symptoms were also associated with lower ART adherence during the 3-month lockdown period (but not prior to the lockdown), as the depressed group had a mean adherence of 71.9% (SD = 27.9) compared to 80.8% (SD = 24.1) among those not depressed (t = 4.1; df = 273; p = 0.041). There was a marginal association (p < 0.10) for those with elevated depressive symptoms to perceive the COVID pandemic as having a negative impact on their ability to take ART, compared to those who were not depressed.

Figure 1 plots the average monthly adherence during the three months of lockdown as well as the three months post-lockdown for those with and without elevated depressive

Table 1 Sample characteristics in the total sample and comparisons between those with and without elevated depressive symptoms (PHQ-8 > 9) at the COVID-19 post-lockdown assessment

| Variable	Total sample (n = 280)	Elevated depressive symptoms			
		No (n = 230)	Yes (n = 50)	Bivariate t/Chi square (df); p	Multivariate regression OR (95% CI)
Measures at month 12 assessment					
Age	37.5 (12.8)	38.0 (13.0)	34.7 (11.6)	1.7 (278); .097	0.98 (0.96, 1.01)
Secondary education or higher	54.3%	54.3%	54.0%	0.0 (1); .964	–
Male	37.1%	40.0%	24.0%	4.5 (1); .034	0.48 (0.22, 1.04)[T]
In relationship	50.4%	51.3%	46.0%	0.5 (1); .497	–
Currently employed	61.4%	64.3%	48.0%	4.6 (1); .031	0.57 (0.29, 1.14)
> 100,000 Ush monthly income	50.4%	53.5%	36.0%	5.0 (1); .025	–
High food insecurity	17.5%	13.0%	38.0%	17.7 (1); .000	4.56 (2.13, 9.75)*
ART adherence from baseline to start of lockdown	79.8% (20.4)	80.7% (20.1)	75.7% (21.8)	1.6 (278); .121	–
Measures assessed at post-lockdown assessment					
Perception that COVID pandemic negatively impacts ability to come to clinic	2.24 (1.28)	2.25 (1.29)	2.20 (1.26)	0.2 (278); .811	–
Perception that COVID pandemic negatively impacts ability to take ART	2.88 (0.82)	2.83 (0.70)	3.14 (1.18)	− 2.5 (57); .075	1.99 (1.24, 3.18)*
ART adherence during lockdown (March 25 to post-lockdown assessment)[a]	79.2% (25.0%)	80.8 (24.1)	71.9 (27.9)	2.5 (275); .041	0.43 (0.12, 1.50)

OR odds ratio, *CI* confidence interval, *ART* antiretroviral therapy

*p value < .05

[a]n = 277

[T]p value < .10

Fig. 1 Monthly antiretroviral adherence during and post-lockdown by elevated depressive symptoms status measured at the post-lockdown assessment
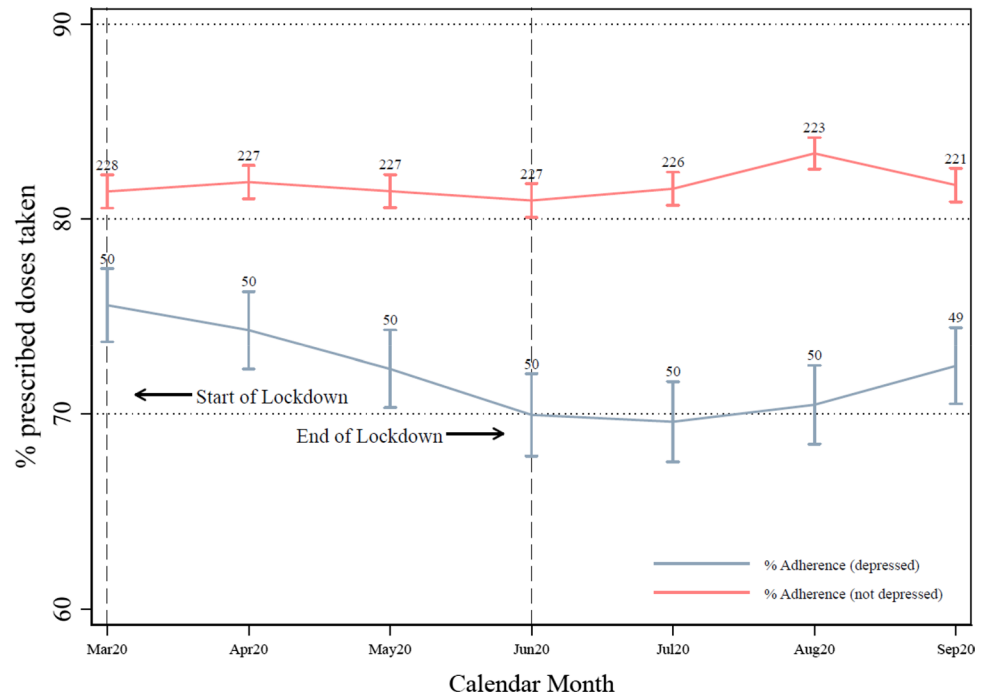
symptoms at the post-lockdown assessment. The trajectory of adherence over the 6-month period did not differ significantly between the two groups, as reflected by non-significant interactions of month and elevated depressive symptoms classification (statistics available in supplementary materials). However, the graph qualitatively depicts a stable level of adherence throughout this six-month period for the non-depressed group, while in the depressed group there is a decline in adherence during the lockdown period followed by a return to pre-lockdown adherence levels three months after the lockdown; in the depressed group, mean adherence in the third month after end of lockdown (74.4%) was similar to adherence during the month prior to lockdown (75.7%; t = 0.2; df = 273; p = 0.76).

In logistic regression analysis to identify correlates of elevated depressive symptoms at the post-lockdown assessment, we included as independent variables all the variables that were at least marginally correlated (p < 0.10) with elevated depressive symptoms in the bivariate analysis, in addition to study arm (intervention or control). An examination of correlations among these independent variables revealed that income and employment were highly correlated (r = 0.66; p = 0.000), so income was not included in the model; ART adherence and perception that COVID negatively impacted ART adherence were not correlated, so both were retained in the model. There were two significant independent correlates of elevated depressive symptoms at post-lockdown: higher food insecurity [adj. OR (95% CI) = 4.64 (2.16–9.96)] and perception that the pandemic negatively impacted ART adherence [adj. OR

(95% CI) = 1.96 (1.22–3.16)] were associated with a greater likelihood of elevated depressive symptoms; being male was marginally associated with a lower likelihood [adj. OR (95% CI) = 0.50 (0.22–1.10)] (see Table 1).

Perceived Factors Contributing to Elevated Depressive Symptoms and ART Adherence

Of the 50 participants with elevated depressive symptoms at the post-lockdown assessment, 13 (10 female, 3 male) had been randomly preselected (prior to the assessment) to be administered the qualitative component, enabling an assessment of stressors (including the pandemic and lockdown) that had contributed to their elevated depressive symptoms, and how these stressors impacted their medication adherence.

Stressors Contributing to Elevated Depressive Symptoms

Surprisingly, none of the participants expressed worry about catching COVID as a source of their depressive symptoms. However, participants indicated the pandemic contributed to their elevated depressive symptoms through several economic-related stressors, including lack of food (which was reported only by the female participants), work and money. One 47 year old woman described the challenges that the lockdown placed on her ability to work and acquire food, "The lockdown came when I wasn't ready for it. I am in a small place (and) I cannot plant food, so everything is for buying and yet money is done so I wasn't ready for it."

Another 31 year old participant described her struggles for finding work during the lockdown, "They [jobs] got lost, because people no longer have money. Some are just resuming so she [employer] tells you to wait and I first work so that I get some money and then I give [you] a job." These economic challenges led respondents to not only worry about their own well-being, but also their ability to provide for their children, "My problem, even eating food to get satisfied… I have kids, how will they eat…They are the ones that bring a problem" (44 year old female).

The lack of public transportation caused by the lockdown restrictions contributed to these stressors as people had less flexibility to get to work, as highlighted by this 28 year old male, "It has affected me so bad in that even when you say that you have gotten a job that you are going to do in town, …how can I get the transport (to get to the job)!" A 27 year old female revealed the connections between depression and lack of income and mobility in this response: "I think it (depression) is because of not being able to get even the little that you used to get, as you have no freedom of movement in the current situation. (You are faced with) having to see that you have lost many things."

In Ugandan culture, particularly in rural settings where poverty is common, individuals are used to relying on family and community members for support and resources. Respondents spoke of their stressors being intensified by the fact that their social network was less able to support them because those who would normally help were also experiencing similar challenges. This is exemplified by this remark from a 28 year old male, "Because now for me in this COVID, some of my friends who live far away whom I have been talking with– I hear them crying for me; they have no food or drinks and they are running to me for help, yet I don't have anything." Similarly, a 31 year old female said, "Friends have helped us before, but right now the situation is bad and they do not have."

How These Stressors Impacted Adherence

Eight out of 13 individuals expressed that changes in their lives as a result of the pandemic had impacted their adherence. Participants alluded to two main reasons for the pandemic's impact on adherence. One was having to missing medication doses because of lack of food, as highlighted by this comment from a 31 year old female, "If you have nowhere you are getting money from, you cannot provide yourself with what to eat … You cannot wake in the morning and take medicine when you didn't eat supper." The other reason was forgetting doses because of the distress the person was feeling; a 47 year old male stated, "Yes, when you are having stress, it can cause you to forget [to take your medicine]."

Discussion

In this study of HIV clients who have been on ART for several years, evaluation of mental health following the end of lockdown restrictions related to the COVID-19 pandemic revealed high levels of elevated depressive symptoms and a significant increase in elevated depressive symptoms compared to just prior to the lockdown and its associated restrictions. Elevated depressive symptoms were associated with food insecurity and perceived negative impact of the pandemic on ART adherence.

We saw elevated depressive symptoms nearly triple in prevalence in our sample (17.9%) following the end of the lockdown (but still in the midst of an ongoing pandemic) compared to the 6.1% rate found at the month 12 assessment, which was just prior to the first detection of COVID-19 in Uganda. This prevalence of elevated depressive symptoms at the post-lockdown assessment was similar to what has been reported in other studies of depression among PLHIV in sub-Saharan Africa that were not conducted in the context of the COVID-19 pandemic [23]. It is also similar to the 13% prevalence rate found in our earlier study of people just entering HIV care in Uganda [24] as well as that of other research groups [25, 26], but much higher than the 4% rate found in this same study when participants had been on ART for one year. This large rise in elevated depressive symptoms reflects the significant stressors experienced by PLHIV and the larger community as a result of the pandemic and lockdown restrictions. Other studies of depression among PLHIV in the context of COVID-19 have been few [9–11], but do support the heightened presence of mental health challenges posed by the pandemic.

Consistent with our prior research of depression among PLHIV in Uganda [15, 16], both the quantitative and qualitative data highlighted the role of economic stressors, and food insecurity in particular, as key contributors to the observed increase in elevated depressive symptoms. The closing of businesses and public transport were severe impediments to being able to work, earn income and obtain food, and caused stress related to being able to care for oneself and one's family. Poverty is prominent for most Ugandans at the best of times, including the client base at the study clinic, so the economic strain caused by the lockdown restrictions only magnified the pressure that people feel to meet basic survival needs. These findings highlight the importance of programs that can ensure food access, to augment mental health interventions that address depression and distress during unexpected crises.

Women were disproportionately affected by elevated depressive symptoms during the lockdown period. While the literature suggests that women living with HIV in

sub-Saharan Africa may have higher rates of depression than their male counterparts [27], there are also factors related to the pandemic that could contribute to this gender differential. In the context of this pandemic, women may be particularly vulnerable to economic obstacles for reasons such as needing to stay at home and care for children who cannot attend schools (which were closed during the lockdown), rather than going to work. Domestic violence is not uncommon in patriarchal societies such as Uganda [28], and stressors associated with the pandemic and lockdown may heighten such violence [29], thus contributing to the worsened mental health of women.

Elevated depressive symptoms were associated with significantly lower ART adherence during the 3-month lockdown period. There is a large body of literature supporting the negative correlation between depression and ART adherence [30], including our research in Uganda [31], and research during the COVID-19 pandemic have also highlighted this relationship [9], although this study may be among the few to have an objective measure of adherence. The proportion of prescribed doses taken was on average about ten percentage points lower among those with elevated depressive symptoms at the post-lockdown assessment compared to those not depressed. Earlier research showed that this magnitude of difference is associated with worse virologic and treatment outcomes [32, 33]. Although the BEST trial was evaluating the effects of an adherence intervention, the intervention (which involved rewards for good adherence) was suspended during the lockdown, so it was unlikely to directly influence the adherence observed during the lockdown period.

A wide range of treatments are effective in treating depression in PLHIV, including antidepressants and talk therapy [34, 35]. In addition to improving mental health, depression treatment has been associated with greater ART utilization, adherence and outcomes [36]. Furthermore, it is reasonable to hypothesize that by alleviating depression, depression treatment increases motivation and self-efficacy to engage in self-care behaviors such as use of masks and social distancing to protect against COVID-19 infection, resuming work and productivity when lockdown restrictions are eased, and caring for self and family. While improved access to mental health services is needed in Uganda and throughout Sub-Saharan Africa in general for PLHIV, such services are particularly important in times of crisis. People need resources and supports to help manage and cope with the multiple stressors posed by the pandemic, highlighting the need for mental health supports, as well as food-based interventions as noted above.

The strengths of this study include it being one of the first to investigate elevated depressive symptoms among PLHIV in Sub-Saharan African in the midst of COVID-19, and the use of an objective measure of ART adherence.

The use of mixed methods to elucidate the relationships between mental health, disease management and pandemic-related stressors are central to the merits of this study. However, there are also limitations to the study. These include a reliance on the self-report PHQ-8, rather than a more rigorous diagnostic interview, to classify the presence of depression. It is important to note that the PHQ-8 has been found to have high correspondence with classification of major depression performed by diagnostic interviews [18], and the PHQ has been validated in Sub-Saharan Africa with PLHIV [37]. We also did not assess whether participants had contracted COVID-19, which could directly affect depression [38]. Other limitations include the change in data collection methods from in-person to phone-based interviewing, which could influence responses; the vulnerability of self-report measures to social desirability bias; and the qualitative methods did not allow for data saturation on the topic of depression, as this was not the primary focus of the study.

Conclusions

The COVID-19 pandemic and associated lockdown restrictions was associated with a significant increase in elevated depressive symptoms in our study sample. Elevated depressive symptoms were more common among women and was associated with worse ART adherence and various aspects of economic well-being, but particularly food insecurity. With the multiple health and economic stressors imposed by the pandemic and other like crises that may arise in the future, mechanisms for identifying and treating depression, as well as food access interventions that can mitigate the stressors that contribute to depression are needed. Such resources can help PLHIV cope with and mitigate the harmful effects of these stressors, so that health and disease management can be sustained until stability is restored and stressors subside.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Ethical Approval Approval was obtained from the Institutional Review Board at Mildmay Uganda and the Human Subjects Protection Committee at the RAND Corporation. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Consent to Participate Informed consent was obtained from all individual participants included in the study.

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