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## Links between Household-Level Income-Generating Agricultural Intervention and the Psychological Well-Being of Adolescent Girls in Human Immunodeficiency Virus-Affected Households in Southwestern Kenya: A Qualitative Inquiry



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### A B S T R A C T

**Background:** Adolescent girls may experience poor psychological well-being, such as social isolation, shame, anxiety, hopelessness, and despair linked to food insecurity.

**Objectives:** This study aimed to investigate the experiences with and perceived effects of a household-level income-generating agricultural intervention on the psychological well-being of adolescent girls in human immunodeficiency virus (HIV)-affected households in southwestern Kenya.

**Methods:** We conducted 62 in-depth interviews with HIV-affected adolescent girls and caregiver dyads in *Adolescent Shamba Maisha* (NCT03741634), a sub-study of adolescent girls and caregivers with a household member participating in *Shamba Maisha* (NCT01548599), a multisectoral agricultural and finance intervention trial aimed to improve food security and HIV health indicators. Participants were purposively sampled to ensure diversity in terms of age and location. Data were audiotaped, transcribed, translated, and uploaded into Dedoose (Sociocultural Research Consultants, LLC) software for management. Data were analyzed thematically based on reports from Dedoose.

**Results:** We found evidence that a household-level structural intervention aimed at increasing food and financial security among persons living with HIV can contribute to better psychological well-being among adolescent girls residing in these households. The intervention also affected: 1) reduction of social isolation, 2) reduction of shame and stigma, 3) increased attendance and concentration in school, 4) improved caregiver mental health, and 5) reduced parental aggression and improved household communication. These associations were reported more commonly among those in the intervention arm than the control arm.

**Conclusions:** This study extends existing research by demonstrating how multisectoral structural interventions delivered at a household level can improve the psychological well-being of adolescents. We recommend that future research test livelihood interventions designed specifically for adolescent girls that integrate food-security interventions with other elements to address the social and psychological consequences of food insecurity holistically.

This trial was registered at [clinicaltrials.gov](https://clinicaltrials.gov) as NCT03741634.

**Keywords:** HIV, psychological well-being, food insecurity, agricultural interventions, adolescent girls, Kenya

## Introduction

An estimated 19–50% of adolescents and young people in Africa experience poor psychological well-being [1–3]. Adolescence

is a critical time for mental health promotion because the onset of mental health disorders commonly occurs during this developmental period [4,5]. From a broad perspective, the psychological well-being of adolescents encompasses self-acceptance, being

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content with life, having an abundance of positive emotions, positive relations with others, autonomy, environmental mastery, and personal growth coupled with the absence of psychopathology [6–8]. Multiple physical, emotional, and social changes, including a desire for greater autonomy, peer pressure, exposure to poverty and food insecurity, gender norms, abuse, or violence (including harsh parenting and bullying), can make adolescents vulnerable to mental health problems [9]. Poor psychological well-being in adolescence is strongly related to other health and development outcomes, notably lower educational achievements, substance abuse, violence, suicide, and poor reproductive and sexual health [9]. In addition, mental health disorders pose substantial economic and emotional burdens on the healthcare system and families [10]. Therefore, promoting psychological well-being and protecting adolescents from adverse experiences and risk factors that may impact their potential to thrive is critical for physical and mental health during adolescence and the transition to adulthood [11,12].

Food insecurity, defined as “the limited or uncertain availability of nutritionally adequate, safe foods or the inability to acquire personally acceptable foods in socially acceptable ways” [13], is associated with poor psychological well-being and behavior problems in adolescents [14–16]. Many adolescents experience psychological issues linked to food insecurity, such as social isolation, shame, anxiety, hopelessness, and despair [17–19], and these experiences contribute to or exacerbate poor psychological well-being [16,18]. Food insecurity is also a major stressor that requires behavioral adaptation by adolescents, such as saving and stretching foods, seeking informal help from others, and prematurely assuming responsible adult roles through employment and other self-supporting activities, including exchanging sex for food or money [20]. The resulting disempowerment from food insecurity drives food-insecure adolescents into high-risk behaviors and sexual exploitation, thus making them more likely to have unplanned pregnancies, sexually transmitted infections, and a higher risk for HIV acquisition [21–23]. Additionally, food insecurity is associated with behavioral problems in school, poor academic performance, and dropping out of school, thus contributing to social disadvantage when adolescents transition to adulthood [24–26].

Preventive and health-promoting interventions to address adolescents' psychological well-being are largely unavailable in low- and middle-income countries [27–31]. The few existing interventions on adolescent psychological well-being from low-resource settings have predominantly focused on adolescents living with HIV and AIDS, thereby excluding adolescents who are not infected but living in households affected by HIV who may also have a heightened risk for poor psychological well-being [32]. Finally, few studies have explored how such interventions may improve mental health. Household-level interventions may be effective in reducing adverse outcomes by addressing food insecurity, poverty, and caregiver well-being, but little is known about the mechanisms through which an intervention designed to address food insecurity and alleviate poverty among HIV-affected families affects the psychological well-being of adolescents within these households. To address these gaps, the main aim of this study was to qualitatively investigate how a household-level agricultural livelihood intervention may affect food insecurity and the psychological well-being of adolescents in HIV-affected households living in southwestern Kenya.

## Methods

### Design

This qualitative study was a sub-study nested within a matched-pair cluster randomized controlled trial of a multi-sectoral agricultural intervention among HIV-infected farmers on antiretroviral therapy known as *Shamba Maisha* (NCT01548599) [33]. The sub-study was launched ~18 mo after the parent study had started [33,34].

### Intervention

The *Shamba Maisha* intervention has been described elsewhere in detail [35,36]. In summary, this multisectoral intervention aimed to address some of the root causes of food insecurity and poor health in southwestern Kenya: relatively poor agricultural practices reliant on unpredictable rainfall patterns and increasing frequency of drought occurring in the setting of climate change. The intervention comprised 1) a market-interest loan (~\$175 United States dollars) from Equity Bank Kenya, Ltd (Nairobi, Kenya) required to purchase agricultural implements; 2) the agricultural implements purchased with the loan, including a human-powered water pump (Super MoneyMaker, Kickstart International), seeds, fertilizers, and pesticides; and 3) education in financial management and in sustainable and regenerative farming practices. The education sessions took the form of 8 small group didactic and discussion sessions and hands-on skills learning over the first 3 mo of enrollment. Topics covered included sustainable farming techniques, pump use, seed selection, plant spacing, soil and water conservation, integrated pest and disease management, pre and postharvest handling and marketing, record keeping, savings, investments, and group dynamics. Importantly, participants were trained in sustainable agriculture techniques, helping to improve soil fertility while reducing the reliance on synthetic fertilizer. The study randomized 8 matched pairs of health facilities in the southwestern region of Kenya in a 1:1 ratio to the intervention and control arms and enrolled 44–55 participants/facility (total  $n = 704$ ). All participants were followed for 2 y. Individuals in the control arm were offered a similar intervention at the conclusion of their participation in the trial [35]; they were informed about this offer as part of the consenting process during enrollment. Individuals in the intervention arm were not offered additional benefits at the end of the study.

### Setting

The Adolescent *Shamba Maisha* study was conducted in Kisumu, Migori, and Homa Bay counties located in southwestern Kenya. This southwestern region has a high prevalence of both HIV and food insecurity [37,38]. At the end of 2018, the prevalence of HIV was 19.6%, 17.5%, and 13% in Homa Bay, Kisumu, and Migori, making up nearly half of HIV cases nationwide, respectively [38]. In addition, ~40% of households report lacking food or money to purchase food [37].

### Study population

The study targeted adolescent girls aged 13–19 y and their primary guardians who were current participants in the *Shamba Maisha* study. The primary guardian was defined as the parent/guardian who is primarily responsible for preparing food for the

adolescent girl and seeking healthcare (i.e., for illness) for the adolescent when needed. The adolescent girl had to live in the same household as a *Shamba Maisha* participant in either the intervention or control arm, and the caregiver was not necessarily the index *Shamba Maisha* participant.

### Recruitment

We recruited adolescent girls with their primary caregivers into the study using purposive sampling to ensure regional variation and diverse ages. Two trained female trilingual (English, Dholuo, and Kiswahili) qualitative interviewers approached the adolescent girls with their primary caregivers independently to explain the study, answer questions about the study, and guide the eligible and willing participants through the informed consent process. As part of the consenting process, they were given information about the study and the reason they were being asked to participate, including a member of their household participating in the main *Shamba Maisha* trial. Households were eligible if they had 1) an adult who was a participant in the parent study, 2)  $\geq 1$  adolescent girl aged 13–19 y old who was not born with HIV, and 3) the adolescent had a parent/primary guardian aged  $\geq 18$  y old who resided in the compound. Adolescent girls were eligible to participate in the study if they were not married, aged between 13 and 19 y, and not living with HIV at the onset of the parent study. None of the adolescent girls selected to participate in the study were emancipated since they were all still under the care of parents/guardians. Adolescents who were married, head of households, male, over the age of 19, or index participants in the main study were excluded. Caregivers were eligible if they were the primary caregivers for the adolescent and were either a participant in the parent study or residents in the compound of participants in the parent study.

### Sample size

At both intervention ( $N = 8$  sites) and control sites ( $N = 8$  sites), we recruited and enrolled a total of 31 dyads comprising adolescents 13–19 y old who were enrolled in the Adolescent *Shamba Maisha* sub-study with their primary caregiver. This sample size was deemed adequate to reach the theoretical saturation of the issues we were investigating. Since we were interested in assessing how the intervention affected psychological well-being, we deliberately oversampled intervention over control participants by 7 dyads to obtain more insights into the intervention effects. Thus, we enrolled 19 adolescent-parent/guardian dyads in the intervention and 12 adolescent-parent/guardian dyads in the control arm. Emphasis was placed on ensuring that there were participants across a range of socio-demographic characteristics, including diverse ages and study sites.

### Data collection

Trained and experienced female qualitative researchers interviewed participants in a private location at the discretion of the participant. Interviews were conducted at the study exit, i.e., after intervention implementation. The adolescent girl and parent/guardian interviews were conducted separately, sometimes on different days and locations. All interviews were done in English, Dholuo, or Kiswahili. We used semi-structured in-depth interview guides ([Supplementary Material](#)) with open-ended questions to obtain the lived experience of the adolescents and caregivers from

their perspectives as well as to elicit reflections on if and how the intervention may have changed financial circumstances, interpersonal relationships, including family relations, food security, and mental health. Questions related to psychological well-being explored 1) perceived changes, if any, in general life at home or with friends since participation in the *Shamba Maisha* study started, 2) perceived changes, if any, in psychological well-being, 3) perceived changes, if any, in behavior, attitudes, moods, and adolescent-caregiver interactions, 4) perceived effects of the intervention on the caregiver-adolescent relationship (intervention participants only), and 5) accessibility to food, household necessities, and education. Questions were similar between adolescents and caregivers, lasted  $\sim 90$  min, and were digitally recorded and transcribed. The interview guides were developed using practical knowledge of the topic and existing literature. Follow-up and probe questions were guided as much as possible by the participants themselves, and we allowed participants to determine the pace and content of the interview. This method allowed for new questions to emerge during the interviews, thus giving us a thorough view and rich narratives of the participant's experiences and perspectives. The interviewers were trained extensively not to ask any questions in a leading manner and to spend the same amount of time probing on positive and negative effects and mechanisms.

### Analysis

The interviews were transcribed verbatim and translated into English. Transcription and translation were conducted by experienced transcriptionists, and the resultant transcripts were checked by assigned study staff for quality before they were approved and filed. Data coding and analysis were done concurrently with the initial data collection period. We first familiarized ourselves with the emerging data by reading the transcripts and noting the initial ideas. We developed a coding frame by combining deductive and inductive coding, which included identifying preliminary codes from the interview guides and available transcripts. We used the scrutiny techniques proposed by Ryan and Bernard [39] to identify themes and subthemes by paying attention to repetitions, indigenous typologies, metaphors and analogies, transitions, linguistic connectors, and similarities and differences. We then used the coding frame developed to code transcripts uploaded in Dedoose (Sociocultural Research Consultants, LLC), an online qualitative software program for managing qualitative data. Four researchers with experience in qualitative analysis and knowledge of the cultural context and study population conducted the analysis, paired for the purposes of double coding. We randomly selected 40% of transcripts to be double-coded, and we calculated inter-coder reliability by measuring the degree of consensus between the 2 different coders coding the same data [40]. The coder discrepancies were discussed with other researchers for feedback until a consensus was established. We extracted relevant data excerpts together with memos that contained analytic notations that contextualized and described emerging key findings and used typical statements for citation. We used the constant comparative analysis method to discover dominant themes by comparing and contrasting within and between transcripts, study arms, and adolescent-parent/guardian dyads [41]. For example, we compared and contrasted themes across and between all adolescents and caregivers at the

individual level but also compared themes within adolescent-caregiver pairs at the dyadic level. The constant comparative analysis allowed us to compare, contrast, and revise iteratively across transcripts to form categories, establish the boundaries of the categories, assign the segments to categories, summarize the content of each category, and describe how the *Shamba Maisha* intervention affected the psychological well-being of adolescents. To address the aim of the study, we focused on perceived changes that occurred since the household joined the intervention. Throughout the illustrative quotations, pseudonyms are used to maintain the confidentiality of the participants. We further ensured trustworthiness by weekly or biweekly peer debriefing of the 2 primary analysts, peer debriefing with a knowledgeable qualitative analyst not directly involved in the analysis, and member checking of findings with community members [42,43].

### Ethics statement

The Kenya Medical Research Institute Science and Ethics Review Unit (KEMRI/SERU/CMR/P00086/3696) and the Committee for Human Research of the University of California San Francisco granted the study ethical approval. Participation was entirely voluntary and had no impact on either the receipt of intervention or standard of care services at the link health facilities. Audio data were stored in password-protected folders separate from the transcripts. All the transcripts had pseudonyms and no identifiers linked to them. Informed written consent was obtained from all participants. Parents of adolescent girls who were <18 y and not emancipated provided written consent and the adolescents' written assent prior to their participation in the study.

## Results

### Participant characteristics

Between April 24, 2019 and December 20, 2019, 62 participants were interviewed (38 intervention and 24 controls). Most caregivers (71%) were female, and two-thirds were aged 40 and above, with the majority (71%) having primary-level education (Table 1). Over two-thirds (69%) were married, and 58% reported a household size of over 6 members. The ~60% of the adolescent girls enrolled were aged 13–16, and just over half reported having postprimary education.

In general, the participants reported that the *Shamba Maisha* intervention improved the food-security and financial status of the households. Financial and food-security improvement, in turn, contributed to the better psychological well-being of adolescent girls living in these households, possibly through 1) reduction of social isolation, 2) reduction of shame and stigma, 3) increased school attendance and mental concentration, 4) improved caregiver mental health, and 5) reduced parental aggression and improved household communication.

### Reduction of social isolation

Participants in the intervention arm reported how lack of food and finances prior to *Shamba Maisha* led to their feelings of loneliness and exclusion from community events, which undermined their psychological well-being. Improved household wealth and food security opened up social networks, however,

**TABLE 1**  
Socio-demographic attributes of participants

Attribute	Frequency	%
Gender of caregiver		
Male	9	29
Female	22	71
Age of caregiver (y)		
<40	10	32
≥40	21	68
Education level of caregiver		
Primary	22	71
Postprimary	9	29
Marital status of caregiver		
Married	20	69
Widowed	9	31
Household size of caregiver		
2–6	13	42
>6	18	58
Age of adolescent (y)		
13–16	16	59
17–19	11	41
Education level of adolescent		
Primary	13	48
Postprimary	14	52
Study arm		
Intervention	19	61
Control	12	39

and restored their “dignity” and gave them a sense of belonging among their peers.

*When I was in form one, I had a few friends who abandoned me because sometimes I lacked a lot of things, and if I asked them for help, they withdrew from me, and they didn't want to associate with me. However, Shamba Maisha has raised my living standard, and so I have been able to have more friends to associate with. I have many friends because now my life has changed. I have moved from poverty to a better state of life that has dignity. Right now, I don't borrow things from my friends; I now even have things I can share with my friends!* – Akoth, Adolescent, Intervention, 17 y

At baseline, participants described how they felt “despised,” isolated, and alone before the intervention. Some of them had gone through traumatic experiences in the past that left them without a stable source of income. This changed after the intervention, however, because the money raised from vegetable sales supported them to lead a better life comparable to their neighbors.

*Lily (pseudonym) used to behave as such, but now she easily interacts with other people. Before, she could not associate with her peers from better-off families because she could not dress well or wear good shoes, and neither did she have body lotion as her counterparts did. However, presently, whatever classy commodity, as long as it is affordable, she will get from the vegetable sale income, buy body lotions, and have neatly designed hair. This has boosted her self-esteem, and she can now stand up amidst people and talk confidently.* – Nyarongo, Female Caregiver, Intervention

### Reduction of shame and anticipated and perceived stigma associated with food insecurity

Economic and food insecurity brought about feelings of shame and stigma. Caregivers felt ashamed of having to ask for

help every time they needed food or money for commodities. Equally, children were stigmatized when they had to ask for help from friends and neighbors for basic supplies. Some participants, however, described how their financial situations changed after the participant got involved with *Shamba Maisha* and started growing vegetables for sale. This information from the caregiver was corroborated with the account of the adolescent girl who expressed gratitude for having overcome the degrading situation they were in:

*There was a time I went to a certain person and explained that I hadn't paid fees and I needed to borrow money, but he refused. He blamed me for taking my daughter to school without proper preparation. This really discouraged me as I kept thinking about what he had said. Farming and growing my vegetables have really helped me out of such shame. ... My daughter is happy now because life was very difficult back then. In the past, she was sad and easily angered.* – Nyaloka, Female Caregiver, Intervention

I used to feel bad because begging is degrading. Now, I am happy because she doesn't beg anyone for food; she just works hard on the farm and then gets us what to eat. She earns her own money, and that makes me feel good because it comes with respect. – Akinyi, Adolescent, Intervention, 19 y (Nyaloka's daughter)

Control participants felt that they were stigmatized for having to work to help their families make ends meet. This further entrenched their psychological distress. This family situation made adolescent girls get involved in child labor to supplement the family income and remain in school. This created the feeling of stigma and isolated adolescent girls.

*... Nowadays, I hardly get time to meet my friends because I always spend time working and coming back home late. This makes my friends keep away. ... Because of my engagements with casual jobs and so they treat me as a low-class person. They despise me.... I don't visit them quite often because they look down upon me, and so I avoid seeing them so as to prevent them from further looking down upon me.* – Adhiambo, Adolescent, Control, 17 y

### **Increased school attendance and concentration**

Across both control and intervention arms, adolescent girls reported a desire to remain in school. As such, the lack of school fees and other school supplies was a great source of stress and anxiety among the adolescent girls. Staying at home for long periods before going back was particularly stressful, as they would fall behind in the syllabus.

*What troubled my mind before was that I was always sent back home for fees; I would return and find that people were ahead in the school syllabus, so I didn't understand the concepts well because they were taught when I was away. I would do exams and find things that I had never heard of, and this made me fail. It was just stressful. I even wished to drop out of school because it was embarrassing to keep on failing. Failing exams made me have low self-esteem; I, therefore, would try to compensate by not going for lunch and missing breakfast so that I could spend many hours studying.* – Akoth, Adolescent, Intervention, 17 y

When the household finances improved because of *Shamba Maisha*, caregivers were able to generate income and pay school fees. This not only decreased stress and anxiety among adolescent girls but also enabled them to stay in school longer, concentrate better, and improve school performance. It also helped adolescent girls regain hope of staying in school and even positively affected their belief in their ability to do better in school.

*Now, I believe that I can do better because I am able to access the things I need in life through the farming that my mother does. I am at peace, and I know that if I work hard, everything will be okay; this is not similar to the past when I was losing hope in schooling.* – Akoth, Adolescent, Intervention, 17 y

### **Improved caregiver mental health**

Caregivers in the control arm who were food insecure described feelings of hopelessness and despair when they could not meet the needs of their adolescent girls, and these feelings were also mirrored in their adolescent girls. Caregivers and adolescent girls felt trapped in a cycle of pain and disappointment resulting from the inability to secure basic needs such as food.

*I have difficulty in that if I don't get these things [food, sanitary towels]. When I arrive home without them, my daughter normally feels pained in the heart because she can see that her peers have them, and so it becomes difficult for me. I wish I had; I would have given her, but it's only that I don't have it. I didn't get it now; I cannot give her, so my daughter feels pain, and I also feel hurt because I feel like I have wronged her by not being able to meet her needs.* – Nyakan, Female Caregiver, Control

Although adolescent girls in the control arm reported that seeing their parents undergo stress because they could not provide for them affected their mental health negatively, those from the intervention arm highlighted how the intervention improved the financial situation at home, thus reducing stress for their caregivers. Caregivers described how their reduced stress contributed to improved happiness and lower anxiety among adolescent girls.

*The kind of work my mother was doing was menial and stressful; she earned KSh 100 [~\$1] from selling firewood. It would disturb me as to how she would spend this money; there were food, clothes, and school fees that she needed to pay for. I was worried about how she would use that KSh 100 to meet all the household needs.* – Awino, Adolescent, Intervention, 17 y

*She is happy now because she knows that we can easily get food. She doesn't look sad like she used to when we lacked food.* – Nyauriri, Female Caregiver, Intervention

### **Reduced parental aggression and improved household communication**

Caregivers reported that poverty and not being able to provide for their adolescent girls made them irritable, and they could exhibit excessive anger toward themselves and even their children. This situation was said to have improved after the intervention increased household wealth and alleviated their

financial concerns because they could now meet the needs of their adolescent girls.

*I think that my getting very angry was mostly caused by the lack of money, and so I considered the children to be an extra burden to me. The children needed things that I couldn't provide for, and that made me really bitter. When I started having a stable income from farming through Shamba Maisha, things began to change. I could now provide for them the things that they wanted, and I had less anger inside of me. I was able to talk calmly to my children, and they responded to my advice more swiftly.* – Nyarongo, Female Caregiver, Intervention

Reports from adolescent girls corroborated their caregivers' sentiments that linked food and financially secure with harsh and irritable behaviors. Food and financial security resulted in caregivers being calm and more approachable, which improved caregiver-adolescent communication and, eventually, mental health.

*I'm free these days, and I do not have the fear I initially had. Nowadays, I can sit with my mother and even tell stories. Before [the Shamba Maisha intervention], she was quick to fight and inflict pain on me at the slightest provocation, and it isn't easy to be free or close to such a person... Back then, I would even get scared to ask her for the sanitary towels; she was always quarreling; therefore, I would suffer in silence. I never used to tell her when I had a problem.* –Adongo, Adolescent, Intervention, 17 y

### Challenges with the intervention for some families

Although *Shamba Maisha* was reported to have resulted in improved food and financial security for many families, a few intervention families still reported food and financial insecurity. They attributed the failure to see intervention benefits to several reasons, including the irrigation pump requiring >1 person to operate and, therefore, was less effective if extra labor was not available. Other reasons given were lack of farm inputs when the grace period for supplying complementary inputs elapsed, withdrawal of the pump because of the inability to repay the loan after the conclusion of the 2-y follow-up period of the main study, and crop destruction by either rain floods or wild animals (especially hippopotamus) that contributed to participants defaulting in repayment of their loans.

*At the moment, I don't find it very easy to provide food because the Shamba Maisha people took away the MoneyMaker pump they had given us since we didn't clear our loan. The reason why we didn't clear our loan is because of the hippopotamus that used to destroy our vegetables; thus, no sales to clear the loan. We can only salvage the situation by getting fences to protect the areas we have grown vegetables in.* – Nyakano, Female Caregiver, Intervention

### Discussion

In this qualitative study, we investigated links between household food insecurity and psychological well-being among HIV seronegative adolescent girls residing with a caregiver living with HIV in southwestern Kenya. We found evidence that a household-level structural intervention aimed at increasing food and financial

security among persons living with HIV can contribute to better psychological well-being among adolescent girls residing in these households. The intervention also affected: 1) reduction of social isolation, 2) reduction of shame and stigma, 3) increased attendance and concentration in school, 4) improved caregiver mental health, and 5) reduced parental aggression and improved household communication. We also found that a few intervention households still reported food and financial insecurity, which they attributed to difficulties managing the pump, paying back the loan, or crop destruction by wild animals (especially hippopotamus) or flooding.

Understanding the links between food and financial insecurity and adverse psychological well-being in adolescent girls is important in informing targeted intervention design [28,44]. Similar to other studies [45,46], we found that HIV seronegative adolescents residing with a caregiver living with HIV in our control households were at particularly high risk of living in a food-insecure and impoverished household, which further increased their vulnerability to adverse psychological well-being. Food insecurity is linked to poor psychological well-being in several ways. As demonstrated in this study and others, individuals living with food insecurity often report powerlessness, guilt, shame, and desperation, which further contribute to anxiety and depressive symptoms [19,44,47]. In a study among females living with HIV in the United States, Palar et al. [48] showed that food-insecure females are stigmatized, which causes chronic stress, thus worsening mental health outcomes. Furthermore, in the San Francisco Bay Area, Whittle et al. [47] found food insecurity to be socially isolating and that getting food at public free meal sites can be stigmatizing. Adolescents in households in the intervention arm of *Shamba Maisha* reported a reduction of social isolation, shame, and stigma and were happy, hopeful, and able to plan for their future. Our study findings, therefore, contribute to understanding the non-nutritional benefits of intervening in food insecurity among adolescent girls.

The present study provides examples of how improving the food and economic security of households that received the *Shamba Maisha* intervention improved parental mental health, reduced parental aggression, and improved household communication, which in turn reduced adolescent stress. Throughout the study, adolescents in intervention households expressed a positive mental outlook when they perceived their parents to be stress-free and open to communication. Caregivers in the intervention arm exhibited improved mental health because of being able to have food and finances to provide for other needs. This link between improved mental health and food availability is corroborated by a study by Homlong et al. [50], which illustrates a strong association between parental mental health and adolescent psychological well-being [49]. This relationship underscores the importance of addressing the psychological needs of adolescents' caregivers living with HIV. Our findings around how improved household economics and food insecurity improved parental mental health, which in turn reduced adolescent stress, provide evidence for the importance of household-level interventions to address adverse conditions in which adolescents live that affect their psychological well-being. Furthermore, whereas this intervention, which targeted households, improved adolescents' psychological well-being, and other interventions, particularly those aimed at individual adolescents, may have negative consequences of

increasing shame and stigma being experienced by adolescents [44,51]. For instance, in a study by Frongillo et al. [44] among adolescents receiving food aid in South Carolina and Oregon, adolescents felt shame knowing that peers were aware of their food insecurity and about them participating in food assistance through school.

The results of our study are supported by other types of economic empowerment interventions in sub-Saharan Africa, which have shown significant improvements in mental health [52–55]. The programs have ranged from conditional or unconditional cash transfers [52] and social protection funds transfers [56] to employment programs [53], but all with the same goal of supporting impoverished households. Although some of these programs improved mental health, similar to our study [57,58], others showed no or unclear impact [59,60]. For instance, 1 systematic review of employment interventions found that 60% of the studies examined had a positive impact on common mental disorders such as depression and anxiety [53].

The findings of our study need to be considered in view of several strengths and limitations. First, the interviews were conducted at the study exit, i.e., after intervention implementation, and thus, the self-reports may be prone to recall bias. To address recall bias, we helped jog the memory of adolescents by referring to the grade (for those in school) they were at the time when *Shamba Maisha* started, and this helped align their thoughts with events during that school calendar year. Second, social desirability bias may have affected results. Although interviewers never participated in the intervention implementation, they knew whether they were interviewing intervention or control participants, which might have resulted in some bias. To minimize social desirability bias, we trained researchers to ask questions neutrally and hired local researchers who were not involved in intervention delivery or other aspects of the study. We also assured participants that their responses would not be shared with other study team members. Intervention participants, however, still may have overemphasized the positive effects of the intervention to maintain good standing with the research team. Third, our study focused on female adolescents, and given the gendered nature of food insecurity and poverty, these findings cannot be generalized to male adolescents. The focus on female adolescents, a group that is often neglected in many international health studies and has been found to be particularly adversely affected by food insecurity, is a strength of this study [61–63]. Finally, interviews were conducted mainly in Dholuo, and therefore, cultural variations beyond the Luo-speaking regions of Kenya are not represented. Further research to confirm findings and to empirically test recommended programmatic implications is needed.

In conclusion, our study findings have implications for intervention, program and policy design, and evaluation. This study expands the existing, albeit limited, literature on interventions addressing food and economic insecurities on the psychological well-being of HIV-affected adolescents in resource-limited settings. Most interventions addressing food security, especially in sub-Saharan Africa, focus on making food more accessible or available through increasing access to soil fertilizers, improved seeds, or access to finance and ignore the individual and often trans-generational social and psychological

component of food insecurity on vulnerable groups such as adolescent girls and young females. The psychological distress associated with food insecurity can directly impact current and future adolescents' development and health. Future research should aim to replicate our findings using rigorous methods [42, 43] and to investigate the integration of food-security interventions with programs that holistically address the social and psychological consequences of food insecurity experienced by adolescents to inform the development of interventions, policies, or programs that incorporate considerations about mental health. For further research on the connection between food insecurity and the mental health of children and adults, collaboration among investigators trained in nutrition and public health and investigators trained in adolescent development and mental health would be valuable.

## Author contributions

The authors' responsibilities were as follows– MAO: contributed to the design of the research, conduct of the research, data analysis, writing the primary draft, and refining; GO: contributed to the conduct of the research, data analysis, and writing of the paper; LS, AC, EAF, CRC, PW, EAB, SDW: contributed to the design of the research, manuscript writing, critical review of manuscript drafts; and all authors: read and approved the final manuscript.

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## Data availability

Data described in the manuscript will be made available upon request, with written approval for the proposed analysis from the Kenya Medical Research Institute (KEMRI) Scientific and Ethics Review Unit (SERU). Their application forms and guidelines can be accessed at <https://www.kemri.org/seru>. To request these data, please contact either the authors or the KEMRI SERU at [seru@kemri.org](mailto:seru@kemri.org). Data cannot be shared publicly because this study was conducted with approval from the KEMRI SERU, which requires that we release data from Kenyan studies (including de-identified data) only after they have provided their written approval for additional analyses.

Code availability (software application or custom code): Not applicable.

## Conflict of interest

The authors declare that they have no competing interests



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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tjn.2023.10.008>.

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