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Comparing the effect of a multisectoral agricultural intervention on HIV-related health outcomes between widowed and married women

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Abstract

Introduction: Widowed women make up 18–40% of the 12 million women living with HIV in eastern and southern Africa. Widowhood has also been associated with greater HIV morbidity and mortality. We compared the effectiveness of a multisectoral climate adaptive agricultural livelihood intervention (called *Shamba Maisha*) on food insecurity, and HIV related health outcomes among widowed and married women living with HIV in western Kenya.

Methods: We implemented *Shamba Maisha* (NCT02815579) using a cluster-randomized control trial design. The intervention arm received an US\$175 in-kind loan to purchase a micro-irrigation pump, seeds, and fertilizer, and received eight training sessions on sustainable agriculture and

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Author's contribution

Jackline Atieno-Odhiambo: Conceptualization, Methodology, Formal analysis, Writing - Original Draft. **Craig R. Cohen:** Conceptualization, Methodology Investigation, Writing - Review & Editing, Supervision, Funding acquisition. **Sheri D. Weiser:** Conceptualization, Methodology, Investigation, Writing - Review & Editing, Funding acquisition. **Edward A. Frongillo:** Methodology, Formal analysis, Investigation, Writing - Review & Editing. **Rachel L. Burger:** Investigation, Writing - Review & Editing, Project administration. **Elly Weke:** Investigation, Writing - Review & Editing, Project administration. **Pauline Wekesa:** Investigation, Writing - Review & Editing, Project administration. **Elizabeth A. Bukusi:** Conceptualization, Investigation, Writing - Review & Editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2023.116031>.

financial management. Study outcomes were measured every 6 months over a 24-month follow-up period and trends in outcomes assessed using multilevel mixed-effects models.

Results: The trial enrolled 232 (61.5%) married and 145 (38.5%) widowed women. Widowed women (mean age 42.8 ± 8.4 years) were older than married women (35.8 ± 9.0 years) ($p < 0.01$). Almost all widowed women (97.2%) self-identified as household heads compared to 10.8% of married women. Comparing widowed vs married women, reduction in food insecurity (-3.13 , 95%CI $-4.42, -1.84$ vs. -3.08 , 95%CI $-4.15, -2.02$), depressive symptoms (-0.21 , 95%CI $-0.36, -0.07$ vs. -0.19 , 95%CI $-0.29, -0.08$), internalized stigma (-0.33 , 95%CI $-0.55, -0.11$ vs. -0.38 , 95%CI $-0.57, -0.19$), and anticipated stigma (-0.46 , 95%CI $-0.65, -0.28$ vs. -0.35 , 95%CI $-0.50, -0.21$) was similar for both groups. In contrast, improvements in social support (-2.22 , 95%CI $-3.85, -0.59$ vs. -4.00 , 95%CI $-5.16, -2.84$; $p = 0.08$) and reduction in enacted stigma (0.01 , 95%CI $-0.06, 0.08$ vs. -0.14 , 95%CI $-0.20, -0.09$; $p < 0.01$) were weaker for widowed than married women.

Conclusions: Our study is among the first comparing the effect of a livelihood intervention on HIV health outcomes among widowed and married women. Widowed women experienced similar benefits as married women on individual-level outcomes, but weaker benefit on outcomes dependent on their external environment like enacted stigma and social support. Future trials and programs targeting widowed women should bolster stigma reduction and social support.

Keywords

Widowhood; Marital status; Food insecurity; Depression; HIV/AIDS; Social support; Stigma; Africa

1. Introduction

Among 12 million women living with HIV/AIDS in eastern and southern Africa (UNAIDS, 2022), an estimated 2.2–4.8 million are widows (O’Laughlin et al., 2016; Sinku et al., 2016; The Loomba Foundation, 2015; UNAIDS, 2022). Widowed women have between 2 and 6 times higher odds of living with HIV/AIDS than married women or women single unmarried (Adedeji et al., 2020; Hailu et al., 2020; O’Laughlin et al., 2016; Sinku et al., 2016). In Kenya, the HIV prevalence among widows in 2013 ranged between 17.0 and 44.2% (Magadi et al., 2021). Historically, widowhood has had a complex yet less scrutinized relationship with HIV/AIDS. In the 90s, HIV/AIDS became known as a “widows’ disease” due high AIDS-related mortality among men that left women both widowed and HIV infected (Chapoto et al., 2011; Lopman et al., 2009). This view of widows as HIV carriers corrupted traditional socio-economic support systems for widows (Lopman et al., 2009; Perry et al., 2014). Practices such as widow inheritance shifted from clan-based support system to a commercialized and exploitative system where non-relative widow inheritors have multiple and concurrent sexual relationships with widows, increasing the risk and burden of HIV among widows (K. Agot, 2015; K. E. Agot et al., 2010; Ndiaye, 2015; Perry et al., 2014).

The social and economic effects of HIV/AIDS, including the collapse of traditional support systems for widows, has left widows living with HIV/AIDS with poorer health outcomes

than their non-widowed counterparts. Widows living with HIV/AIDS are more likely to be accused of killing their husbands and as result experience social isolation, reduced social support and property disinheritance, all of which affect their mental health and limit their livelihoods and food security (Chapoto et al., 2011; Izumi, 2007). Food insecurity exposes women living with HIV/AIDS to nutrient deficiencies, lowers their adherence to HIV treatment, and increases their depressive symptoms (Bukonya et al., 2019; Daka and Ergiba, 2020; Nigusso and Mavhandu-Mudzusi, 2020; Papageorgiou et al., 2022; Singer et al., 2015; Weiser et al., 2011). This bidirectional relationship between food insecurity and HIV/AIDS increases HIV morbidity and mortality (Weiser et al., 2011) with widows reporting lower ART initiation (Ruzagira et al., 2018), higher morbidity (Olaleye and Ogwumike, 2013) and higher depressive symptoms (Mekonen et al., 2021) compared to married women.

Because of the association of food insecurity and HIV/AIDS, we developed a multisectoral agricultural livelihood intervention to improve food security and physical and mental health outcomes among people living with HIV/AIDS (Cohen et al., 2015, 2022; Weiser et al., 2015). *Shamba Maisha*, “farming for life”, was an agriculture and finance intervention trial implemented in western Kenya, a region with a HIV prevalence that is thrice the national average (Cohen et al., 2015; Weiser et al., 2015). While there were no effects on HIV outcomes, the main *Shamba Maisha* study showed benefits on food security, depression, stigma, empowerment, and social support (Cohen et al., 2022). This study is a sub-analysis of *Shamba Maisha* data, comparing HIV health and mental health outcomes between widowed and married women after the intervention.

2. Methods

2.1. Shamba Maisha trial and study population

Prior studies provide detailed description of the *Shamba Maisha* trial design and implementation (Cohen et al., 2015). In summary, *Shamba Maisha* was a cluster randomized controlled trial in Homa Bay, Kisumu, and Migori Counties in western Kenya with a goal to test the effect of an agricultural livelihood intervention on HIV health outcomes. The trial population included food-insecure adults living with HIV/AIDS aged 18–60 years, recruited from eight matched pairs of Ministry of Health facilities where they received HIV care. The facilities were first matched on size, sub-county, main source of irrigation water and market accessibility to minimize baseline cluster differences, then randomized using computer generated random numbers within pairs into intervention and control arms. Cluster pairs were separated geographically to minimize contamination. Eligible participants needed to join a support group, have farmland near a water body or shallow well, and save ~ US\$20 as a down payment for the project financial loan.

Shamba Maisha was a bundled intervention that sought to reduce food insecurity and its impact on health by enhancing the production of vegetables. The main components of the intervention were agricultural training and inputs and a loan. Intervention participants received an asset loan of ~US\$175 to purchase a micro-irrigation water pump and farm inputs including seeds, fertilizers, and pesticides. They also received eight 3-hour training sessions on sustainable agriculture and financial management. Study follow-up occurred every half year for two years. Research staff met participants at clinic and home for

interview-based questionnaire to collect data on various demographic and socioeconomic characteristics and health outcomes, including samples for CD4 count and viral load and anthropometric data. The control participants did not receive any intervention during the trial period but were offered the livelihood intervention after two years of follow-up.

All participants continued their usual HIV care and treatment. The study received ethical approval from the Kenya Medical Research Institute Scientific and Ethical Review Unit and the University of California San Francisco Institutional Review Board.

2.2. Study design and population

For this study, we performed a mixed-model analysis of a subset of *Shamba Maisha* trial population restricted to adult women who were either married or widowed as self-reported at their baseline visit. Women who identified as divorced or separated were excluded from the analysis because of a small sample size of nine.

2.3. Outcome measures

The outcomes in this study were similar to the outcomes reported in the main impact evaluation article of the *Shamba Maisha* trial (Cohen et al., 2022). The HIV/AIDS outcomes were 1) the proportion of women with undetectable HIV RNA viral load defined as < 200 copies/mL blood, 2) the proportion of women with CD4 cell count > 500 copies/mL blood, 3) the proportion of women with any hospitalizations in previous six months, and 4) the proportion of women with an AIDS-defining illness.

The food security and nutrition outcomes included food insecurity score as measured continuously by the Household Food Insecurity Access Scale which has been validated in several African contexts including Kenya and has a 9-items with four response options from 1 (Never) to 4 (Often) and had a Cronbach alpha at the baseline visit of 0.81 (Coates et al., 2007), and continuous measure of body mass index (BMI). Health behaviors included the proportion of women with any missed clinic visits in the past six months, and ART adherence measured continuously as percent adherence in the last 30 days using a questionnaire and visual analog scale (Oyugi et al., 2004).

For mental health, we measured overall mental and physical health scores using a 35-item health-related quality of life questionnaire which has a reliability > 0.70 , varied response options with total scores standardized from 0 to 100, and has been validated in resource limited settings (Mast et al., 2004; Wu et al., 1991). Cronbach alphas for the mental and physical health scores at the baseline visit were 0.87 and 0.75, respectively. Depression symptoms was measured using the 15-item Hopkins Symptom Checklist for Depression, which has also been validated in low resource settings with a reliability of 0.60 and was reported both as a continuous variable and a binary variable with scores of > 1.75 defined as depression symptoms (Bolton et al., 2004). Cronbach alpha at the baseline visit was 0.86. Perceived emotional and instrumental social support was measured using an adaptation of the 14-item Functional Social Support Scale with four response options ranging from 1 (As much as I would like) to 4 (Never) and lower scores indicating higher social support (Antelman et al., 2001). Cronbach alpha at the baseline visit was 0.84.

We also measured self-confidence to assess empowerment using a three-item scale on public speaking, offering agricultural advice, and financial confidence with responses comprising an index ranging from 3 (not confident) to 9 (very confident) (Kim et al., 2007). Cronbach alpha at the baseline visit was 0.70. Three types of stigma, internalized, anticipated, and enacted were measured using the 9-item internalized AIDS-related stigma scale with five response options from 1 (Very unlikely/Strongly disagree) to 5 (Very likely/Strongly agree) (Kalichman et al., 2009). The internalized AIDS-related stigma scale has been validated in several African settings and has an internal consistency of 0.75, with higher scores indicating more stigma (Kalichman et al., 2009). Cronbach alphas for internalized, anticipated, and enacted stigma at the baseline visit were 0.85, 0.90, and 0.82, respectively.

2.4. Statistical analysis

We first conducted descriptive and bivariate analyses of the women's demographic, socio-economic and clinical characteristics at the baseline visit. We reported number and percent for categorical variables including p-value from Pearson's chi-squared test. For numerical variables, we reported mean, standard deviation (SD) and p-value for two sample *t*-test for normally distributed variables or median, interquartile range and p-value for Wilcoxon ranksum test for skewed variables. We compared baseline differences by marital status: widowed vs married.

We estimated multilevel mixed-effects models with maximum likelihood. For binary outcomes, we used logistic regression and reported proportional changes in log odds, 95% CI, and p-values. For numerical outcome, we used linear regression and reported mean difference, 95% CI, and p-values. Fixed effects were the intervention, visits, and the interaction of intervention and visits. Random effects were the facilities and participants. We dropped pair-matching as its inclusion complicated the models but did not change the results. We stratified modelling analysis by marital status, widowed vs. married. We also conducted a test for three-way interaction to assess if health outcomes differed by the women's marital status and reported the p-value. For all outcomes, we reported trend in the control arm per 24 months, trend in the intervention arm per 24 months, and difference in the trends between the intervention and control per 24 months. We also graphed 24-month trend of the mean scores for outcomes that had low interaction p-value. We used Stata v17 for all analyses (StataCorp LP, College Station, TX).

3. Results

3.1. Sociodemographic and clinical characteristics at baseline

The *Shamba Maisha* trial enrolled 377 women; 145 (38.5%) were widowed and 232 (61.5%) were married (Table 1) with a 94% retention rate at 24-months. Widows were older than married women with a mean age of 42.8 ± 8.4 years compared to 35.8 ± 9.0 years ($p < 0.01$). Almost all widows (97.2%) were household heads compared to only 10.8% of married women ($p < 0.01$). At baseline widows had poorer overall physical health score than married women (median (IQR) 80.2 (65.8, 87.2) vs 84.5 (70.7, 88.3) $p = 0.02$), poorer social support score than married women (mean \pm SD 19.0 ± 5.3 vs 17.7 ± 5.0 , $p = 0.02$) and lower

self-confidence than married women (mean \pm SD 5.2 ± 1.5 vs 6.0 ± 1.5 , $p < 0.01$). Detailed comparison of baseline clinical characteristics is in Supplementary Table 1.

3.2. 24-Month trends for widowed and married women

Widows in the intervention compared to the control arm had a greater decline in household food insecurity (-3.13 , 95%CI $-4.42, -1.84$, $p < 0.01$), depressive symptoms (-0.21 , 95%CI $-0.36, -0.07$, $p < 0.01$), internalized stigma (-0.33 , 95%CI $-0.55, -0.11$, $p < 0.01$), and anticipated stigma (-0.46 , 95%CI $-0.65, -0.28$, $p < 0.01$) (Table 2). The widows in the intervention arm also experienced a greater improvement in social support than those in the control arm (lower scores = higher social support: 2.22 , 95%CI $-3.85, -0.59$, $p < 0.01$) and a lower increase in BMI (-0.35 , 95% CI $-0.77, 0.06$, $p = 0.10$).

Similarly, married women in the intervention compared to the control arm had a greater decline in their household food insecurity (-3.08 , 95%CI $-4.15, -2.02$, $p < 0.01$), depressive symptoms, (-0.19 , 95%CI $-0.29, -0.08$, $p < 0.01$), internalized stigma (-0.38 , 95%CI $-0.57, -0.19$, $p < 0.01$) and anticipated stigma (-0.35 , 95%CI $-0.50, -0.21$, $p < 0.01$) (Table 2). Married women also had greater improvements in social support (-4.00 , 95%CI $-5.16, -2.84$, $p < 0.01$) and greater declines in enacted stigma (-0.14 , 95%CI $-0.20, -0.09$, $p < 0.01$). Among married women, those in the control arm compared to the intervention arm had fewer missed clinic visits (1.67 , 95%CI $0.50, 2.84$, $p < 0.01$) and a higher increase in BMI (-0.51 , 95% CI, $-0.85, -0.16$, $p < 0.01$). The intervention showed no improvement in HIV clinical indicators among either married or widowed women.

3.3. Differences in intervention effects between widowed and married women

The intervention had different effects between widowed and married women for four outcomes (differences calculated as widows minus married women): food insecurity (0.05 , $p < 0.01$), missed clinic visits (-2.35 , $p = 0.04$), social support (1.78 , $p = 0.08$), and enacted stigma (0.15 , $p < 0.01$) (Table 2).

Fig. 1 compares mean trend in the outcomes between widowed and married women across baseline and the four 6-month follow-up visits. All four groups of women, widowed intervention and control, and married intervention and control, experienced a declining trend in food insecurity. Widowed women in the intervention arm had the highest food insecurity scores at baseline and experienced the fastest decline in food insecurity which levelled off after 18 months. Married women in the control group had a faster decline in their food insecurity compared to widowed women in the control arm, although this difference diminished by 24-months visit.

Widowed women in the control arm had the least social support at baseline that improved slightly by 24-months. Social support declined for married women in the control arm over time. Both widowed and married women in the intervention arm experienced a relatively similar trend in their increase in social support, with greater social support among married women.

All four groups of women experienced a decline in enacted stigma over time. Married women in the intervention arm had the greatest decline, starting with the highest scores for

enacted stigma at baseline, and ending with the lowest scores at 24 months. While widowed women in the control arm had a higher enacted stigma score than married women in the control arm at baseline, this difference was eliminated by 24-month.

At baseline, women in the intervention arm had a higher proportion of missed clinic visits than women in the control arm, with higher proportion among widows. Same trend was observed at 24-months.

4. Discussion

In this sub-analysis of a randomized controlled trial, the livelihood intervention reduced food insecurity, depressive symptoms, internalized and anticipated stigma similarly for widowed and married women, but increase in social support and reduction in enacted stigma were stronger among married than widowed women. Our study is among the first to compare HIV health outcomes for widowed and married women after an agricultural livelihood intervention. Previous studies have reported gender differences in HIV health outcomes between men and women (Cohen et al., 2022). Several studies among people living with HIV/AIDS link undernutrition, depression, and low social support with widowed status (Daka and Ergiba, 2020; Mekonen et al., 2021; Seid et al., 2020; Yimer et al., 2021), making a comparative assessment of the impact of the livelihood intervention on these outcomes between widowed and married women important.

Despite widows' disadvantaged social and economic positions in the society, they experienced similar improvements as married women in individual level outcomes like food security, depression, internalized and anticipated stigma. The similar benefits are likely due to widows' enhanced agency as heads of household, which gave them decision making control over what to grow and how to reinvest profits from their farms, and was strengthened by the multisectoral nature of the intervention. Agency, the ability to make real choices and translate the choices into preferred outcomes, has been shown to reduce gender inequality and improve women's health outcomes (Chang et al., 2020; Klugman et al., 2014). While studies on widows' agency in Africa are scarce, a qualitative study in Nepal found that widows experienced and negotiated new spaces of agency as a survival mechanism such as through taking up employment for their livelihood (Ramnarain, 2016). The literature on women's agency also shows that training and financial support are critical for strengthening women's agency (Klugman et al., 2014).

In contrast, widows experienced weaker improvements in outcomes that were more influenced by external factors such as social support and enacted stigma. Social interactions play an important role on the perception of social support and widows report fewer social contacts and lower frequency of social contact compared with married women (Harling et al., 2020; Mekonen et al., 2021; Olawa et al., 2019). In addition to the stigma of HIV/AIDS, widows also experience stigma linked to their widowhood status that worsens their experience of societal stigma (Ky-Zerbo et al., 2014; The Loomba Foundation, 2015). Future programs and studies need to further characterize widowhood stigma and include in the bundle of interventions, components that address the social support and enacted stigma for widows.

There are several aspects of our study to consider in its interpretation. First, this randomized control trial is one of the largest evaluations to compare health outcomes for widowed and married women living with HIV/AIDS, with 94% retention rate at 24-months. While this sub-set analysis of widowed versus married women was not pre-specified in the *Shamba Maisha* trial protocol, we wanted to explore the impact of the intervention among the most vulnerable women, the analysis uses baseline marital status, and the conclusions in this sub-set data align with results of the main trial (Cohen et al., 2022). The outcomes measured such as food insecurity, depression, and social support were distinct and were measured with validated tools, providing results that are useful for understanding the impact of the livelihood intervention. The intervention had no effect on HIV clinical outcomes likely due to high baseline viral suppression and government program for improving HIV outcomes. Additional studies are needed to characterize the stigma that widows experience and how stigma affects their health and wellbeing, and understand the role of agency in women's health, and how the role of stigma and agency may differ between widowed and married women. There is also a need for interventions that can improve social support and reduce stigma among widows.

5. Conclusion

The multisectoral agricultural livelihood intervention improved food security, depression, internalized and anticipated stigma similarly for widowed and married women, but the intervention had less impact on social support and enacted stigma for widows compared with married women. As household heads, widows have a greater agency which gave them decision-making control over the financial benefits of intervention that was likely strengthened by the multisectoral nature of the intervention. Future studies and trials targeting widows need to characterize the stigma of widowhood and to bolster intervention components that address social support and reduce stigma.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Role of the funder/sponsor

The NIH had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Data availability

Data will be made available on request.

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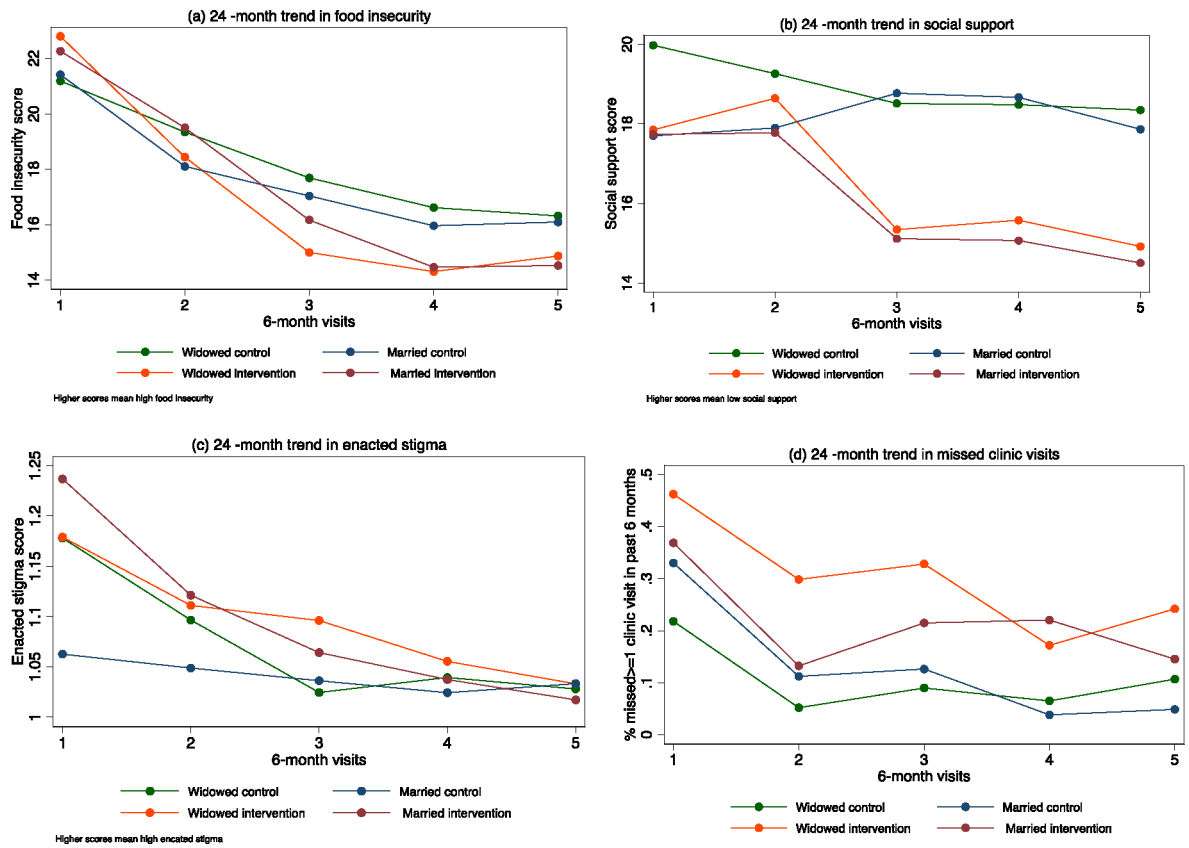


Fig. 1. 24-month trend in (a) food insecurity, (b) social support, (c) enacted stigma and (d) missed clinic visits for widowed vs married women in the intervention and control arms of *Shamba Maisha* trial.

Table 1

Baseline demographic, socioeconomic and clinical characteristics of widowed vs married women in *Shamba Maisha* trial (N = 377).

Characteristic	Widowed women N = 145	Married women N = 232	P-value
Age in years, mean (SD)	42.8 (8.4)	35.8 (9.0)	<0.01
Religion			
Christian	145 (100.0%)	230 (99.1%)	0.26
Other	0 (0.0%)	2 (0.9%)	
Education level			
Primary or less	118 (81.4%)	188 (81.0%)	0.93
Some secondary or more	27 (18.6%)	44 (19.0%)	
Household head	141 (97.2%)	25 (10.8%)	<0.01
Household size, mean (SD)	5.4 (2.3)	6.3 (2.0)	<0.01
Wealth index, quintiles			
Lowest	38 (26.6%)	44 (19.1%)	0.30
Second	31 (21.7%)	47 (20.4%)	
Third	26 (18.2%)	43 (18.7%)	
Fourth	28 (19.6%)	47 (20.4%)	
Highest	20 (14.0%)	49 (21.3%)	
Virally suppressed, < 200 copies/mL	119 (82.1%)	192 (83.1%)	0.79
CD4 count (< 500 cells)	45 (31.0%)	76 (32.8%)	0.73
Hospitalized in the past 6 months	11 (7.6%)	22 (9.5%)	0.52
AIDS defining illness	6 (4.1%)	8 (3.5%)	0.74
Food insecurity score, median (IQR)	22.0 (20.0, 24.0)	22.0 (18.5, 24.0)	0.71
Food insecure	145 (100.0%)	232 (100.0%)	
Body mass index, median (IQR)	22.8 (20.6, 25.6)	21.9 (20.0, 24.3)	0.06
Body mass index in categories			
Underweight	16 (11.1%)	23 (10.0%)	0.20
Normal	83 (57.6%)	156 (67.8%)	
Overweight	34 (23.6%)	36 (15.7%)	
Obese	11 (7.6%)	15 (6.5%)	
Missed > one scheduled HIV visit in the past 6 months	48 (33.1%)	81 (35.1%)	0.70
Antiretroviral therapy adherence			
95–100%	137 (94.4%)	220 (94.8%)	0.67
75–94%	7 (4.9%)	9 (3.9%)	
Mental health score, median (IQR)	57.1 (46.1, 72.4)	60.5 (47.7, 69.6)	0.80
Physical health score, median (IQR)	80.2 (65.8, 87.2)	84.5 (70.7, 88.3)	0.02
Depression score, mean (SD)	1.7 (0.5)	1.7 (0.5)	0.49
Screens positive for depression	67 (46.2%)	102 (44.0%)	0.67
Social support score, mean (SD)	19.0 (5.3)	17.7 (5.0)	0.02
Self confidence score, mean (SD)	5.2 (1.5)	6.0 (1.5)	<0.01
Internalized stigma score, mean (SD)	2.1 (0.8)	2.2 (0.8)	0.41

Characteristic	Widowed women N = 145	Married women N = 232	P-value
Anticipated stigma score, mean (SD)	1.9 (0.7)	1.8 (0.6)	0.98
Enacted stigma score, mean (SD)	1.2 (0.4)	1.2 (0.3)	0.52

SD: standard deviation; IQR: Interquartile range; AIDS: Acquired Immunodeficiency Syndrome.

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Table 2

Shamba Maisha main outcomes compared between widowed and married women.

	Trend per 24 months in widowed women				Trend per 24 months in married women				P-value for 3-way interaction†
	Control	Intervention	Difference in trend between arms	P-value	Control	Intervention	Difference in trend between arms	P-value	
HIV Outcomes									
% Virally suppressed (< 200 copies/ mL)	- 3.51	- 1.91	1.6	0.20	- 1.49	- 1.47	0.02	0.97	0.75
% CD4(> 500 cells)	0.11	0.41	0.29	0.67	- 0.67	- 0.44	0.23	0.67	0.78
% Hospitalized in the past 6 months	- 0.41	- 0.39	0.02	0.98	0.93	- 0.37	- 1.29	0.07	0.51
% With AIDS-defining condition	- 0.14	0.07	0.21	0.77	- 1.28	- 1.04	0.23	0.61	0.99
Food Insecurity and nutrition									
Food insecurity score (0–27, higher = more insecure)	- 4.89	- 8.02	- 3.13	<0.01	- 5.09	- 8.18	- 3.08	<0.01	<0.01
Body Mass Index (kg/m ² , continuous, higher = higher BMI)	0.59	0.24	- 0.35	0.10	0.86	0.35	- 0.51	<0.01	0.83
Behavioral Pathway									
% Missed one scheduled HIV visit in the past 6 months	- 0.7	- 1.38	- 0.68	0.30	- 2.65	- 0.98	1.67	<0.01	0.04
ART Adherence (continuous, self-report)	0.17	0.51	0.34	0.25	- 0.35	0.14	0.48	0.58	0.64
Mental Health									
Mental health score (higher = better mental health)	12.47	12.77	0.30	0.91	12.2	13.6	1.41	0.50	0.27
Physical health score (higher = better physical health)	5.40	- 0.07	- 5.46	0.08	2.20	2.68	0.48	0.84	0.11
Depression score (continuous 1–4, higher = more depression)	- 0.26	- 0.47	- 0.21	<0.01	- 0.30	- 0.49	- 0.19	<0.01	0.58
% With Probable depression (higher = more depression)	- 1.81	- 2.46	- 0.65	0.29	- 1.97	- 2.81	- 0.84	0.11	0.97
Social support score (lower = more social support)	- 1.47	- 3.69	- 2.22	<0.01	0.42	- 3.58	- 4.00	<0.01	0.08
Empowerment									

	Trend per 24 months in widowed women				Trend per 24 months in married women				P-value for 3-way interaction†		
	Control	Intervention	Difference in trend between arms	95% CI	P-value	Control	Intervention	Difference in trend between arms		95% CI	P-value
Self-Confidence score	-0.69	-0.72	-0.03	(-0.50, 0.45)	0.91	-0.43	-0.73	-0.30	(-0.69, 0.09)	0.13	0.52
HIV/AIDS stigma											
Internalized stigma score (higher = more stigma)	-0.41	-0.74	-0.33	(-0.55, -0.11)	<0.01	-0.34	-0.72	-0.38	(-0.57, -0.19)	<0.01	0.41
Anticipated stigma score (higher = more stigma)	-0.18	-0.64	-0.46	(-0.65, -0.28)	<0.01	-0.25	-0.60	-0.35	(-0.50, -0.21)	<0.01	0.89
Enacted stigma score (higher = more stigma)	-0.11	-0.10	0.01	(-0.06, 0.08)	0.75	-0.03	-0.18	-0.14	(-0.20, -0.09)	<0.01	<0.01