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Cash for assets during acute food insecurity: an observational study in South Sudan

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Abstract

Background Cash-based assistance in humanitarian contexts has grown substantially in recent years, yet little is empirically known about differential impacts of cash for diverse beneficiaries, which could better inform assistance targeting. In the context of increasing food insecurity and extreme levels of famine in South Sudan despite significant scale-up of humanitarian assistance, this analysis examined food security and household economy outcomes to better understand the impact of cash assistance and characteristics associated with worsened household food security and coping strategies.

Methods In 2019–2021, a prospective cohort study was conducted leveraging a program providing cash for work in community gardens. 1213 households receiving cash prior to the start of the study (Cohort A/B), 582 non-intervention households (Control), and 300 households that received cash after the start of the study (Cohort C) completed 2 interviews spaced one year apart to measure household food insecurity and coping mechanism adoption.

Results There were no significant differences in change over time in household hunger score ($p=0.074$), livelihoods coping strategy index score ($p=0.104$), or meal frequency ($p=0.113$) between program participants and the comparison group. The comparison group had a significantly larger increase in dietary diversity over time (0.6 vs. 0.2 in Cohort A/B, $p=0.005$); however, at endline there were no significant differences in dietary diversity between program participants and the non-intervention group (4.3 in both groups). There were few factors associated with increased likelihood of worsened food security and coping outcomes, the most noticeable being recent investment livestock, which was associated with 1.5 times greater odds of worsened hunger and 1.63 times greater odds of worsened coping strategy adoption.

Conclusion Cash transfers did not appear to have lasting benefits on food security and livelihoods coping strategy use. Larger transfer sizes may need to be considered in future programming to achieve more substantial improvements in household food security; however, maintaining rather than improving household food security may be sufficient in worsening food crises contexts.

Keywords South Sudan, Humanitarian emergency, Humanitarian assistance, Cash transfer, Food insecurity, Food crisis

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Background

Cash-based assistance in humanitarian contexts has grown substantially in recent years. In 2021, cash and voucher assistance (CVA) accounted for 21% of all international humanitarian assistance with approximately US\$5.3 billion in CVA provided, representing an increase of 3.9% from 2020 and 141% from 2016 [1]. In the third



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quarter of 2019 (when this study was initiated), a total of US\$4 million in CVA was provided to 137,000 households, including more than 800,000 people, in South Sudan, of which 95% was provided through the Food Security and Livelihood cluster [2]. Nearly three-quarters of this assistance was provided as cash and most was unconditional (i.e., with no qualifying restrictions). In 2022, CVA accounted for more than US\$7 million of South Sudan's humanitarian response and the use of multipurpose cash assistance, cash-for-work, and cash-for-assets have all expanded [3]. CVA has long been seen as a more effective and efficient means for addressing outcomes in multiple sectors (particularly food security), strengthening the dignity of crisis-affected populations, and supporting local economies [4–7]. Little is empirically known, however, about differential impacts of cash for diverse beneficiaries, including factors associated with worsened or improved outcomes following receipt of cash assistance, which could better inform targeting of assistance [15, 16].

Recently, South Sudan faced increasing food insecurity and extreme levels of famine despite significant scale-up of humanitarian assistance. At study initiation in 2019, there were an estimated 7 million people in South Sudan facing crisis or worse (Integrated Food Security Phase Classification System (IPC) Phase 3 or above). Where the study was conducted, Gogrial West County in Warrap State, the population faced emergency (IPC Phase 4) levels of food insecurity and acute malnutrition in mid-2019 [8]. In 2020, food insecurity worsened in Warrap and some counties worsened to Phase 5, famine/catastrophe [18]. By 2021, South Sudan was included among the worst global food crises with 7.2 million people facing crises or above level food insecurity, including 2.4 million in the emergency phase (IPC 4) and 110,000 facing famine/catastrophe (IPC 5) levels of food insecurity [9]. Driven by the protracted conflict, economic crisis, high food prices, impacts of COVID-19, and unprecedented flooding, food insecurity levels in 2021 were the highest ever recorded in South Sudan [19]. Warrap was among the most food insecure states in South Sudan, and disruption of agricultural activity and hindered market access and functioning due to continued sub-national conflict and flooding continue to drive Warrap's high levels of food insecurity [10, 11].

To address these gaps in light of the worsening food crisis and, given hypotheses regarding improved household economy and the associated increase in food security and improved coping strategies, [13] we examined food security and household economy outcomes within a larger study that evaluated the effect of cash assistance on intimate partner violence (IPV) in South Sudan to better understand the impact of cash assistance and

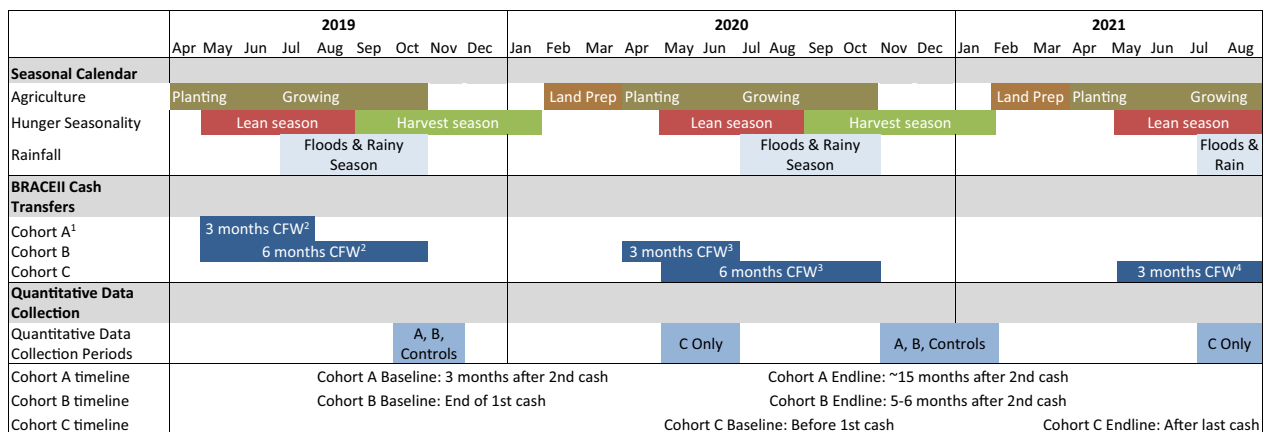
characteristics associated with worsened household food security and coping strategies.

Methods

The present analysis was nested within a prospective cohort study conducted from October 2019 through August 2021 in Gogrial West County where World Vision implemented BRACEII, a multi-year program that aimed to strengthen food and nutrition security and resilience among food insecure households. BRACEII provided cash transfers conditional upon households' participation in schemes to strengthen their own crop production and build community assets such as feeder roads, clinics, schools, market stalls, and ponds. The population of Gogrial West is predominantly rural Dinka agro-pastoralists and includes some internally displaced persons (IDPs) from the contested area of Abyei. The study design leveraged the existing BRACEII program in a real-world humanitarian setting, strengthening external validity and research impact. No other significant food security interventions were covering the population at the time of study implementation. Annual household enrolment of BRACEII in communities and non-BRACEII neighboring households formed the study's cohorts with outcomes of interest observed at 2 time points. The BRACEII program enrolled approximately 3000 households in 2018 (Cohort A) and 1500 households in 2019 (Cohort B), each of which received cash transfers valued at US\$40 to \$49 per month during the subsequent 2 lean seasons (for 6 months in the first and 3 months in the second). A timeline of the studied intervention and quantitative data collection is provided in Fig. 1. The initial study sample drew from Cohorts A and B, stratified proportionally to each; with the extension of the BRACEII program to an additional 2000 households in 2020 (Cohort C), the study was extended to include this new group.

Sampling

Sample size calculations were based on the primary outcome of the study, change in IPV prevalence in the preceding year, using difference-in-difference analysis and are detailed in Additional file 1 and also in the paper that presents the study's IPV findings [12]. Cohort C was not considered in sample size calculations because it was not part of the initial study design and data were collected at a later time when the food insecurity context had changed. Sample sizes for each study group are presented in Table 1. Cohort A & B samples were analyzed together; 1562 households were recruited for the study and 1213 (77.7%) households were included in the final analysis. Additionally, 769 control households were recruited, of which 582 (75.7%) were included in the final analysis. The primary outcome for the food insecurity analysis was the



¹ Also received 6 months of CFW from May-Oct 2018
² Transfer values = US\$44.50 per household per month (equivalent to 17 - 31% of monthly food basket cost)
³ Transfer values = US\$49 per household per month (equivalent to 21 - 30% of monthly food basket cost); double payment (US\$98) given in April and August 2020
⁴ Transfer values = US\$49 per household per month in May 2021 and US\$45 in July and August 2021 (equivalent to 63 - 67% of monthly food basket cost). No transfers provided in June 2021.

Fig. 1 Seasonal calendar and timelines for cash transfers and study data collection

Table 1 Enrolled and analyzed sample by group

Study group	Enrolled sample	Analyzed sample
Initial intervention groups	1562	1213 (77.7%)
Cohort A	830	628 (75.7%)
Cohort B	732	585 (79.9%)
Control	769	582 (75.7%)
Cohort C	338	300 (88.8%)
Total sample (all groups)	2669	2095 (78.5%)

proportion of households facing moderate or severe hunger based on the Household Hunger Scale [13]. Using a baseline proportion of 70% (observed baseline proportions were 66.9% in Cohort A/B and 73.2% among controls), Type I error (α) of 0.05, and a Type II error (β) of 0.20, the analyzed sample was sufficient to detect endline differences $\geq 6.3\%$ between BRACEII beneficiaries and the non-intervention control group [14, 15].

All study participants were required to be female, age 15–65 years, married or in a relationship with a partner, and willing to be interviewed for the duration of the research study. For the intervention group, a systematic list-based sample was used to randomly select households from among planned BRACEII beneficiaries in each cohort. Sample allocation was done proportionally to the number of BRACEII households at accessible project sites (flooding precluded access to some areas). A neighborhood sampling approach was used to identify control households, which were matched to Cohort B households [because Cohort B households received cash transfers during the study period whereas Cohort A did not]. In this approach, the nearest household to Cohort

B study participants was recruited and screened; if the household was not eligible, the next nearest household was approached until one meeting eligibility criteria that consented to participate was identified.

Data collection and outcome measures

Due to high illiteracy levels, verbal informed consent was obtained from all women for their participation in the study prior to enrolment and initiation of the first interview. An abbreviated oral consent was used for subsequent data collection to affirm agreement for continued participation. All interviews took place in the respondent’s home or in a mutually agreeable, private location in the community except for Cohort C baseline interviews, which were performed at or near the location where participants were registered for the BRACEII program. Participants were asked to complete 2 in-person questionnaire-based interviews spaced approximately 1 year apart. Interviews were conducted in Dinka by trained female interviewers and responses recorded on a tablet. Interviews collected background information on the respondent and their household including household economy and receipt of humanitarian assistance, food insecurity, and coping mechanism adoption, as well as decision-making behaviors and gender-based violence. The baseline and endline questionnaires are provided in Additional file 2.

In this manuscript, several secondary outcomes of interest related to household food security are presented, notably household hunger and coping strategy adoption. Change in household hunger was analyzed using the Household Hunger Scale (HHS), both as a continuous outcome and categorical (little to no, moderate, or severe

hunger) [23]. In addition to analyzing change in household hunger, we examined potential predictors of worsened household hunger, defined as having a more severe category of household hunger at endline than at baseline (e.g., moving into moderate or severe hunger). Change in household food expenditures in the past month, meal frequency on the preceding day, and household dietary diversity were also analyzed. Change in coping strategy adoption was also evaluated using the livelihood-based coping strategy index to identify both the prevalence of households adopting any coping strategy in each severity grouping (stress, crisis, and emergency), and based on the most severe coping strategy category adopted by a household [16]. Potential predictors of worsened coping strategy adoption (e.g., households that adopted a more severe level of coping strategy at endline relative to baseline) were also examined.

Data analysis

Analyses were performed on data from all households that completed both baseline and endline interviews, which consisted of 2095 total households, including 1213 households in Cohorts A and B that received cash transfers through the BRACEII program before study enrollment, 582 control households that never received cash through the BRACEII program during the study period, and 300 households in Cohort C that started receiving cash through BRACEII after the start of the study. Baseline characteristics for the 21.5% of households lost to follow-up during the study period did not significantly differ from households in the final analyzed sample (i.e., those who completed an endline interview). Data analysis was performed using Stata 15 (College Station, TX).

Income and expenditure amounts were visually inspected for outliers using the general guidance that points falling 4 or more standard deviations from the mean should be considered as potential outliers. Outlying values that appeared to be the result of misreporting or recording errors were corrected or removed from the dataset; others were checked with field teams for accuracy and corrected as needed. The remaining income and expenditure outliers were Winsorized to 4 standard deviations from the mean. Differences in descriptive statistics between study groups (i.e., Cohort A/B, control, Cohort C) were examined using chi-square and *t*-test methods for binary/categorical and continuous variables, respectively (Tables 2 and 3). Given known differences (including residence location, intervention receipt timing, and sociodemographic characteristics) between Cohort C and the other study participants, *p*-values were calculated to assess statistically significant differences across all 3 groups in addition to those between only Cohort A/B and controls (all of which had data collected at the

same time resided in the same communities). Given the lack of statistically significant differences at endline for food security and coping measures (Additional file 3), Cohorts A + B were combined into an 'ever cash' group to improve power and simplify interpretation of findings.

Regression models were used to evaluate change in food security and coping outcomes from baseline to endline, both unadjusted and controlling for differences in household characteristics at baseline. Linear probability models were used to estimate differences in binary outcomes between study groups from baseline to endline with main terms for study group (i.e., Cohort A/B, control, Cohort C), time period (i.e., baseline or endline), and the interaction between study group and time period. All models utilized cluster-robust standard errors with clustering defined at the individual level, allowing for correlation between baseline and endline observations for each study participant. Logistic regression analysis including adjustment for study group was used to examine independent predictors of households with worsened household hunger score category and coping strategy adoption at endline relative to baseline for all study participants. Independent variables included in adjusted regression models were selected based on a demonstrated relationship with outcome(s) of interest in previous studies, prioritizing modifiable characteristics (i.e., those that could be changed with future intervention such as drinking water source, toilet type, income sources, savings/lending group membership, etc.) and are described in Additional file 4 [17–20]. Adjusted models examining change in food security and coping strategy use over time included independent variables with statistically significant differences across all 3 groups at baseline except for redundant, correlated, and/or otherwise statistically restrictive variables. Independent variables included in models seeking to identify potential predictors of worsened household hunger and coping strategy adoption were selected based on how adaptable they are to intervention and/or their previously demonstrated relationship with household hunger and/or coping strategy adoption.

Ethical review

The study was approved by the Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health and the South Sudan National Bureau of Statistics.

Results

Study population characteristics

A total of 2669 women were enrolled in the study, of which 2095 (78.5%) also completed endline interviews and were retained for analysis. Of the final sample, 1213 were in Cohort A/B (57.9%), 582 in the control group

Table 2 Respondent and household demographic characteristics and living conditions at baseline

	Cohort A/B		Control		Cohort C		P-value	
	(N = 1213)		(N = 582)		(N = 300)		All 3 groups	A + B vs Control
	%	(95% CI)	%	(95% CI)	%	(95% CI)		
Respondent and household characteristics								
Respondent age ¹								
14–29 years	22.5%	(20.2–24.9)	32.8%	(29.0–36.6)	26.0%	(21.0–31.0)	< 0.001	< 0.001
30–35 years	30.3%	(27.7–32.9)	31.3%	(27.5–35.0)	29.0%	(23.8–34.2)		
36–46 years	30.9%	(28.3–33.5)	22.7%	(19.3–26.1)	32.3%	(27.0–37.7)		
47+ years	16.2%	(14.2–18.3)	13.2%	(10.5–16.0)	12.7%	(8.9–16.5)		
Highest level of education completed								
Never attended	85.9%	(83.9–87.9)	80.4%	(77.2–83.6)	90.3%	(87.0–93.7)	0.001	0.015
Attended but did not complete primary	9.7%	(8.1–11.4)	12.2%	(9.5–14.9)	9.0%	(5.7–12.3)		
Primary complete	2.4%	(1.5–3.3)	3.4%	(2.0–4.9)	0.7%	(– 0.3–1.6)		
Secondary complete	2.0%	(1.2–2.8)	3.8%	(2.2–5.3)	0.0%	–		
Female headed household	19.5%	(17.3–21.8)	22.0%	(18.6–25.4)	38.0%	(32.5–43.5)	< 0.001	0.226
Household size								
Median	8.0		7.0		8.0			
Mean	8.0	(7.9–8.2)	7.7	(7.5–7.9)	7.7	(7.4–7.9)	0.007	0.010
Time living in current community								
Entire life	68.6%	(66.0–71.2)	62.7%	(58.8–66.7)	65.7%	(60.3–71.1)	< 0.001	0.002
More than 5 years	22.8%	(20.4–25.1)	24.7%	(21.2–28.3)	21.3%	(16.7–26.0)		
Less than 5 years	5.3%	(4.0–6.5)	9.8%	(7.4–12.2)	12.7%	(8.9–16.5)		
Displacement status								
Never displaced	81.4%	(79.2–83.6)	83.8%	(80.9–86.8)	54.7%	(49.0–60.3)	< 0.001	0.428
Returnee (formerly displaced)	11.0%	(9.3–12.8)	8.8%	(6.5–11.1)	41.7%	(36.1–47.3)		
Currently displaced from elsewhere	7.5%	(6.0–9.0)	7.4%	(5.3–9.5)	3.7%	(1.5–5.8)		
Living conditions								
Safe drinking water source ²	74.8%	(72.3–77.2)	73.4%	(69.8–77.0)	49.3%	(43.6–55.0)	< 0.001	0.523
Improved sanitation ³	2.6%	(1.7–3.5)	4.1%	(2.5–5.7)	0.0%	–	< 0.001	0.226
Residence type								
Tukul (s)	95.1%	(93.8–96.3)	92.3%	(90.1–94.4)	91.0%	(87.7–94.3)	0.009	0.023
House/house and tukul(s)	4.9%	(3.7–6.1)	7.2%	(5.1–9.3)	9.0%	(5.7–12.3)		
Crowding (people/sleeping room)								
Mean	4.5	(4.4–4.6)	4.3	(4.2–4.5)	4.5	(4.3–4.8)	0.392	0.207
% of all HHs w/ 5+ per room	35.3%	(32.6–38.0)	34.7%	(30.8–38.6)	36.0%	(30.5–41.5)	0.927	0.801
Household has electricity	1.8	(1.1–2.6)	2.7%	(1.4–4.1)	0.3%	(– 0.3–1.0)	0.062	0.153
Receipt of humanitarian assistance (past 3 months, other than BRACEII)								
In-kind food assistance	23.8%	(21.4–26.2)	2.6%	(1.3–3.9)	5.3%	(2.8–7.9)	< 0.001	< 0.001
Cash or voucher food assistance	19.0%	(16.8–21.2)	1.0%	(0.2–1.9)	1.3%	(0.0–2.6)	< 0.001	< 0.001
Food or cash for work	3.3%	(2.3–4.3)	1.0%	(0.2–1.9)	0.7%	(– 0.3–1.6)	0.001	0.004

¹ Given the large number of respondents unsure of precise age, two questions were used to capture age: exact age (in years) and categorical age based on important/memorable events (Born before 2nd peace agreement and after military seizes power = 14–29 years old, born before military seizes power and after 2nd civil war begins = 30–35 years old, born before beginning of 2nd civil war and after 1st peace agreement = 36–46 years old, born before 1st peace agreement and after civil war begins = 47–56 years old, born before 1st civil war = 57 years or older)

² Safe drinking water sources include borehole, protected or covered well, and other safe drinking water source (piped or public tap, protected spring)

³ Improved sanitation facilities include unshared traditional latrines (pit with slab, ventilated or VIP latrine)

(27.8%), and 300 in Cohort C (14.3%). Baseline characteristics for each group are presented in Table 2. Control group participants were younger than those in Cohort

A/B and were more likely to have had some formal schooling. Compared to controls, Cohort A/B households were larger (8.0 vs. 7.7 members) and had lived in

Table 3 Household income and expenditures at baseline (SSP)

	Cohort A/B			Control			Cohort C			P-value	
	(N = 1,213)			(N = 582)			(N = 300)				
	Median	Mean	(95% CI)	Median	Mean	(95% CI)	Median	Mean	(95% CI)		
Household Expenditures (past month)											
Total household expenditures (SSP) ¹	11,500	20,467	(19,041–21,892)	9115	19,328	(17,185–21,471)	14,925	16,765	(15,084–18,447)	0.059	0.379
Expenditures by quartile											
Top quartile (24,050+)	41,700	51,900	(48,340–55,459)	44,250	55,755	(50,328–61,182)	31,350	37,369	(32,725–42,013)	<0.001	0.240
3rd quartile (11,500–24,000)	16,500	17,045	(16,616–17,474)	17,750	17,573	(16,921–18,225)	17,500	17,823	(17,148–18,499)	0.116	0.191
2nd quartile (5550–11,400)	7800	8040	(7858–8222)	8000	8168	(7890–8447)	7500	7798	(7383–8213)	0.338	0.456
Bottom quartile (< 5500)	3275	3000	(2781–3219)	2000	2182	(1917–2448)	3000	2693	(2169–3217)	<0.001	<0.001
Household income (past 3 months)											
Total household income (SSP)	4500	7810	(7131–8489)	2000	6,008	(5037–6980)	3000	7,167	(5691–8643)	0.013	0.003
Income by quartile											
Top quartile (8580+)	15,025	20,904	(19,148–22,659)	14,600	21,328	(17,796–24,861)	17,000	25,629	(20,772–30,486)	0.146	0.817
3rd quartile (3600–8500)	6000	6074	(5927–6221)	5,500	5,807	(5577–6038)	5000	5568	(5272–5864)	0.005	0.059
2nd quartile (50–3500)	2000	1846	(1731–1961)	1925	1730	(1557–1903)	1240	1491	(1280–1702)	0.016	0.258
Bottom quartile (\$0)	0	0	–	0	0	–	0	0	–	–	–
Household Income Sources											
Small business	–	34.9%	(32.2–37.6%)	–	33.2%	(29.3–37.0%)	–	42.0%	(36.4–47.6%)	0.028	0.475
Crop/vegetable farming	–	32.0%	(29.4–34.6%)	–	21.5%	(18.1–24.8%)	–	14.3%	(10.3–18.3%)	<0.001	<0.001
Livestock	–	22.7%	(20.3–25.0%)	–	20.1%	(16.8–23.4%)	–	32.3%	(27.0–37.7%)	<0.001	0.218
Casual/daily labor (temporary)	–	20.3%	(18.0–22.5%)	–	16.0%	(13.0–19.0%)	–	19.7%	(15.1–24.2%)	0.089	0.029
Market stall, vendor, or sales	–	14.5%	(12.5–16.5%)	–	15.8%	(12.8–18.8%)	–	6.7%	(3.8–9.5%)	<0.001	0.470
Money sent by family / friends	–	11.2%	(9.4–13.0%)	–	14.9%	(12.0–17.9%)	–	5.7%	(3.0–8.3%)	<0.001	0.025
Humanitarian assistance	–	9.3%	(7.7–11.0%)	–	1.0%	(0.2–1.9%)	–	0.0%	–	<0.001	<0.001
Formal job/salaried employment	–	4.3%	(3.1–5.4%)	–	2.1%	(0.9–3.2%)	–	0.0%	–	<0.001	0.017
Number of income generating activities ²	1.0	1.3	(1.2–1.4)	1.0	1.1	(1.0–1.2)	1.0	1.1	(1.0–1.3)	0.001	0.001
Household saving, loans, and gifts (past 3 months)											
Savings											
Any savings (%)	–	34.4	(31.7–37.1%)	–	21.3%	(18.0–24.6%)	–	21.0%	(16.4–25.6%)	<0.001	<0.001
Amount saved (among savers only)	4000	8771	(7511–10,030)	4,000	9,824	(7138–12,510)	3,000	5,113	(3744–6481)	0.058	0.448
Purchased livestock (%)	–	28.8	(26.3–31.4%)	–	10.3%	(7.8–12.8%)	–	9.3%	(6.0–12.6%)	<0.001	<0.001
Savings/lending group member (%)	–	13.9	(11.9–15.8%)	–	6.7%	(4.7–8.7%)	–	2.0%	(0.4–3.6%)	<0.001	<0.001
Gift(s) received from family/friends	–	22.3	(20.0–24.7%)	–	20.1%	(16.8–23.4%)	–	19.3%	(14.8–23.8%)	0.351	0.160
Total value of all gifts received	2500	4991	(3955–6027)	2000	4027	(2950–5105)	3000	8619	(4322–12915)	0.008t	0.267

¹ Presented in South Sudanese Pounds due to exchange rate volatility

² Excluding humanitarian assistance and remittances; reported as number of different types based on categories shown

the community longer (68.6% of Cohort A/B always lived in their community vs. 62.7% of controls, and 5.3% of Cohort A/B lived there < 5 years vs. 9.8% of controls). Living conditions for Cohort A/B and control participants were largely similar, though a larger proportion of control participants lived in houses [and not tukuls] compared to Cohort A/B beneficiaries (7.2% vs. 4.9%). Reported receipt of in-kind food assistance in the past 3 months was also substantially higher in Cohort A/B than in the control group (23.8% vs. 2.6%) at baseline.

Cohort C participants differed from those in Cohort A/B and the control group in many notable ways (Table 2), likely a result of coming from different communities and data collection being conducted at different time points. Women in Cohort C had differing age distribution and were less likely to have any formal schooling. More Cohort C households were female-headed and many more were returnees. Living conditions for Cohort C participants were worse than the other groups with fewer having access to safe drinking water and none to improved sanitation, though a few more lived in a house. Few Cohort C participants reported receipt of any humanitarian assistance prior to baseline.

Baseline household economy

Reported household (cash) income and expenditures at baseline are presented in Table 3. While household expenditures in the prior month were similar in Cohort A/B and control group households, the mean household income in the past 3 months was substantially higher in Cohort A/B compared to the control group (7810 SSP vs. 6008 SSP) and Cohort A/B was more likely than the control group to have multiple type of income sources (mean 1.3 vs. 1.1). Similar proportions of Cohort A/B and control households were engaged small business, livestock production, and market sales but fewer control households were engaged in farming (21.5% vs. 32.0%) or casual labor (16.0 vs. 20.3%). More Cohort A/B households reported receiving humanitarian assistance (9.3% vs. 1.0%), while more control group households reported receiving remittances (14.9% vs. 11.2%). Saving was more common in Cohort A/B than among controls (34.4% vs. 21.3%); however, the mean amount saved was similar between the 2 groups. Cohort A/B households were more likely than controls to report livestock purchase in the past 3 months (28.8% vs. 10.3%) and to have participated in village savings and lending groups (13.9% vs. 6.7%).

In Cohort C, household expenditures in the preceding month were similar to the other groups, and mean household income in the preceding was intermediate at 7167 SSP (vs. 7810 SSP in Cohort A/B and 6008 SSP among controls) (Table 3). Cohort C households averaged 1.1 types of income sources, of which small business

and livestock production were the most frequent. Saving was less common in Cohort C than in Cohort A/B, but similar to controls, and the amount saved was lower ($p=0.058$). Cohort C also was less likely to have purchased livestock in the past months or participate in village savings or lending groups.

Household food security

Household food security at baseline and endline are presented in Table 4 along with change over time. Cohort A/B and control households had similar monthly food expenditures at baseline (5540 SSP and 5408 SSP; $p=0.736$) and endline (13,602 SSP and 14,318 SSP; $p=0.245$), representing similar increases (8062 SSP Cohort A/B and 8910 SSP controls; $p=0.244$). Food expenditures as a percentage of total household expenditures were also similar between Cohort A/B and the control group at baseline (32.6% and 34.8%; $p=0.149$) and at endline (44.9% and 47.4%; $p=0.079$); this represents similar increases of 12.2% for Cohort A/B (CI 10.0–14.5%) and 12.6% for the control group (CI 9.1–16.2%).

Mean meal frequency on the preceding day was relatively unchanged and similar from baseline to endline in both groups. At baseline, Cohort A/B consumed an average of 1.8 meals compared to 1.7 in the control group ($p=0.005$); at endline both groups reported consuming an average of 1.7 meals ($p=0.647$). The proportion of households consuming one or fewer meals on the preceding day was higher for the control group at both baseline and endline; and both groups worsened by similar amounts: Cohort A/B from 26.4 to 35.1% ($p<0.001$) and controls from 32.6 to 38.7% ($p=0.023$). Baseline dietary diversity, defined as the number of food groups consumed on the preceding day, was greater in Cohort A/B than controls (4.1 vs. 3.7; $p=0.001$), but both groups had a mean dietary diversity score of 4.3 at endline ($p=0.791$). This translates to increases in mean food groups consumed of 0.2 (CI 0.0–0.4) in Cohort A/B and 0.6 (CI 0.4–0.8) in the control group, with greater improvement among controls ($p=0.005$). The proportion of households with adequate dietary diversity was similar in both groups at baseline (35.9% of Cohort A/B, 31.8% of controls; $p=0.089$) and endline (42.8% of Cohort A/B, 44.8% of controls; $p=0.410$), representing similar increases in In Cohort A/B (6.9%, CI 3.2–10.6%) and the control group (13.1%, CI 7.8–18.4%) ($p=0.060$). In adjusted models, changes of 5.2% (CI 2.1–8.4%) in Cohort A/B and 10.3% (CI 5.3–15.3%) in the control group were observed ($p=0.078$).

Average household hunger scores were higher in the control group than in Cohort A/B at baseline (2.4 vs. 2.1; $p=0.007$), but at endline both groups had average scores of 2.4 ($p=0.534$). Crude changes in HHS scores

were similar between the 2 groups ($p=0.074$) with Cohort A/B seeing an increase of 0.2 (CI 0.1–0.3) and the control group increasing 0.1 (CI – 0.1–0.2). Viewing hunger categorically (Fig. 2), a smaller proportion of Cohort A/B reported little to no hunger at baseline than controls 33.1% vs. 26.8%), but by endline households in the 2 groups were similarly distributed across hunger categories ($p=0.490$). Both Cohort A/B (– 10.4%, CI – 13.8,– 7.0%) and the control group (– 4.8%, CI – 9.4,– 0.2%) saw decreases in the proportion of households with little to no hunger over time ($p=0.095$). While the proportion of households with severe hunger did not significantly change in either group (and neither crude [$p=0.579$] nor adjusted [$p=0.529$] changes were statistically significantly different between groups), moderate hunger significantly increased by 8.2% (CI 4.3–12.0%) in Cohort A/B and 1.0% (CI – 4.3–6.4%) in the control group.

Cohort C was notably worse off than the other groups on nearly all food security outcomes (Table 4). Cohort C households reported substantially higher food expenditures at both time periods and a larger share of expenditures on food at baseline. While the other groups saw increases in the share of expenditures on food, Cohort C saw a significant decrease (group comparison $p<0.001$). Despite higher expenditures, Cohort C had significantly lower mean meal frequency at baseline and endline but was the only group to see a decrease in the proportion of households consuming one or fewer meals daily (group comparison $p=0.003$). Dietary diversity was also lowest in Cohort C at both baseline and endline despite having a larger increase between time periods (group comparison $p<0.001$). Cohort C also had the smallest proportion of households with adequate dietary diversity at baseline and endline, but again saw the largest increase both in crude (group comparison $p=0.001$) and adjusted change (group comparison $p=0.002$). Household hunger was highest in Cohort C at baseline and nominally higher at endline; Cohort C was the only group with a decrease in HHS score (group comparison $p<0.001$). Cohort C had the largest proportion of households with severe hunger at baseline, but this proportion was similar to the other groups at endline. Cohort C was the only group to see fewer households with severe hunger at endline than at baseline (group comparison $p=0.002$).

Coping strategy adoption

Livelihood-based coping strategy adoption at baseline and endline, as well as change over time, is presented in Table 4 and Fig. 3. The proportion of households adopting any livelihood-based coping strategy at baseline was higher in Cohort A/B than in the control group (75.8% vs. 70.6%; $p=0.001$) but the groups converged

at endline (94.2% controls vs. 95.7% Cohort A/B; $p=0.191$) with a substantial increase for both, though larger for controls (25.1%, CI 21.0–29.2% controls vs 18.4%, CI 15.7–21.1% Cohort A/B; $p=0.030$). When analyzed as a weighted continuous score (range=0–25; higher indicating more severe coping strategy adoption), coping strategy adoption at baseline was similar in Cohort A/B and the control group (mean 4.3 vs. 4.2; $p=0.566$). At endline, coping was higher in the control group than in Cohort A/B (6.0 vs. 5.6; $p=0.043$). Change in coping scores during the study in Cohort A/B (1.3, CI 0.9–1.6) and the control group (1.8, CI 1.3–2.3) were similar ($p=0.104$).

Examining adoption of coping strategies based on level of severity, use of any stress coping strategy was higher in Cohort A/B than controls at baseline (56.1% vs. 51.0%; $p=0.042$), but similar at endline (74.4% vs. 73.7%; $p=0.740$). The proportion of households using stress coping strategies increased by 18.3% (CI 14.7–21.9%) in Cohort A/B and 22.7% (CI 17.5–27.9%) in the control group, and these changes were similar in magnitude ($p=0.256$). Use of any crisis coping strategy was similarly common in both groups at baseline (56.1% of Cohort A/B, 43.8% of controls, $p=0.105$) and at endline (75.5% of Cohort A/B, 78.2% of controls, $p=0.214$); however, the increase in crisis coping strategy use was greater ($p=0.048$) in the control group (34.4%, CI 29.0–39.7%) compared to Cohort A/B (27.6%; CI 23.9–31.3%). Use of emergency coping strategies (the most severe type) was also similar between groups at baseline (26.9% of Cohort A/B, 28.0% of controls, $p=0.614$) and at endline (28.5% of Cohort A/B, 29.9% of controls, $p=0.548$). Changes in emergency coping strategy adoption were small and not statistically significant in either group, and neither crude ($p=0.951$) nor adjusted ($p=0.869$) changes were statistically significantly different between the 2 groups.

As with food security, Cohort C was the worst off at baseline with the highest coping strategy index score; it was the only group to see a decrease in coping mechanism use such that by endline mean CSI was similar across groups (Table 4). At baseline, Cohort C had the largest proportion of households reporting any coping strategy use, stress coping strategy use, crisis coping strategy use, and emergency coping mechanism use. Cohort C was also the only group to see a decrease in the proportion of households adopting stress coping strategies (group comparison $p<0.001$) and had a smaller increase in adoption of crisis coping strategies (group comparison $p<0.001$). Cohort C was also the only group that saw a decrease in emergency coping mechanism use during the study ($p<0.001$), though differences in adjusted change across all 3 groups were not statistically significant ($p=0.081$).

Table 4 (continued)

	Cohort A/B			Control			Cohort C			Change P-value	
	Baseline	Endline	Change (95% CI)	Baseline	Endline	Change (95% CI)	Baseline	Endline	Change (95% CI)	All 3 groups	A + B vs Control
Any stress coping	56.1%	74.4%	18.3% (14.7, 21.9%)	51.0%	73.7%	22.7% (17.5, 27.9%)	73.7%	68.7%	- 5.0% (- 12.2, 2.2%)	<0.001	0.256
Any crisis coping	47.9%	75.5%	27.6% (23.9, 31.3%)	43.8%	78.2%	34.4% (29.0, 39.7%)	78.0%	84.7%	6.7% (0.4, 12.9%)	<0.001	0.048
Any emergency coping	26.9%	28.5%	1.6% (- 1.8, 5.1%)	28.0%	29.9%	1.9% (- 3.2, 7.0%)	33.3%	26.3%	- 7.0% (- 14.0, 0.0%)	<0.001	0.951
	Adjusted change ¹ = 1.2% (- 1.7, 4.1%)			Adjusted change ¹ = 1.7% (- 2.6, 6.1)			Adjusted change ¹ = - 5.7% (- 11.6, 0.2)			0.081	0.869

Guidance Note: Consolidated Approach to Reporting Indicators of Food Security (CARI)

¹ Models adjusted for the following baseline variables: age; education; HH head sex; HH size; time in current community; displacement status; main drinking water source; toilet type; residence type; total income amount; income source types (small business, crop/vegetable farming, livestock, market stall vendor/sales, remittances, humanitarian assistance, salaried employment); number of types of income sources; any savings; purchased livestock; savings/lending group membership. These encompass all variables with statistically significant differences across all 3 groups at baseline with the exception of redundant, correlated, and/or otherwise statistically restrictive variables. Bold % change/95 CI indicates statistically significant ($p < 0.05$) change in group; bold italics indicates $p < 0.001$

² Little no hunger = HHS score of 0-1; moderate hunger = HHS score of 2-3; severe hunger = HHS score of 4-6

³ Scale range 0-25; higher = more severe

⁴ Categorized as 'stress', 'crisis', and 'emergency' per WFP's 2015 Technical

Worsened household hunger and coping

Overall, 29.0% of participants saw worsened household hunger at endline relative to baseline (Table 5). The largest proportion of households with worsened hunger was in Cohort A/B (32.2%) compared to 27.8% in the control group and 18.7% in Cohort C ($p < 0.001$). Worsened coping strategy adoption was more common overall (43.5%), though a significantly larger proportion of control group households (48.1%) adopted severe coping strategies at endline compared to Cohort A/B (45.3%) and Cohort C (27.3%) ($p < 0.001$). A sizable proportion of households (42.9%) did not see deterioration in hunger or coping, and relatively few households saw worsening in both outcomes (15.4%) or in hunger but not coping (13.6%) (Fig. 4). More than one-quarter (28.1%) of households had more severe coping but not worsened hunger at endline.

There was no statistically significant association between worsened hunger and household size, crowding, time living in the current community, income generation activities, savings, and participation in savings or lending groups. Worsened household hunger was significantly associated with formal education, expenditure quartile, and having purchased livestock. Women who attended any formal education, even if not completed, had 26% lower odds of worsened hunger (OR=0.74, CI 0.55–0.98). Conversely, relative to those in the bottom quartile, women in the third quartile of household expenditures had increased odds of worsened hunger (OR=1.37, CI 1.05–1.80), as did women who reported purchasing livestock in the past 3 months (OR=1.63, CI 1.27–2.09).

As with worsened hunger, crowding, time living in the current community, number of income source types, savings, and participation in savings or lending groups were not significantly associated with adoption of more severe coping strategies at endline relative to baseline. Unlike hunger, larger household size was associated with significantly higher odds of worsened coping strategy adoption (OR=1.05, CI 1.01–1.09). Higher spending, however, was associated with decreased odds of worsened coping with those in the second (OR=0.68, CI 0.54–0.85), third (OR=0.67, CI 0.51–0.86), and top (OR=0.65, CI 0.49–0.87) expenditure quartiles seeing lower odds relative to those in the bottom expenditure quartile. Several income generation activities were also associated with reduced odds of worsened coping strategy adoption including generating income from livestock (OR=0.59, CI 0.46–0.76), casual/daily/temporary labor (OR=0.70, CI 0.54–0.91), and market stall/vending/sales (OR=0.38, CI 0.28–0.52). Like worsened hunger, livestock purchase in the past 3 months was associated with increased odds of worsened coping (OR=1.63, CI 1.27–2.09).

Discussion

The originally proposed study sought to compare BRACEII beneficiaries to non-intervention households in the same communities using data collected at the same time before and after the program; however, baseline data collection occurred after Cohort A/B had begun to receive cash transfers and agriculture production support. This is a likely reason for the group's higher and more diverse incomes, greater savings, livestock purchases, and receipt of assistance at baseline compared to the control group [21]. Despite these seemingly considerable advantages for Cohort A/B, the differences in baseline food security were modest. The proportions of households consuming 2+ meals per day and having adequate dietary diversity, respectively, were only 6.2% and 4.1%, greater in the Cohort A/B while both groups had a similar proportion of households experiencing severe hunger. At endline, the proportion of households consuming 2+ meals per day declined (6.0–8.7%) and dietary diversity increased (5.2–10.3%) similarly in both groups. The proportion of households with little to no hunger decreased in both groups, and again, the magnitude of change was small (2.0–3.4% in adjusted models) and not statistically significantly different, suggesting that agriculture and community assets production and cash transfers did not have sustained impacts on food security. Sharing of food and/or cash was reported by approximately 20–25% of households (both giving and receiving), which may have reduced the magnitude of difference observed between the comparison groups and resulted in BRACEII benefits extending beyond targeted beneficiaries.

This finding is further supported by the 18–24% increase in coping mechanism use that was observed in both Cohort A/B and the control group; a significantly larger proportion of control households adopted coping strategies (25.1% vs. 18.4%) compared to Cohort A/B, but few households adopted emergency coping strategies in either group (<2%). Further analysis considering worsened status for hunger and adoption of coping strategies saw no differences between Cohort A/B and the control group for either outcome; however, Cohort C, which was enrolled later, had notably better outcomes with fewer households transitioning to worsened hunger and coping categories. This observation suggests that the broader context and trends in food availability, access, and prices may be more important drivers of household food security than participation in the BRACEII intervention [22, 23]. Considering previous evidence of the variation in cash transfers' impact on a range of outcomes (including nutrition) depending on transfer amounts, timing/frequency, and duration, this is not unsurprising given that

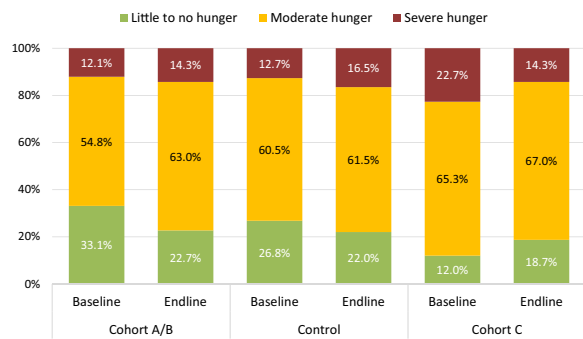


Fig. 2 Household hunger categories by group and time

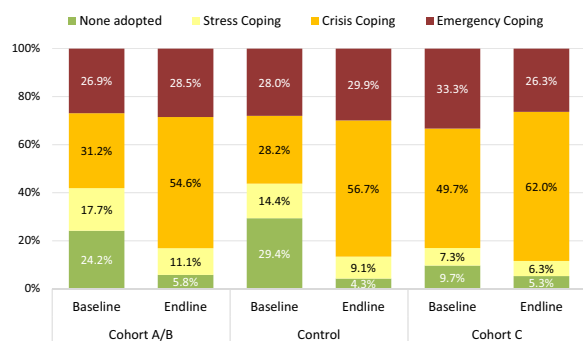


Fig. 3 Most severe coping strategy adopted by group and time

BRACEII is not an emergency food assistance program and that the transfer amount was intended to cover only a modest proportion of household food needs [15, 24, 25]. Moreover, as Cohort A received no cash assistance through BRACEII after the start of the study and Cohort B received cash for only 3 months in 2020, our findings related to worsening hunger and coping may support previous evidence of the detrimental impact of stopping cash assistance even after receiving it for extended periods [26]. More evidence is needed to understand the relationship between transfer value, duration, and household vulnerability to inform future cash programming.

An important outcome of this analysis is understanding which households were likely to experience a deterioration in food security or adoption of worsened coping strategies. Identifying risk factors for poor outcomes in acute food crisis can improve targeting, beneficiary selection, and the effectiveness of food assistance in future crises [27, 28]. Surprisingly, there were few significant associations between household demographic characteristics and worsened food outcomes. One potential reason for this is that only households with labor capacity were eligible, thus beneficiary households were likely less diverse than the community at large [17, 20]. Household size and length of time residing in the community were not associated with worsened food security or

coping outcomes; larger households were slightly more likely to adopt more severe types of coping strategies and households with any amount of formal schooling were less likely to experience worsened hunger. Interestingly, households in higher income quartiles were more likely to experience worsened hunger, potentially because those in the lowest expenditure quartile were already in the most severe hunger category. Being in a higher expenditure quartile was, however, protective against adoption of more extreme coping strategies. There was no association between primary income source or number of income-generating activities and increased risk of worsened hunger, which is surprising given that different households with different livelihoods strategies are often differentially affected in food crises [29]. It was also unexpected that having savings and participation in savings and lending groups were not significantly associated with reduced risk of worsened hunger or coping strategy adoption. It may be that the expected benefits of savings and lending were insufficient to offset contextual factors that limited the availability of and access to markets and food during this time, but still have positive longer-term impacts [30]. Surprisingly, recent livestock purchase was associated with the greatest odds of both worsened hunger and worsened coping strategy adoption. This is somewhat non-intuitive given that livestock are typically purchased as a form of savings, however, the livestock situation in South Sudan notably deteriorated during the study with reported increases in livestock losses and volatile market prices due to periods of extensive flooding and prolonged dry spells, intensified conflict, spread of livestock diseases, and COVID-19 restrictions in Warrap State and throughout the country [31–33]. If households lost animals, could not sell animals, or were forced to sell them at a loss, this could reflect the food security situation at a zonal/regional level and poorly timed livestock acquisition.

Limitations

This analysis leveraged an ongoing study during COVID-19 and a severe food crisis to examine the effectiveness of components of a resilience intervention on household food security and coping mechanism use. As a result of COVID-19 and the ongoing food crisis, there were unanticipated challenges in program delivery and changes in receipt of [non-BRACEII] humanitarian assistance over time that were unpreventable. The analysis attempted to control for baseline differences in beneficiary characteristics and humanitarian assistance receipt, but receipt of humanitarian assistance was not monitored for the full project period, preventing the ability to account for assistance received outside the 3 months preceding data collection. The project leveraged an ongoing intervention,

Table 5 Prevalence of and characteristics associated with worsened outcomes at endline relative to baseline

Overall prevalence	Outcome: Worsened Hunger ¹			Outcome: Worsened Coping Strategy Adoption ²		
	%	(95% CI)	P-value	%	(95% CI)	P-value
Cohort A/B	32.2%	(29.5–34.8)	<0.001	45.3%	(42.5–48.1)	<0.001
Control Group	27.8%	(24.2–31.5)		48.1%	(44.1–52.2)	
Cohort C	18.7%	(14.3–23.1)		27.3%	(22.3–32.4)	
Associated characteristics	OR	(95% CI)	P-value	OR	(95% CI)	P-value
Demographic characteristics						
Any formal education (including incomplete)	0.74	(0.55–0.98)	0.037	1.21	(0.93–1.56)	0.160
Household size	0.99	(0.95–1.03)	0.652	1.05	(1.01–1.09)	0.020
Crowding (5 + HH members per room)	0.85	(0.69–1.05)	0.121	0.84	(0.69–1.03)	0.091
Living in current community < 5 years	1.26	(0.88–1.81)	0.210	1.06	(0.75–1.50)	0.748
Household income and expenditures						
Expenditure quartile						
Bottom quartile		Reference			Reference	
2nd quartile	1.13	(0.88–1.45)	0.339	0.68	(0.54–0.85)	0.001
3rd quartile	1.37	(1.05–1.80)	0.022	0.67	(0.51–0.86)	0.002
Top quartile	1.14	(0.84–1.55)	0.396	0.65	(0.49–0.87)	0.004
Income generation activities						
Small business	1.10	(0.86–1.42)	0.436	1.12	(0.88–1.42)	0.352
Crop/vegetable farming	1.19	(0.93–1.53)	0.168	1.24	(0.98–1.58)	0.075
Livestock	0.90	(0.69–1.17)	0.438	0.59	(0.46–0.76)	<0.001
Casual/daily labor (temporary)	0.85	(0.65–1.13)	0.262	0.70	(0.54–0.91)	0.008
Market stall, vendor, or sales	1.04	(0.77–1.41)	0.788	0.38	(0.28–0.52)	<0.001
More than one type of income source	1.05	(0.77–1.44)	0.748	1.13	(0.83–1.52)	0.439
Any savings	1.12	(0.90–1.41)	0.312	0.89	(0.71–1.10)	0.287
Purchased livestock	1.50	(1.16–1.92)	0.002	1.63	(1.27–2.09)	<0.001
Savings/lending group member	0.77	(0.55–1.09)	0.139	0.73	(0.53–1.01)	0.060

Models also adjust for study group (i.e., Cohort A/B, control group, Cohort C)

¹ Includes households that moved at least one category worse (into moderate or severe hunger) from baseline to endline

² Includes households that adopted a more severe level coping strategy at endline vs baseline

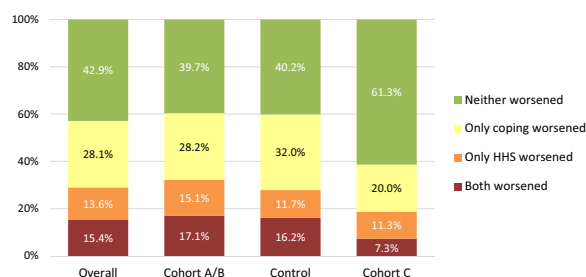


Fig. 4 Worsened household hunger and coping from baseline to endline by group

meaning it was not possible to have an intervention group that had not received assistance at baseline in the original design. Cohort C was added when the project was expanded to serve as such an intervention group; however, it was not possible to control for temporal and

contextual differences and Cohort C was sampled from different communities, which made a rigorous comparison challenging.

Conclusions

This study examined food security and livelihoods-related coping mechanism use among resilience program participants in South Sudan during an acute food crisis. The program provided seasonal cash for work, valued at 50% of an average household’s food needs, where households were compensated for time spent working in community gardens. The primary comparison focused on households from the same community that were and were not engaged in the program, for whom data were collected at the same time periods. There were no significant differences in change over time in household hunger score, livelihoods coping strategy index score or meal frequency between program participants and the

comparison group. The comparison group had a significantly larger increase in dietary diversity over time; however, at endline there were no significant differences in dietary diversity between program participants and the non-intervention group.

These findings suggest that additional food access from community gardens and modest size cash transfers did not have immediate benefits for household food security. It is likely that seasonality influenced these findings and that newer gardens may have lower production, which may have limited their benefit in terms of food consumption and/or additional income. Given the high levels of food insecurity and deteriorating situation along with extensive unmet household needs, the cash transfer amount may have been too small to translate into significant gains, particularly as benefits (e.g., improved consumption) may be relatively short lived. There were few factors associated with increased likelihood of worsened food security and coping outcomes, the most noticeable being recent investment livestock, suggesting this is a poor household asset strategy within the context of crisis level food insecurity.

Limited humanitarian assistance funding necessitates decision making between increased beneficiary caseloads and larger benefits for a smaller number of beneficiaries. In the case of this study, cash transfers did not appear to have substantial lasting benefits on food security and livelihoods coping strategy use. In future food assistance and resilience programming, larger transfer sizes may need to be considered if more substantive gains in household food security are desired, though within the context of a worsening food crises, maintaining household food security as opposed to improving it may be sufficient.

Abbreviations

CI	95% Confidence Interval
CVA	Cash and voucher assistance
HHS	Household hunger scale
IDP	Internally displaced persons
IPC	Integrated food security phase classification system
IPV	Intimate partner violence
OR	Odds ratio
SSP	South Sudanese pounds

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40066-023-00431-7>.

Additional file 1: Original planned sample size calculations. Detailed description of initially planned sample size calculations.

Additional file 2: Baseline and endline questionnaires. Complete questionnaires used for baseline and endline interviews.

Additional file 3: Food security and coping strategies for all groups. More detailed descriptive analysis of food security and coping strategy adoption.

Additional file 4: Independent variables included in regression models (all measured at baseline). Detailed overview of independent variables included in adjusted analyses.

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Author contributions

SD contributed to study design and implementation, and co-led manuscript preparation. EL led data analysis and co-led manuscript preparation. RKM supported field implementation, assisted with contextualization of findings, and critically reviewed the manuscript. KPM led quality monitoring, data cleaning, and contributed to data analysis. CR and KS were the principal investigators and obtained funding, led study design, and oversaw implementation. All authors read and approved the final manuscript.

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Availability of data and materials

The dataset supporting the conclusions of this article are available in the Humanitarian Data Exchange, and [upon acceptance] can be accessed at <https://data.humdata.org/dataset/cash-for-assets-during-acute-food-insecurity-in-south-sudan>.

Declarations

Ethics approval and consent to participate

Due to high illiteracy levels, verbal informed consent was obtained from all women for their participation in the study prior to enrolment and initiation of the first interview. An abbreviated oral consent was used for subsequent data collection to affirm agreement for continued participation. The study, including use of oral informed consent, was approved by the Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health (reference number: 00009692) and the South Sudan National Bureau of Statistics.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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References

1. Development Initiatives. Global humanitarian assistance report 2022. 2022. https://devinit.org/documents/1193/GHA2022_Digital_v6_dcYRQ4X.pdf. Accessed 11 Aug 2022.
2. Inter-Agency CWG South Sudan. Quarterly Dashboard- Third Quarter 2019. 2019. https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/cwg_3qtr_infograph.pdf. Accessed 17 May 2023.
3. United Nations Office for the Coordination of Humanitarian Affairs (OCHA). South Sudan Humanitarian Response Plan 2023. 2022. <https://>

- reliefweb.int/report/south-sudan/south-sudan-humanitarian-response-plan-2023-december-2022. Accessed 17 May 2023.
4. Arnold C, Conway T, Greenslade M. Cash transfers evidence paper. 2011. UK Department of International Development (DFID). <https://gsdr.org/document-library/cash-transfers-evidence-paper>. Accessed 1 Sep 2022.
 5. Creti P, Jaspars S. Cash transfer programming in emergencies. 2006. Oxford. <https://policy-practice.oxfam.org/resources/cash-transfer-programming-in-emergencies-115356>. Accessed 1 Sep 2022.
 6. Venton C, Bailey S, Pongracz S. Value for money of cash transfers in emergencies. 2015. UK Department for International Development. <https://www.calpnetwork.org/publication/value-for-money-of-cash-transfers-in-emergencies>. Accessed 1 Sep 2022.
 7. Austin A, Frize J. Ready or not? emergency cash transfers at scale. 2011. Oxford: Cash Learning Partnership. <http://www.cashlearning.org/downloads/resources/calp/CalP%20Ready%20Or%20Not%20-%20Emergency%20Cash%20Transfers%20At%20Scale.pdf>. Accessed 1 Sep 2022.
 8. Food Security Information Network. Global report on food crises 2020. 2020. <https://www.wfp.org/publications/2020-global-report-food-crises>. Accessed 2 Nov 2022.
 9. Food Security Information Network. Global report on food crises 2022. 2022. <https://www.wfp.org/publications/global-report-food-crises-2022>. Accessed 2 Nov 2022.
 10. Integrated Food Security Phase Classification. South Sudan IPC acute food insecurity and acute malnutrition analysis February–July 2022. 2022. https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/South_Sudan_IPC_Key_Messages_February-July-2022_Report.pdf. Accessed 1 Sep 2022.
 11. Johns Hopkins Center for Humanitarian Health. National and State-level trends in community management of acute malnutrition (CMAM) programs in South Sudan before and during the COVID-19 pandemic. 2022. <https://reliefweb.int/report/south-sudan/national-and-state-level-trends-community-management-acute-malnutrition-cmam-programs-south-sudan-and-during-covid-19-pandemic>. Accessed 6 Feb 2023.
 12. Robinson et al. Cash transfers and intimate partner violence in South Sudan. Manuscript under review [citation to be updated].
 13. Ballard T, Coates J, Swindale A, Deitchler M. Household hunger scale: indicator definition and measurement guide. 2011. Washington, DC: Food and Nutrition Technical Assistance II Project, FHI 360. <https://www.fantaproject.org/sites/default/files/resources/HHS-Indicator-Guide-Aug2011.pdf>. Accessed 8 Feb 2023.
 14. Wang X, Ji X. Sample size estimation in clinical research: from randomized controlled trials to observational studies. *Chest*. 2020;158(1):S12–20.
 15. Browner WS, Newman TB, Hulley SB. Estimating sample size and power: applications and examples. *Design Clin Res*. 2007;3:66–85.
 16. World Food Programme (WFP). Technical guidance for WFP: consolidated approach for reporting indicators of food security (CARI). 2021. <https://docs.wfp.org/api/documents/WFP-0000134704/download>. Accessed 6 Dec 2022.
 17. Sassi M. Determinants of household nutrition security in countries in protracted crisis: evidence from South Sudan. *Sustainability*. 2022;14(8):4793. <https://doi.org/10.3390/su14084793>.
 18. Lokosang LB, Ramroop S, Zewotir T. The effect of weakened resilience on food insecurity in protracted crisis: the case of South Sudan. *Agric Food Secur*. 2016;5:1–8. <https://doi.org/10.1186/s40066-016-0051-y>.
 19. Grimaccia E, Naccarato A. Food insecurity individual experience: a comparison of economic and social characteristics of the most vulnerable groups in the world. *Soc Indic Res*. 2019;15(143):391–410. <https://doi.org/10.1007/s11205-018-1975-3>.
 20. Lokosang LB. 2009. Statistical analysis of determinants of household food insecurity in post-conflict Southern Sudan (Doctoral dissertation). <https://ukzn-dspace.ukzn.ac.za/handle/10413/11600>. Accessed 25 June 2023.
 21. Bonilla J, Carson K, Kiggundu G, Morey M, Ring H, Nillesen E, Erba G, Michel S. 2017. Humanitarian cash transfers in the Democratic Republic of the Congo: evidence from UNICEF's ARCC II programme. <https://www.air.org/sites/default/files/downloads/report/Humanitarian-Cash-Transfer-DRC-April-2017.pdf>. Accessed 25 June 2023.
 22. Otekunrin OA, Otekunrin OA, Sawicka B, Pszczółkowski P. Assessing food insecurity and its drivers among smallholder farming households in rural Oyo State, Nigeria: the HFIAS approach. *Agriculture*. 2021;11(12):1189.
 23. Misselhorn AA. What drives food insecurity in southern Africa? A meta-analysis of household economy studies. *Glob Environ Chang*. 2005;15(1):33–43.
 24. South Sudan Inter Agency Cash Working Group (IACWG). Joint Market Monitoring Initiative (JMIMI). <https://reach-info.org/ssd/jmimi/>. Accessed 6 Dec 2022.
 25. South Sudan Inter Agency Cash Working Group (IACWG). Multisector survival minimum expenditure basket (SMEB) South Sudan. 2021. <https://reliefweb.int/report/south-sudan/multisector-survival-minimum-expenditure-basket-smeb-south-sudan-guidance-note>. Accessed 6 Dec 2022.
 26. Buser T, Oosterbeek H, Plug E, Ponce J, Rosero J. The impact of positive and negative income changes on the height and weight of young children. IZA Discussion Paper 8130. 2014. Bonn: IZA. <https://docs.iza.org/dp8130.pdf>. Accessed 6 Dec 2022.
 27. Glijarano C, Verme P. Optimal targeting under budget constraints in a humanitarian context. 2017. <https://openknowledge.worldbank.org/server/api/core/bitstreams/a8e3d6d5-af12-5adc-af67-d035bc718ac7/content>. Accessed 17 May 2023.
 28. UNICEF. Technical note: targeting for social protection in humanitarian and fragile contexts. 2021. <https://www.unicef.org/media/100036/file/Technical%20Note%20-%20Targeting.pdf>. Accessed 17 May 2023.
 29. Sen A. Poverty and famines: an essay on entitlement and deprivation. 1981. New York: Oxford University Press. <https://www.prismaweb.org/nl/wp-content/uploads/2017/06/Poverty-and-famines%E2%94%82Amaritya-Sen%E2%94%821981.pdf>. Accessed 6 Dec 2022.
 30. Burchi F, De Muro P. From food availability to nutritional capabilities: Advancing food security analysis. *Food Policy*. 2016;60:10–9.
 31. Food and Agriculture Organization of the United Nations (FAO). Impact of floods on crop production, livestock and food security: South Sudan, December 2021. 2021. <https://fscluster.org/south-sudan-rep/document/impact-floods-crop-production-livestock>. Accessed 6 Dec 2022.
 32. Integrated Food Security Phase Classification. IPC acute food insecurity & acute malnutrition analysis: October 2020–July 2021. 2020. https://fscluster.org/sites/default/files/documents/ipc_south_sudan_key_messages_oct_2020-july_2021.pdf. Accessed 6 Dec 2022.
 33. United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). South Sudan humanitarian needs overview 2021. 2021. <https://reliefweb.int/report/south-sudan/south-sudan-humanitarian-needs-overview-2021-january-2021>. Accessed 6 Dec 2022.

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