The Roles of Knowledge and Food Vouchers in Improving Child Nutrition

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January 3, 2020

Motivation

- More than 150 million young children are stunted (chronically undernourished) (World Bank 2017).

  - ▶ Severe and prevalent problem Global prevalence
  - ▶ Increases rapidly during 6-18 months of age HAZ by age

- Chronic undernutrition leads to poor health, low education achievement, and bad labor market outcomes (Black et al. 2008, Hoddinott, Behrman, et al. 2013, Schwarzenberg et al. 2018).

- Substantial research on the causes of chronic child undernutrition, but less is known about what accelerates undernutrition reduction.

- Limited success of interventions that target a single aspect of undernutrition (Bhutta et al. 2013, Ruel et al. 2013).

- Would addressing multiple constraints simultaneously be more effective in accelerating undernutrition reduction?

This Study

- What are the impacts of

  1. Nutrition education for mothers (behavior change communication, BCC)

  2. Food vouchers

  3. Nutrition education & Food vouchers

     on child feeding practices and child nutrition outcomes?

Preview of Results
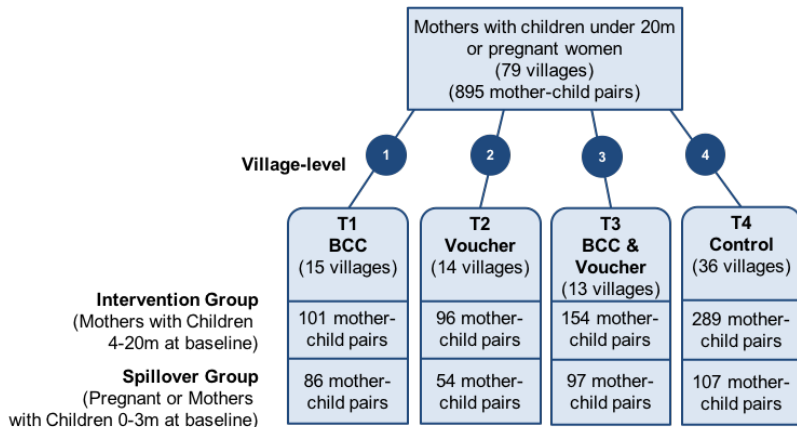
- Knowledge
  - BCC improves mother knowledge.
  - Voucher alone does not.

- Diet quality
  - BCC increases child diet quality on a number of measures.
  - The effect is greatest when combined with vouchers.
  - Voucher alone does not increase child diet quality.

- Nutrition outcomes
  - When BCC and vouchers combined, stunting decreased by 25%.

- BCC intervention sustainability
  - Substantial knowledge spillovers to untreated new mothers.

Contribution

1. Establish complementarity between nutrition education and vouchers

   (Banerjee et al. 2015, Bandiera et al. 2017)

2. Identify causal effects of single interventions (nutrition education and food vouchers) on child nutrition

   (Fitzsimons et al. 2016, Hoddinott, A. Ahmed, et al. 2018, Manley et al. 2013

3. Assess intervention sustainability through knowledge spillovers

   (Cole and Fernando 2018, Hoddinott, I. Ahmed, et al. 2017, Kremer and Miguel 2007)

Background: Ethiopia

- Income constraints
  - GDP per capita: 707USD ($\approx$ \$2/day)

- Ethiopia's child undernutrition challenges (Ethiopia DHS, 2016)
  - Prevalence of stunting among children < 5: 38%
  - Prevalence of stunting by age: 16% (6 months) $\longrightarrow$ 47% (24 months)
    Ethiopia HAZ by age

- Misconceptions on child nutrition common
  - Babies should not be fed animal-source food, especially meat.
  - Babies can only digest thin gruel.

- Study area: 6 wards (*kebeles*) from Ejere district (*woreda*) Map of Ejere

Experimental Design

Mothers with children under 20m or pregnant women
(79 villages)
(895 mother-child pairs)

Village-level

	T1 BCC (15 villages)	T2 Voucher (14 villages)	T3 BCC & Voucher (13 villages)	T4 Control (36 villages)
Intervention Group (Mothers with Children 4-20m at baseline)	101 mother-child pairs	96 mother-child pairs	154 mother-child pairs	289 mother-child pairs
Spillover Group (Pregnant or Mothers with Children 0-3m at baseline)	86 mother-child pairs	54 mother-child pairs	97 mother-child pairs	107 mother-child pairs

Interventions: BCC

- For mothers with children 4–20 months of age

- 16 week curriculum

| Week	Contents	Week	Contents
1	Introduction	9	A: Frequency & amount of complementary food B: Eating schedule & discussion
2	Dietary diversity and weekly diet schedule	10	Recipe and cooking demonstration
3	When to start complementary feeding	11	Responsive feeding
4	Thickness & consistency of complementary food	12	Feeding during illness
5	Role play & discussion	13	Role play & discussion
6	Food variety-iron, proteins from meat	14	Hygienic preparation & storage of food
7	A: Enrichment of complementary food B: Household food processing strategy	15	Group discussion & review
8	Role play & discussion	16	Testimonials & ceremony

- Key messages: increase dietary diversity
  - ▶ Animal-source food
  - ▶ Vitamin A-rich fruits and vegetables
  - ▶ Complementary feeding information: feeding amount, frequency, and age of introduction

Picture 1. Nutrition BCC Sessions

Interventions: Food Vouchers

- 200 ETB/month ($\approx$ 10USD/month) for 4 months

  - Similar to food/cash transfers of Ethiopia's Productive Safety Net Programme (PSNP)

- Redeemable at nearby markets for purchasing a wide range of food items including:

  - Cereals, roots and tubers, fruits, vegetables, legumes, milk products, eggs, oil, sugar, spices, and (meat and fish),

- Non-transferable to other households and no rollovers across months

- Recorded each food voucher purchase
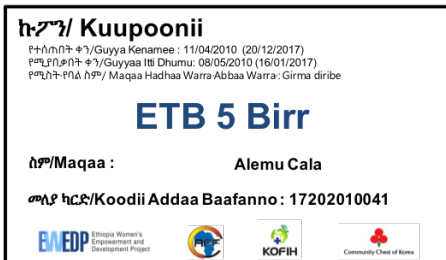
Picture 2. Sample Voucher Coupon

Data Sources

- Ejere census data (2016/05-09)
    - Census of Ejere district for about 22,000 households
    - Demographic, socioeconomic, and health surveys

- Baseline data (2017/04-08) `Survey module`
    - Nutritional knowledge and practices, food consumption, household expenditures, health, gender, social networks, anthropometry, demographics, and socioeconomic modules

- Follow-up data (2017/12-2018/03) `Survey module`

- Voucher purchase record data

- Administrative data on BCC attendance
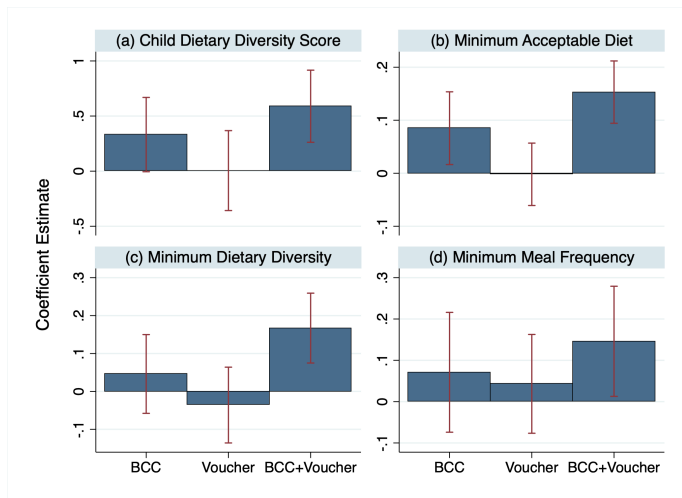
Methods

Basic treatment effects specification:

$$y_{ij} = \beta_0 + \beta_1 BCC_{ij} + \beta_2 Voucher_{ij} + \beta_3 BCC\&Voucher_{ij} + \beta_4 X_{ij} + \epsilon_j + \varepsilon_{ij}$$

- β_1, β_2, β_3: Intent-to-treat estimators

- Controls: baseline outcome, mother, child, and household characteristics.

- Area fixed effect (6 wards)

- Wild-cluster bootstrapping for inference (Cameron et al. 2008)

- Balanced between treatment and control, and between treatment groups. Balance Check

Intervention Attendance and Take-up

- BCC attendance was 74% on average, similar between *BCC* and *BCC + Voucher*.

- Mothers' nutritional knowledge increased for both *BCC* and *BCC + Voucher* (0.47SD and 0.42SD, respectively). [Results Table]

- Voucher households redeemed 88% of the vouchers.

- More than $1/3$ of vouchers spent on non-staple food.

- Similar patterns of voucher redemption by food group between *Voucher* and *BCC + Voucher*. [Results Table]
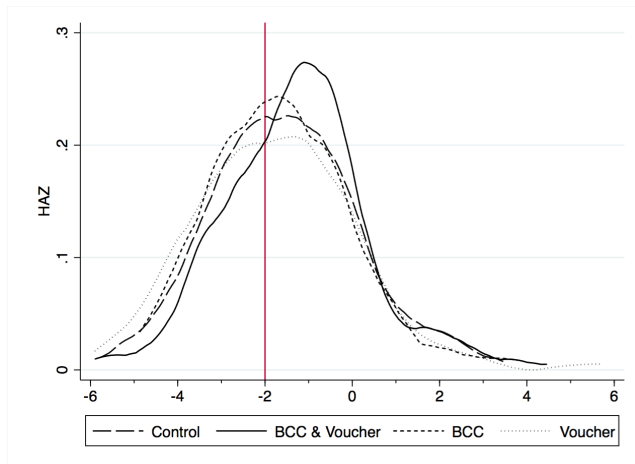
Results: Child Diet Quality
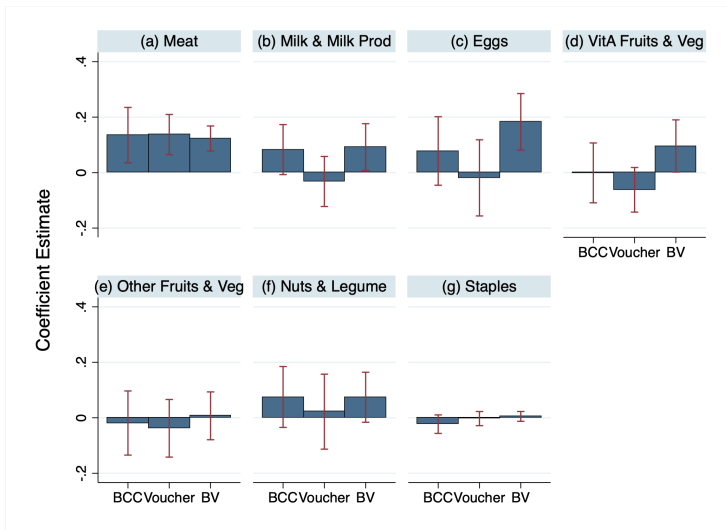
Results: Child Consumption by Food Group

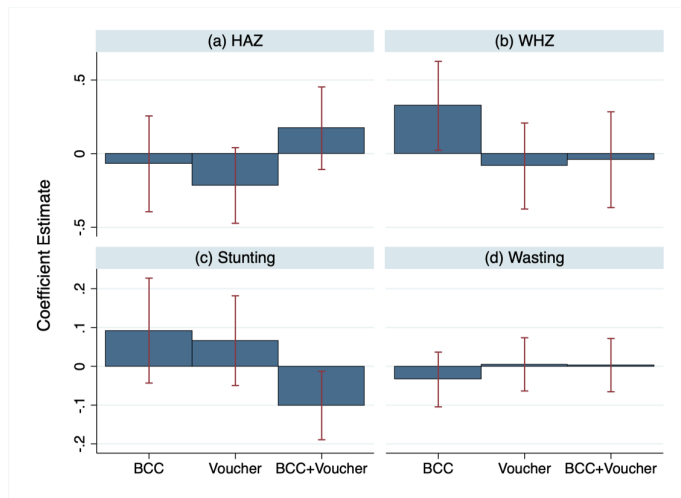# Results: Child Growth Outcomes Density Graph

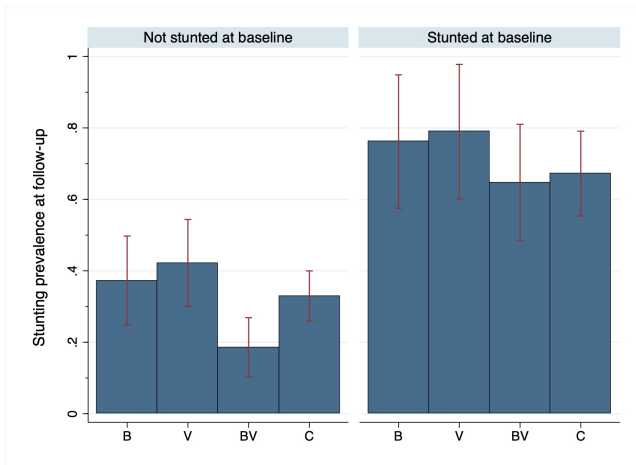# Results: Child Growth Outcomes

Results: Child Growth Outcomes by Baseline Stunting

Results: Spillover Effects

Peer definitions:	(1) Spillover group mother listed BCC participant as friend	(2) BCC participant listed spillover group mother as friend
Dependent variable:	Mother IYCF knowledge score	
Have BCC-eligible friends	0.259*	0.372*
	(0.155)	(0.222)
Observations	275	275
R-squared	0.119	0.121
Have BCC-eligible friends in top 2	0.371***	0.152
	(0.141)	(0.267)
Observations	275	275
R-squared	0.116	0.118

All estimations include controls and additionally controls for the total number of friends listed in the social network module. Robust standard errors clustered at the unit of randomization, the village level, in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Conclusion

- **BCC** also has the same effect on knowledge as **BCC+Voucher** but effects on child-feeding behaviors and nutrition outcomes limited.

- **Voucher** also has no effect on knowledge or child-feeding behaviors.

- Sizable effect of **BCC+Voucher** on knowledge, child-feeding behaviors, and nutrition outcomes.

  - Accelerated stunting reduction by 10 percentage points within 6 months.

- Substantial knowledge spillovers to untreated new mothers demonstrate that the impact of **BCC** could be sustained in the community.

Appendix

Global Stunting Prevalence

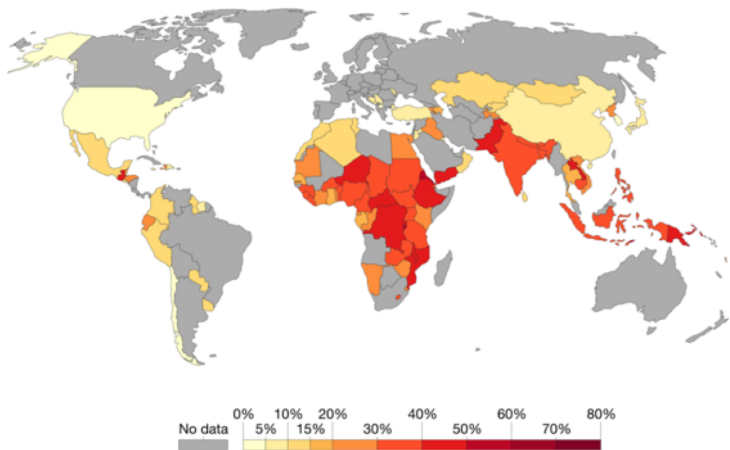Figure A1. Global Stunting Prevalence Among Under 5

Growth Trends by Age, Ethiopia
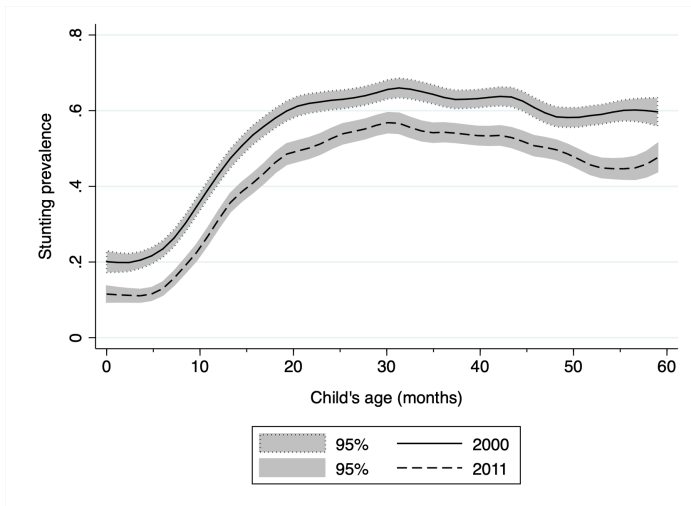
Figure A2. Stunting Prevalence by Age (Ethiopia DHS)

Study Sample
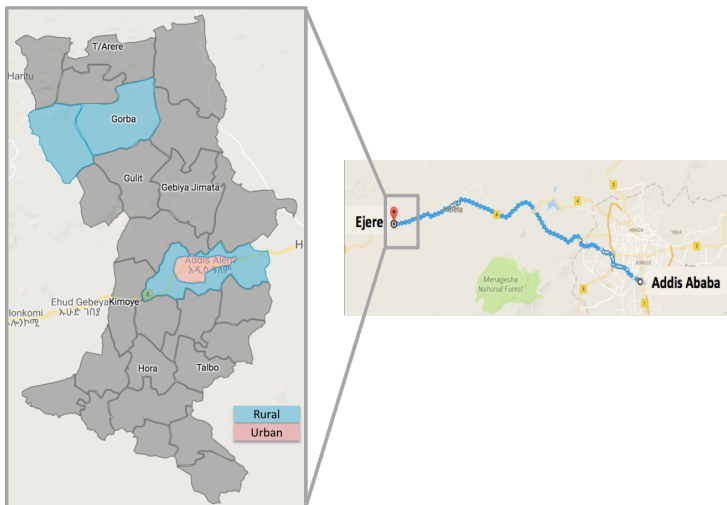
Figure A3. Map of Ejere District

Baseline & Follow-up Survey Module

1. Household roster
2. Education and employment
3. Demographic and marital information
4. Breastfeeding, CF knowledge and practices
5. Exposure to health and nutrition services
6. Household hygiene environment
7. Access to market
8. Intrahousehold decision
9. Household labor allocation

10. Communication with partner
11. Gender norm attitudes
12. Maternal capabilities
13. Social Networks
14. Food frequency
15. Household consumption
16. Food security
17. Computational test
18. Anthropometry

Sample Characteristics and Balance

	Mean		Difference between treatment and control				N	Difference between treatments		
	All	Control	B-C	V-C	BV-C	B=V=BV p-value		B-V	B-BV	V-BV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A. Mother characteristics										
Mother age (years)	28.29	28.21	-0.681	-0.063	0.696	0.318	632	0.618	1.377	0.759
Mother is Oromo	0.766	0.765	-0.016	0.000	0.001	0.988	634	0.016	0.017	0.001
Mother is Orthodox Christian	0.844	0.851	0.018	0.010	-0.038	0.776	634	-0.008	-0.057	-0.048
Mother is married	0.768	0.778	-0.049	-0.055	0.028	0.403	633	-0.007	0.077	0.083
Mother has work	0.564	0.543	0.045	0.040	0.042	0.998	634	-0.005	-0.003	0.002
Mother able to read	0.495	0.471	0.081	0.052	0.008	0.797	633	-0.029	-0.074	-0.045
Mother able to write	0.485	0.457	0.085	0.056	0.021	0.846	633	-0.029	-0.064	-0.034
Mother years of schooling	4.258	3.958	0.595	-0.221	0.835	0.611	634	-0.817	0.240	1.057
Mother IYCF knowledge score	21.49	21.46	0.005	-0.168	0.195	0.808	634	-0.173	0.190	0.363
Panel B. Child characteristics										
Eligible child age (months)	12.48	12.29	1.100**	-0.183	0.016	0.057	634	-1.28**	-1.083*	0.199
Child dietary diversity score	2.359	2.433	0.022	-0.236	-0.185	0.456	634	-0.258	-0.207	0.051
Minimum acceptable diet	0.128	0.116	0.074	0.004	0.004	0.361	627	-0.070	-0.070	0.000
Height-for-age Z score	-1.06	-1.04	-0.043	-0.111	-0.128	0.930	613	-0.068	-0.084	-0.016
Stunting	0.272	0.266	0.005	-0.015	0.045	0.549	613	-0.020	0.040	0.060

B=BCC only, V=voucher only, BV=both BCC and voucher. Columns 1-2 show a summary of the whole sample and the control group. Columns 3-5 report mean differences and significance levels from test of mean differences between each treatment group and control. Column 6 shows p-values from the joint test of equality of parameters reported in columns 3-5, column 7 the number of observations, and columns 8-10 test of mean differences between treatment groups. * , ** , and *** denote significance at 10% , 5% , and 1% , respectively.

Sample Characteristics, Balance, and Attrition

	Mean		Difference between treatment and control				N	Difference between treatments		
	All	Control	B-C	V-C	BV-C	B=V=BV p-value		B-V	B-BV	V-BV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel C. Household characteristics										
Female household head	0.139	0.135	0.026	0.004	-0.008	0.772	634	-0.022	-0.033	-0.012
Household size	4.539	4.495	-0.100	0.160	0.140	0.500	634	0.260	0.240	-0.020
Number of children	2.348	2.315	-0.101	0.126	0.146	0.572	634	0.227	0.247	0.020
Asset index	-0.02	-0.06	0.162	-0.086	0.113	0.807	634	-0.249	-0.050	0.199
Rural	0.445	0.505	-0.017	-0.060	-0.194	0.673	634	-0.043	-0.177	-0.133
Total weekly food expenditure, per capita	131.7	129.9	11.26	-11.92	2.275	0.818	634	-23.18	-8.984	14.20
Total weekly non-food exp., per capita	17.05	16.82	3.522	-5.27**	1.302	0.076	634	-8.788*	-2.220	6.568
Household food consumption score	43.19	43.28	-1.003	-0.016	0.333	0.830	634	0.987	1.337	0.349
Distance to the nearest market (km)	3.593	4.978	-1.924	-2.327	-3.013	0.521	626	-0.403	-1.089	-0.686
Panel D. Attrition										
Follow-up Survey Attrition Rates	0.084	0.093	0.007	-0.040	-0.013	0.478	634	-0.047	-0.020	0.027
Anthropometry Attrition Rates	0.166	0.156	0.045	-0.049	0.038	0.049	634	-0.094*	-0.007	0.087**

B=BCC only, V=voucher only, BV=both BCC and voucher. Columns 1-2 show a summary of the whole sample and the control group. Columns 3-5 report mean differences and significance levels from test of mean differences between each treatment group and control. Column 6 shows p-values from the joint test of equality of parameters reported in columns 3-5, column 7 the number of observations, and columns 8-10 test of mean differences between treatment groups. * , ** , and *** denote significance at 10% , 5% , and 1% , respectively.

First-stage Results: BCC Attendance and Knowledge

	BCC attendance rate (1)	Mother IYCF knowledge score (%, standardized) (2)
BCC (B)	0.744***	0.468***
	(0.020)	(0.100)
		[0.006]
Voucher (V)	-0.005	0.060
	(0.006)	(0.137)
		[0.964]
BCC & Voucher (BV)	0.773***	0.415***
	(0.008)	(0.103)
		[0.017]
Observations	577	576
R-squared	0.909	0.127
Control group mean	0	-0.166
P-value: B=BV	0.189	0.657

All estimations include controls. Robust standard errors clustered at the unit of randomiza-
tion, the village level, in parentheses. Wild-cluster bootstrap p-values in square brackets.
*** p<0.01, ** p<0.05, * p<0.1.

First-stage Results: Voucher Redemption

	Total voucher exp. (month)	Total voucher exp. (week)	Animal prod. total	Vitamin A fruits & veg.	Other fruits & veg.	Nuts & legumes	Starch
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Voucher	153.2***	38.31***	1.592***	1.178***	5.497***	1.985***	15.15***
	(4.035)	(1.009)	(0.336)	(0.141)	(0.403)	(0.472)	(0.944)
BCC & Voucher	151.8***	37.95***	1.282***	1.577***	7.366***	1.542***	13.28***
	(3.227)	(0.807)	(0.173)	(0.178)	(0.426)	(0.458)	(0.635)
	472	472	472	472	472	472	472
	0.903	0.903	0.241	0.389	0.623	0.323	0.638
P-value: V=BV	0.789	0.789	0.357	0.086	0.004	0.453	0.110

All estimations include controls. Robust standard errors clustered at the unit of randomization, the village level, in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Results: Child Diet Quality

	Child dietary diversity score (CDDS) (1)	Minimum acceptable diet (2)	Minimum dietary diversity (3)	Minimum meal frequency (4)
BCC (B)	0.332*	0.085**	0.046	0.071
	(0.174)	(0.034)	(0.053)	(0.074)
Voucher (V)	0.005	-0.002	-0.036	0.043
	(0.185)	(0.030)	(0.051)	(0.061)
BCC & Voucher (BV)	0.589***	0.153***	0.167**	0.146*
	(0.167)	(0.030)	(0.047)	(0.068)
Observations	583	537	583	440
R-squared	0.121	0.124	0.123	0.067
Control group mean	3.073	0.124	0.328	0.565
P-value: B=BV	0.186	0.088	0.038	0.403

All estimations include controls. Robust standard errors clustered at the unit of randomization, the village level, in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Results: Child Consumption by Food Group

	Meat	Milk	Eggs	Vitamin A fruits & veg.	Other fruits & veg.	Nuts & legumes	Starchy staples
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
BCC (B)	0.135***	0.083*	0.078	-0.001	-0.019	0.075	-0.023
	(0.051)	(0.046)	(0.063)	(0.055)	(0.059)	(0.056)	(0.017)
Voucher (V)	0.137***	-0.032	-0.019	-0.062	-0.038	0.022	-0.003
	(0.037)	(0.046)	(0.070)	(0.041)	(0.053)	(0.069)	(0.013)
BCC & Voucher (BV)	0.123***	0.092**	0.183***	0.096**	0.007	0.074	0.005
	(0.023)	(0.043)	(0.052)	(0.048)	(0.044)	(0.046)	(0.009)
Observations	583	583	583	583	583	583	583
R-squared	0.099	0.099	0.100	0.060	0.042	0.047	0.038
Control mean	0.119	0.275	0.286	0.226	0.805	0.368	0.992
P-value: B=BV	0.813	0.852	0.139	0.128	0.687	0.995	0.123

All estimations include controls. Robust standard errors clustered at the unit of randomization, the village level, in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure

Results: Household Expenditures

	Total food exp. (1)	Non-food exp. (2)	Animal prod. total (3)	Vitamin A fruits & veg. (4)	Other fruits & veg. (5)	Nuts & legumes (6)	Starchy staples (7)
BCC (B)	13.34	-4.623	8.712*	0.192	1.863*	3.473***	1.056
	(10.75)	(3.273)	(4.781)	(0.253)	(1.037)	(1.259)	(6.167)
Voucher (V)	13.68	4.559	13.16**	-0.207	0.148	0.171	-2.824
	(12.26)	(3.511)	(5.709)	(0.223)	(0.618)	(1.106)	(7.011)
BCC & Voucher (BV)	12.01	9.983*	9.580**	0.967***	0.930	0.325	-3.931
	(10.52)	(5.215)	(4.083)	(0.271)	(0.618)	(1.106)	(7.011)
Observations	583	583	583	583	583	583	583
R-squared	0.228	0.162	0.127	0.155	0.250	0.100	0.170
Control mean	81.008	31.451	18.336	0.769	6.592	3.001	30.824
P-value: B=BV	0.915	0.009	0.516	0.011	0.413	0.035	0.487

All estimations include controls. Robust standard errors clustered at the unit of randomization, the village level, in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Figure

Results: Household Consumption by Food Group

| | FCS | Whether eaten by household in the last one week: | | | | | | |
| | | Meat | Milk | Eggs | Vit A fruits & veg. | Other fruits & veg. | Nuts & legumes | Starchy staples |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BCC (B)	5.446***	0.147**	0.093**	0.005	-0.049	-0.036*	-0.013	0.013*
	(1.672)	(0.070)	(0.050)	(0.064)	(0.056)	(0.027)	(0.011)	(0.016)
Voucher (V)	1.750	0.070	0.020	-0.002	0.020	-0.003	-0.019	-0.006
	(2.154)	(0.067)	(0.056)	(0.064)	(0.056)	(0.027)	(0.011)	(0.016)
BCC & Voucher (BV)	5.658***	0.149**	0.187**	0.213***	0.187***	0.011	-0.014	0.005
	(1.632)	(0.060)	(0.059)	(0.050)	(0.059)	(0.026)	(0.011)	(0.011)
Observations	583	583	583	583	583	583	583	583
R-squared	0.218	0.201	0.245	0.203	0.245	0.061	0.064	0.055
Control mean	53.425	0.360	0.234	0.345	0.402	0.061	0.992	0.985

All estimations include controls. Robust standard errors clustered at the unit of randomization, the village level, in parentheses. *** p¡0.01, ** p¡0.05, * p¡0.1.

Figure

Results: Child Growth Outcomes

	HAZ (1)	Stunted (2)	WHZ (3)	Wasted (4)
BCC (B)	-0.069	0.092	0.325**	-0.034
	(0.166)	(0.069)	(0.154)	(0.036)
Voucher (V)	-0.216	0.066	-0.084	0.005
	(0.131)	(0.059)	(0.149)	(0.035)
BCC & Voucher (BV)	0.173	-0.101**	-0.041	0.003
	(0.143)	(0.045)	(0.166)	(0.035)
Observations	462	462	474	474
R-squared	0.367	0.250	0.121	0.087
Control group mean	-1.521	0.410	0.048	0.078
P-value: B=BV	0.145	0.006	0.037	0.384
P-value: B+V=BV	0.028	0.006	0.230	0.563

All estimations include controls. Robust standard errors clustered at the unit of randomization,

the village level, in parentheses.   *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

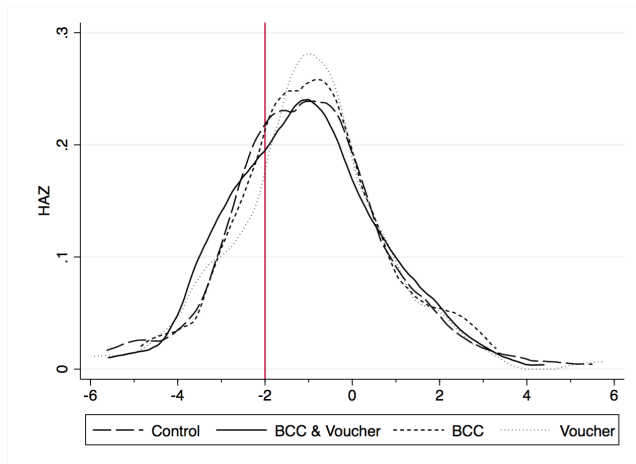Figure

Results: Baseline Child Growth Outcomes Density Graph

Figure A4. Height-for-age (HAZ) *Z* Score Kernel Density Graph

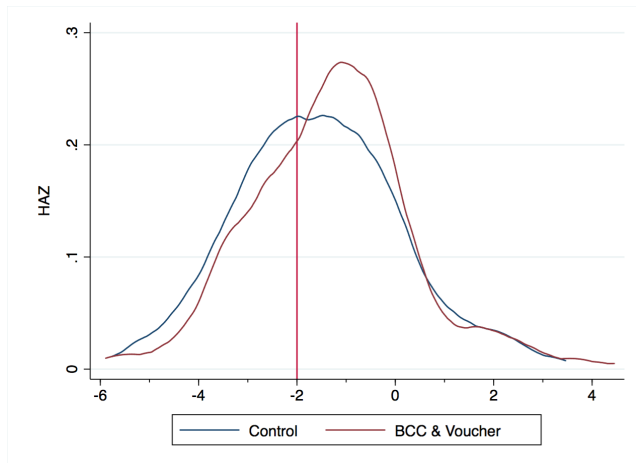# Results: Child Growth Outcomes Density Graph

Figure A5. Height-for-age (HAZ) *Z* Score Kernel Density Graph
(BCC & Voucher and Control Groups Only)

References

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