Supplemental material

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BMJ Global Health

Supplement to: **Cookstove interventions to improve infant health in Ghana**

Table of contents:

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Control and intervention cookstoves

Figure S1. Photographs of representative study cookstoves. Panel A: traditional, open-fire cookstove; panel B: two Improved Biomass (BioLite) cookstoves; and panel C: two-burner liquefied petroleum gas (LPG) cookstove.

Asset index

All household assets were enumerated as counts when possible (e.g. number of livestock, electronic devices, etc.). Categorical variables were made ordinal according to their indication of wealth (e.g. home ownership type). Dichotomous variables indicative of household wealth were retained, e.g. floor material (dirt/concrete). Variables were centered, standardized, and included in a principal components analysis. The first principal component served as our measure of household wealth. This approach was adapted from Gunnsteinsson et al.[1]

Definitions of obstetric endpoints

Preterm Birth: A birth was considered preterm if the infant was born alive after 28 completed weeks' gestation and before 37 completed weeks' gestation. The lower gestational age limit was set as 28 weeks for our study as births <28 weeks are considered miscarriages or abortions in this African setting.

Preterm birth rate: For the purpose of this trial, the preterm birth rate or proportion was calculated by dividing the number of preterm births (as defined above) by the number of total number live births ≥ 28 weeks. In high-income settings, preterm births are counted from 20 weeks gestation through 36 completed weeks gestation. In low- and middle- income settings, deliveries (liveborn or stillborn) are often considered miscarriages or abortions if they occur before 28 completed weeks' gestation. In our study, as women were enrolled and entered the trial up through 24 weeks with delivery of intervention allowed until 27 completed weeks'

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gestation, we chose to define the lower bound of preterm births as 28 weeks. Our preterm birth rate is therefore is lower than global estimates using the broader definition.

Small-for-gestational age: An infant was considered small for gestational age if born alive with a birth weight less than the 10th percentile for the gestational age at delivery after creating a Ghanaian specific curve using methodology described by the World Health Organization.[2] The tenth percentiles for birth weight at specific gestational ages (in completed weeks) generated by this methodology and used in our analysis is outlined in the Table below.

Table S1: Birth weight at the tenth percentile for completed weeks of gestation

Gestational age (in completed weeks)	10th percentile for birth weight (grams)
28	953
29	1081
30	1219
31	1364
32	1515
33	1672
34	1832
35	1993
36	2153
37	2309
38	2459
39	2600
40	2730
41	2846
42	2846
43	2846
44	2846

Small-for-gestational age rate: The SGA rate was the proportion of infants born SGA divided by the total number of live births $\geq$ 28 weeks.

Stillbirth: A stillbirth was defined as the birth of an infant without any signs of life after 28 weeks gestation.

Stillbirth rate: The stillbirth rate is calculated in this study as the number of stillbirths divided by the total of both live births and stillbirths after 28 completed weeks' gestation.

Fetal loss <28 weeks: Fetal losses less than 28 weeks gestation include spontaneous abortions (miscarriages), induced abortions, or live births < 28 weeks gestation.

Fetal loss rate: The fetal loss rate was calculated by dividing the number of fetal losses by the total number of pregnancies enrolled into the study.

Neonatal death: A neonatal death was defined as an infant death within seven days of a live birth.

Neonatal death rate: The neonatal death rate was calculated by dividing the number of neonatal deaths by the number of live births after 28 completed weeks' gestation.

Stove use

Figure S2 shows study arm stove use by study week. Improved biomass stove use for the main meal the preceding day was high at the beginning of the study period (within the first 10 weeks of receiving the intervention), but declined monotonically for the rest of the study period. In comparison, while there were some small decreases in use, LPG stove use remained high over the course of the period.
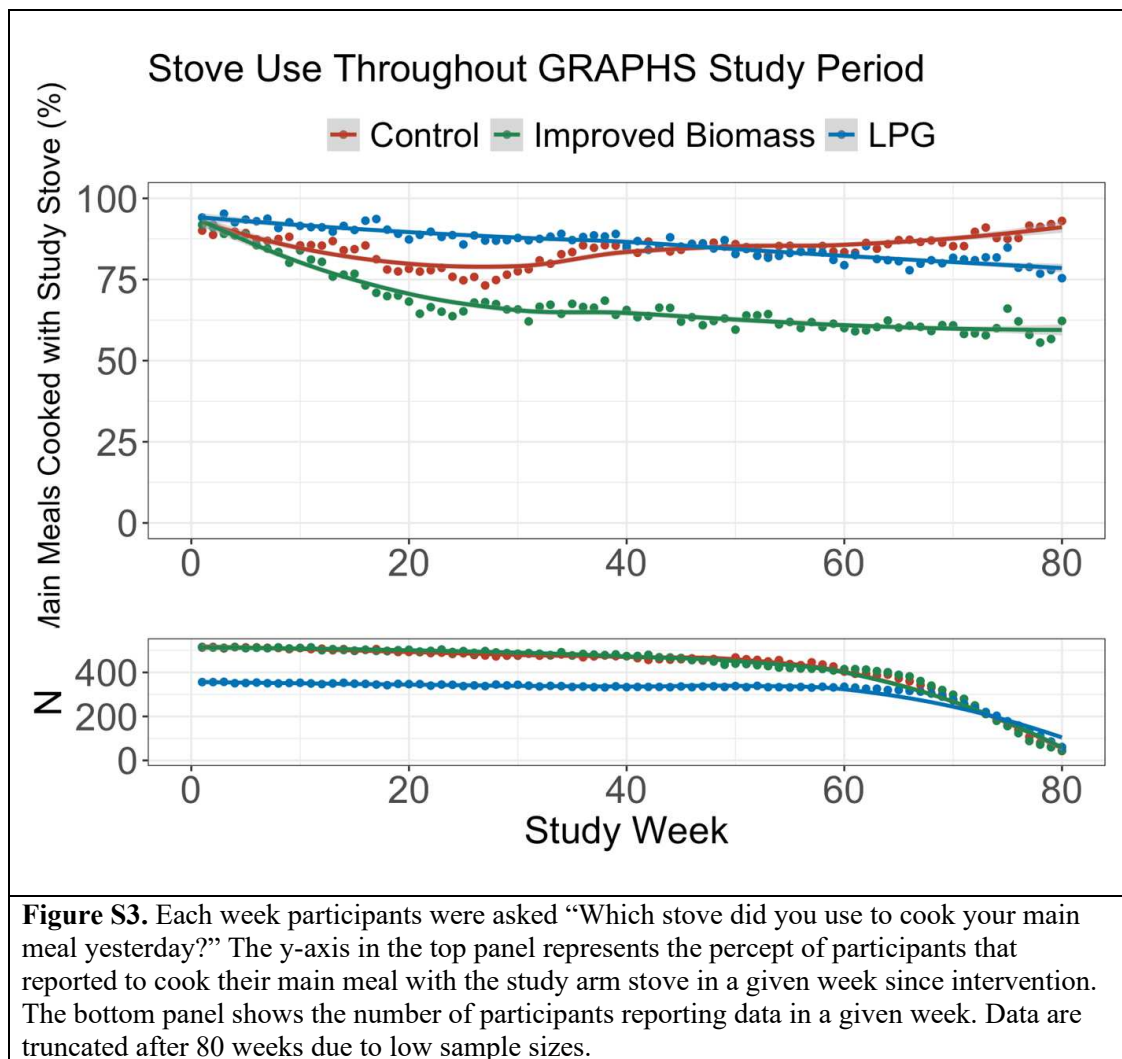

Figure S3. Each week participants were asked "Which stove did you use to cook your main meal yesterday?" The y-axis in the top panel represents the percept of participants that reported to cook their main meal with the study arm stove in a given week since intervention. The bottom panel shows the number of participants reporting data in a given week. Data are truncated after 80 weeks due to low sample sizes.

Table S2. Cox-proportional hazard models assessing associations between study arm and time to pneumonia event. *

Outcome	Observed Outcomes			Unadjusted Survival Analysis †				Adjusted Survival Analysis ‡			
	Control (N=464)	Improved biomass (N=483)	LPG (N=332)	Improved biomass		LPG		Improved biomass		LPG	
Physician-Assessed Cases				HR (95% CI)	P	HR (95% CI)	P	HR (95% CI)	P	HR (95% CI)	P
Pneumonia	110 (23.7)	127 (26.3)	86 (25.5)	1.15 (0.84-1.58)	0.39	1.06 (0.77-1.46)	0.72	1.17 (0.85-1.62)	0.34	1.14 (0.81-1.59)	0.46
Severe Pneumonia	38 (8.2)	48 (9.9)	26 (7.8)	1.26 (0.78-2.04)	0.34	0.96 (0.63-1.46)	0.83	1.20 (0.72-2.01)	0.48	0.96 (0.61-1.51)	0.87
Physician- and Fieldworker-Assessed Cases §											
Pneumonia	162 (34.9)	175 (36.2)	118 (35.5)	1.08 (0.82-1.43)	0.75	0.97 (0.78-1.20)	0.79	1.09 (0.82-1.45)	0.54	1.05 (0.84-1.30)	0.69
Severe Pneumonia	58 (12.5)	66 (13.7)	44 (13.3)	1.12 (0.69-1.80)	0.65	1.03 (0.72-1.48)	0.85	1.11 (0.68-1.81)	0.68	1.08 (0.76-1.54)	0.66

* Pneumonia and severe pneumonia in the first 12 months of life as defined by the WHO Integrated Management of Childhood Illness criteria

† Rate ratios derived from cox proportional hazard models with Wald robust standard errors to account for community-clustered stove intervention study design.

‡ Rate ratios derived from cox proportional hazard models with Wald robust standard errors to account for community-clustered stove intervention study design, adjusting for month of delivery, child sex, and asset index.

§ Physician- and fieldworker-assessed cases defined as physician-diagnosed pneumonia cases plus those diagnosed by a fieldworker in cases where the child did not receive a study physician assessment within seven days.

6

References cited in the supplement

1. Gunnsteinsson S, Labrique AB, West KP, et al. Constructing indices of rural living standards in Northwestern Bangladesh. J Health Popul Nutr 2010;28(5):509–19.

2. Mikolajczyk RT, Zhang J, Betran AP, et al. A global reference for fetal-weight and birthweight percentiles. Lancet 2011;377(9780):1855–61.