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Supplemental Material

Prenatal and Postnatal Household Air Pollution Exposure and Infant Growth Trajectories: Evidence from a Rural Ghanaian Pregnancy Cohort

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Table S11. Associations between prenatal and postnatal average particulate matter ($PM_{2.5}$) and growth trajectories: Ordinal regression sensitivity models.

Table S12. Sex-specific associations between prenatal and postnatal average particulate matter ($PM_{2.5}$) exposure and growth trajectories: Ordinal regression.

Table S13. Associations between cookstove intervention arm and anthropometric growth trajectories: Multivariable Ordinal Regression sensitivity models.

Table S14. Sex-specific associations between cookstove intervention arm and anthropometric growth trajectories.

Figure S1. Directed Acyclic Graph illustrating implied conditional dependencies amongst study variables. The green circle with black inset triangle represents the exposure of interest (prenatal and postnatal household air pollution exposure). The blue circle with the vertical line represents the outcome of interest (infant growth). Green lines represent unbiased causal pathways. Black lines represent neither unbiasing causal pathways nor potentially biased paths. White circles represent adjusted variables in the minimally-sufficient adjustment set (infant sex, race/ethnicity, wealth index, maternal age). Sensitivity models additionally adjust for gestational age at delivery, birth weight, breastfeeding duration or maternal body mass index. DAGgity v3.0 available at http://www.dagitty.net/.

Figure S2. This figure demonstrates a representative plot of a maternal prenatal 72-hour personal carbon monoxide (CO) exposure in parts per million (ppm) over time. The Lascar EL-CO-USB Data Logger was worn in the participant's breathing zone and measured CO levels every 10 seconds which were then averaged into 1-minute averages. Reported cooking periods correspond with elevated CO exposures; outside of these cooking episodes the CO exposures were near zero. The first 48-hours were used in analyses and for this session the 48-hour average CO exposure was 1.62ppm (range 0-79.3ppm).

Figure S3. Post intervention exposure by study arm for (A) 48-hr maternal CO measurements, (B) 48-hr children CO measurements, and (C) 48-hr maternal PM2.5. Violin plots display mirrored density along the variable range. Boxplots depict the median – extended by a notch for clarity – with lower and upper hinges corresponding with the 25th and 75th percentile. Whiskers extend 1.5 times the interquartile range from the hinge. Outliers beyond the whiskers are depicted as points. Diamonds represent distribution means. In plots A, B, and D the WHO guideline for CO exposure is drawn in a dotted line and in plot C the WHO guidelines for PM2.5 exposure are drawn in a dotted line (interim guideline: 35) and a solid line (guideline: 10). The y-axis is log-transformed to improve readability because of the clustering of exposure levels at lower values.

Figure S4. This figure shows associations between interquartile change in prenatal and postnatal average carbon monoxide (CO) exposure and head circumference (HC), length-for-age z-score (LAZ), length and lowest length-for-age z-score (stunted). Here we show a linear relationship between quartile of CO exposure and LAZ (P_{trend} =0.01), length (P_{trend} =0.01), and stunted (P_{trend} <0.01). We note that while postnatal CO exposure is associated with smaller head circumference trajectory in the primary analyses, we do not see a linear trend in these analyses by interquartile change in CO exposure.

Table S1. Household characteristics used to construct the wealth index

	Study Arm			Total (N=1144)
	Control (N=414)	Improved biomass (N=430)	LPG (N=300)	
Do you or anyone in the household own _____? If yes, how many?				
Television				
Median	0	0	0	0
Q1, Q3	0, 1	0, 1	0, 0	0, 1
Sleeping Mattress				
Median	1	1	1	1
Q1, Q3	1, 2	1, 2	0, 2	1, 2
Chicken				
Median	6	5	5	5
Q1, Q3	0, 15	0, 11	0, 10	0, 12
Sheep				
Median	0	0	0	0
Q1, Q3	0, 5	0, 3	0, 4	0, 4
Cart				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0
Pig				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0
Cattle				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0
Table				
Median	2	1	1	1
Q1, Q3	1, 2	1, 2	1, 2	1, 2
Cupboard/wardrobe				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0
Radio				
Median	1	1	1	1
Q1, Q3	0, 1	0, 1	1, 1	0, 1
Gas or electric cooker				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0
Refrigerator or Freezer				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0
Bicycle				
Median	1	1	1	1
Q1, Q3	0, 1	0, 2	0, 2	0, 2
Motorcycle				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 1	0, 0
Tractor				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0
Phone (Fixed or mobile)				
Median	2	2	2	2
Q1, Q3	1, 3	1, 2	1, 2	1, 3
Store, shop or kiosk				
Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

Commercial vehicle

Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

Car

Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

Electric Iron

Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

Fan

Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

TV satellite dish

Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

Computer

Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

Sewing machine

Median	0	0	0	0
Q1, Q3	0, 1	0, 1	0, 1	0, 1

Air conditioner

Median	0	0	0	0
Q1, Q3	0, 0	0, 0	0, 0	0, 0

Do you own any land?

No	167 (40.3%)	151 (35.1%)	97 (32.3%)	415 (36.3%)
Yes	247 (59.7%)	279 (64.9%)	203 (67.7%)	729 (63.7%)

What is the main source of drinking water for members of your household?

Stream/river, rain water, lake/dam/pond, or other	141 (34.1%)	128 (29.8%)	71 (23.7%)	340 (29.7%)
Open well	2 (0.5%)	12 (2.8%)	55 (18.3%)	69 (6.0%)
Public tap, hand pump/closed bore hold, closed well, or water truck	264 (63.8%)	290 (67.4%)	165 (55.0%)	719 (62.8%)
Piped into home, sachet/ "pure water,"or bottled water	7 (1.7%)	0 (0.0%)	9 (3.0%)	16 (1.4%)

Does anyone in the household own their own farm?

No	110 (26.6%)	83 (19.3%)	81 (27.0%)	274 (24.0%)
Yes	304 (73.4%)	347 (80.7%)	219 (73.0%)	870 (76.0%)

What kind of toilet facility does your household have?

Open fields or other	269 (65.0%)	229 (53.3%)	192 (64.0%)	690 (60.3%)
Ventilated improved pit, other pit latrine, defecates in house and transfers elsewhere	144 (34.8%)	201 (46.7%)	107 (35.7%)	452 (39.5%)
Flush latrine or wash closet	1 (0.2%)	0 (0.0%)	1 (0.3%)	2 (0.2%)

Do you own/rent the house you live in, or have another type of arrangement, such as "perching?"

Perching or other	0 (0.0%)	2 (0.5%)	1 (0.3%)	3 (0.3%)
Family/relation house or house provided rent free	171 (41.3%)	147 (34.2%)	96 (32.0%)	414 (36.2%)
Renting	58 (14.0%)	43 (10.0%)	23 (7.7%)	124 (10.8%)
Joint ownership	7 (1.7%)	12 (2.8%)	3 (1.0%)	22 (1.9%)
Sole ownership	178 (43.0%)	226 (52.6%)	177 (59.0%)	581 (50.8%)

What materials are used in the construction of the house?

Floor of sleeping room

Mud, clay or other	26 (6.3%)	17 (4.0%)	24 (8.0%)	67 (5.9%)
Cement	388 (93.7%)	413 (96.0%)	276 (92.0%)	1077 (94.1%)

Roof of sleeping room

Thatch, mud, wood or other	169 (40.8%)	149 (34.7%)	117 (39.0%)	435 (38.0%)
Metal, asbestos	245 (59.2%)	281 (65.3%)	183 (61.0%)	709 (62.0%)

Walls of sleeping room

Mud, other	170 (41.1%)	138 (32.1%)	143 (47.7%)	451 (39.4%)
Cement	244 (58.9%)	292 (67.9%)	157 (52.3%)	693 (60.6%)

Does the household have a separate room for cooking?

No	227 (54.8%)	213 (49.5%)	176 (58.7%)	616 (53.8%)
Yes	187 (45.2%)	217 (50.5%)	124 (41.3%)	528 (46.2%)

Does the household have a domestic worker not related to the household head?

No	404 (97.6%)	409 (95.1%)	290 (96.7%)	1103 (96.4%)
Yes	10 (2.4%)	21 (4.9%)	10 (3.3%)	41 (3.6%)

This table presents the household characteristics used in the construction of the wealth index. Continuous variables were centered and standardized. All variables were then included in a principal component analysis where the first principal component describes the wealth index.

Table S2. Distribution of anthropometric measurements by age, for all children and by study arm

	Control (N=414)	Improved Biomass (N=430)	LPG (N=300)	Total (N=1144)
Birth Weight, kilograms				
Birth				
Mean (SD)	2.91 (0.46)	2.92 (0.45)	2.89 (0.47)	2.91 (0.46)
Range	1.08 – 4.40	1.65 – 4.24	1.50 – 4.70	1.08 – 4.70
Three Months				
Mean (SD)	5.97 (0.93)	6.02 (0.91)	5.99 (0.87)	5.99 (0.91)
Range	2.28 – 9.44	2.67 – 9.75	3.10 – 8.70	2.28 – 9.75
Six Months				
Mean (SD)	7.20 (1.00)	7.17 (0.96)	7.17 (1.01)	7.18 (0.99)
Range	4.08 – 10.12	4.60 – 10.36	4.58 – 10.40	4.08 – 10.40
Nine Months				
Mean (SD)	7.84 (1.11)	7.84 (1.04)	7.91 (1.03)	7.86 (1.06)
Range	4.31 – 10.80	5.11 – 12.57	4.64 – 11.42	4.31 – 12.57
Twelve Months				
Mean (SD)	8.48 (1.09)	8.50 (1.10)	8.48 (1.06)	8.48 (1.08)
Range	5.11 – 11.87	5.82 – 13.15	4.69 – 12.27	4.69 – 13.15
Length, meters				
Birth				
Mean (SD)	0.47 (0.04)	0.46 (0.05)	0.45 (0.06)	0.46 (0.05)
Range	0.14 - 0.57	0.14 - 0.64	0.15 - 0.57	0.14 - 0.64
Three Months				
Mean (SD)	0.59 (0.04)	0.59 (0.03)	0.59 (0.04)	0.59 (0.04)
Range	0.43 - 0.70	0.46 - 0.72	0.46 - 0.69	0.43 - 0.72
Six Months				
Mean (SD)	0.65 (0.04)	0.65 (0.03)	0.65 (0.03)	0.65 (0.04)
Range	0.52 - 0.74	0.51 - 0.77	0.54 - 0.74	0.51 - 0.77
Nine Months				
Mean (SD)	0.69 (0.03)	0.69 (0.03)	0.69 (0.03)	0.69 (0.03)
Range	0.55 - 0.78	0.56 - 0.79	0.61 - 0.78	0.55 - 0.79
Twelve Months				
Mean (SD)	0.73 (0.03)	0.73 (0.03)	0.73 (0.03)	0.73 (0.03)
Range	0.60 - 0.81	0.62 - 0.88	0.64 - 0.81	0.60 - 0.88
Head Circumference, centimeters				
Birth				
Mean (SD)	33.38 (2.26)	33.86 (2.60)	33.58 (2.52)	33.61 (2.47)
Range	25.00 - 43.80	26.50 - 45.00	25.00 - 47.50	25.00 - 47.50
Three Months				
Mean (SD)	40.04 (2.31)	40.43 (1.98)	40.50 (2.04)	40.31 (2.13)
Range	32.00 - 49.00	30.00 - 47.00	34.00 - 48.60	30.00 - 49.00
Six Months				

Mean (SD)	42.49 (2.00)	42.76 (1.61)	42.79 (1.89)	42.66 (1.85)
Range	34.20 - 48.00	33.50 - 48.00	30.00 - 52.30	30.00 - 52.30
Nine Months				
Mean (SD)	43.85 (1.58)	44.11 (1.57)	44.33 (1.53)	44.07 (1.58)
Range	38.50 - 48.30	38.00 - 48.20	35.00 - 50.00	35.00 - 50.00
Twelve Months				
Mean (SD)	45.01 (1.57)	45.13 (1.61)	45.47 (1.42)	45.19 (1.55)
Range	39.70 - 51.50	34.00 - 49.10	41.00 - 50.50	34.00 - 51.50
Mid-Upper Arm Circumference, centimeters				
Birth				
Mean (SD)	11.37 (1.24)	11.28 (1.40)	11.3 (1.6)	11.32 (1.4)
Range	8.00 - 16.00	4.00 - 17.10	4.50 - 21.00	4.00 - 21.00
Three Months				
Mean (SD)	14.08 (1.48)	14.10 (1.43)	14.52 (1.53)	14.21 (1.49)
Range	10.00 - 18.60	8.60 - 18.20	10.00 - 21.10	8.60 - 21.10
Six Months				
Mean (SD)	14.61 (1.43)	14.68 (1.34)	15.01 (1.36)	14.74 (1.39)
Range	10.80 - 19.00	11.40 - 20.10	11.40 - 19.00	10.80 - 20.10
Nine Months				
Mean (SD)	14.69 (1.34)	14.84 (1.37)	15.24 (1.35)	14.9 (1.37)
Range	11.00 - 18.90	10.90 - 19.20	10.70 - 19.00	10.70 - 19.20
Twelve Months				
Mean (SD)	14.94 (1.52)	15.02 (1.37)	15.34 (1.33)	15.09 (1.42)
Range	11.50 - 19.70	11.10 - 20.00	11.50 - 19.00	11.10 - 20.00
Length-for-Age Z-score				
Three Months				
Mean (SD)	-0.65 (1.70)	-0.62 (1.46)	-0.59 (1.58)	-0.62 (1.58)
Range	-4.94 - 4.38	-4.50 - 4.91	-4.99 - 4.38	-4.99 - 4.91
Six Months				
Mean (SD)	-0.66 (1.57)	-0.77 (1.49)	-0.81 (1.53)	-0.74 (1.53)
Range	-4.97 - 3.20	-4.97 - 4.46	-4.65 - 3.42	-4.97 - 4.46
Nine Months				
Mean (SD)	-0.81 (1.33)	-0.90 (1.40)	-0.73 (1.30)	-0.82 (1.35)
Range	-4.89 - 3.04	-4.74 - 3.54	-4.44 - 2.63	-4.89 - 3.54
Twelve Months				
Mean (SD)	-0.81 (1.32)	-0.97 (1.15)	-0.76 (1.1)	-0.85 (1.19)
Range	-4.94 - 2.72	-4.69 - 2.00	-3.73 - 2.00	-4.94 - 2.72
Weight-for-Age Z-score				
Three Months				
Mean (SD)	-0.23 (1.19)	-0.23 (1.19)	-0.24 (1.19)	-0.23 (1.19)
Range	-4.74 - 3.94	-4.28 - 4.25	-4.63 - 2.73	-4.74 - 4.25
Six Months				
Mean (SD)	-0.56 (1.17)	-0.66 (1.13)	-0.60 (1.20)	-0.60 (1.16)
Range	-4.96 - 2.38	-4.28 - 2.47	-4.61 - 2.51	-4.96 - 2.51

Nine Months				
Mean (SD)	-0.81 (1.15)	-0.89 (1.14)	-0.75 (1.13)	-0.82 (1.14)
Range	-4.67 - 2.19	-3.98 - 3.24	-4.57 - 2.32	-4.67 - 3.24
Twelve Months				
Mean (SD)	-0.85 (1.09)	-0.89 (1.10)	-0.86 (1.05)	-0.87 (1.08)
Range	-4.74 - 2.24	-4.08 - 3.02	-4.08 - 2.22	-4.74 - 3.02
Weight-for-Length Z-score				
Three Months				
Mean (SD)	0.50 (1.74)	0.39 (1.55)	0.42 (1.72)	0.43 (1.66)
Range	-4.47 - 4.75	-4.99 - 4.71	-4.09 - 4.80	-4.99 - 4.80
Six Months				
Mean (SD)	0.06 (1.57)	-0.09 (1.38)	0.04 (1.50)	-0.003 (1.49)
Range	-4.20 - 4.57	-4.86 - 4.22	-4.45 - 4.25	-4.86 - 4.57
Nine Months				
Mean (SD)	-0.35 (1.46)	-0.43 (1.35)	-0.39 (1.25)	-0.39 (1.36)
Range	-4.01 - 4.84	-4.94 - 4.41	-4.69 - 2.85	-4.94 - 4.84
Twelve Months				
Mean (SD)	-0.56 (1.33)	-0.56 (1.21)	-0.65 (1.14)	-0.59 (1.23)
Range	-4.26 - 3.55	-4.76 - 3.40	-4.84 - 3.43	-4.84 - 3.55

Table S3. Fit statistics for latent class growth analysis

Variable/ number of classes	AIC	BIC	Entropy	Number of individuals in each class					
				1	2	3	4	5	6
Anthropometric measurements									
Weight									
2	11540·5	11601·0	0·75	473	671				
3	10963·2	11043·9	0·78	325	623	196			
4 [a]	10678·9	10779·8	0·79	356	526	204	58		
5	10524·3	10645·3	0·78	410	413	173	124	24	
6	10416·4	10557·6	0·79	315	419	227	126	41	16
Length									
2	27029·6	27090·1	0·66	368	776				
3 [a]	26686·6	26767·2	0·73	249	759	136			
4	26491·2	26592·2	0·76	263	695	157	29		
5	26450·8	26571·9	0·68	389	479	163	86	27	
6	26068·7	26209·9	0·81	261	676	156	20	14	17
Head circumference									
2	20267·5	20328·0	0·65	784	360				
3 [a]	19885·6	19966·3	0·74	695	380	69			
4	19731·0	19831·9	0·74	597	420	76	51		
5	19655·3	19776·3	0·77	555	449	70	59	11	
6	19599·3	19740·4	0·78	513	476	71	69	10	5
MUAC									
2	17090·2	17150·7	0·69	749	395				
3	16743·3	16824·0	0·72	661	348	135			
4 [a]	16630·9	16731·8	0·72	598	283	216	47		
5	16577·6	16698·6	0·73	519	353	210	40	22	
6	16552·0	16693·2	0·68	457	357	170	45	20	95
Z-scores									
Weight for length									
2	13091·0	13146·3	0·60	649	478				
3	12868·4	12943·8	0·69	718	289	120			
4 [a]	12781·5	12877·0	0·71	531	474	76	46		
5	12756·3	12871·9	0·74	520	460	83	41	23	
6	12734·5	12870·3	0·73	545	371	141	36	19	15
Length for age									
2	12672·6	12727·9	0·66	583	544				
3	12285·6	12361·0	0·75	669	311	147			
4 [a]	12186·8	12282·3	0·72	501	423	115	88		
5	12148·4	12264·1	0·70	540	306	167	62	52	
6	12109·7	12245·5	0·72	508	289	182	72	57	19
Weight for age									
2	10573·8	10629·1	0·78	598	532				
3	9964·0	10039·4	0·79	592	302	236			
4 [a]	9578·1	9673·6	0·82	467	442	125	96		
5	9388·2	9503·8	0·81	426	348	233	76	47	
6	9316·8	9452·6	0·78	341	329	251	127	57	25

Note:

Table S4. Posterior probabilities by trajectory assignment

Weight	Heaviest (N=58)	Heavy-Moderate (N=356)	Light-Moderate (N=526)	Lightest (N=204)	Total (N=1144)
Median	0.98	0.94	0.94	0.97	0.95
Q1, Q3	0.81, 1.00	0.81, 0.99	0.79, 0.99	0.82, 1.00	0.80, 0.99
Range	0.52 - 1.00	0.49 - 1.00	0.45 - 1.00	0.51 - 1.00	0.45 - 1.00

Length	Longest (N=249)	Moderate (N=759)	Shortest (N=136)		Total (N=1144)
Median	0.94	0.94	0.96		0.94
Q1, Q3	0.75, 0.99	0.79, 0.99	0.81, 1.00		0.77, 0.99
Range	0.50 - 1.00	0.50 - 1.00	0.51 - 1.00		0.50 - 1.00

Mid-Upper Arm Circumference	Largest (N=47)	Large-Moderate (N=283)	Small-Moderate (N=598)	Smallest (N=216)	Total (N=1144)
Median	0.92	0.88	0.86	0.91	0.88
Q1, Q3	0.70, 1.00	0.71, 0.96	0.71, 0.96	0.76, 0.99	0.72, 0.96
Range	0.50 - 1.00	0.45 - 0.99	0.47 - 0.99	0.51 - 1.00	0.45 - 1.00

Head Circumference	Largest (N=380)	Medium (N=695)	Smallest (N=69)		Total (N=1144)
Median	0.91	0.95	0.99		0.94
Q1, Q3	0.76, 0.99	0.81, 0.99	0.87, 1.00		0.79, 0.99
Range	0.50 - 1.00	0.50 - 1.00	0.53 - 1.00		0.50 - 1.00

Weight-for-age z-score	Normal-High (N=96)	Normal (N=467)	At-risk for underweight (N=442)	Underweight (N=125)	Total (N=1130)
Median	0.99	0.97	0.97	0.99	0.97
Q1, Q3	0.90, 1.00	0.83, 0.99	0.80, 0.99	0.85, 1.00	0.83, 0.99
Range	0.53 - 1.00	0.49 - 1.00	0.50 - 1.00	0.55 - 1.00	0.49 - 1.00

Length-for-age z-score	Normal-High (N=88)	Normal (N=423)	At risk for stunting (N=501)	Stunted (N=115)	Total (N=1127)
Median	0.92	0.84	0.90	0.97	0.89
Q1, Q3	0.70, 0.99	0.66, 0.94	0.74, 0.97	0.83, 1.00	0.71, 0.96
Range	0.50 - 1.00	0.45 - 0.98	0.46 - 0.99	0.51 - 1.00	0.45 - 1.00

Weight-for-length z-score	Overweight (N=76)	Normal (N=531)	At-risk for wasting (N=474)	Wasted (N=46)	Total (N=1127)
Median	0.96	0.88	0.89	0.91	0.89
Q1, Q3	0.78, 1.00	0.73, 0.96	0.70, 0.96	0.70, 0.99	0.72, 0.96
Range	0.51 - 1.00	0.48 - 0.99	0.50 - 0.99	0.52 - 1.00	0.48 - 1.00

Note: All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).

Table S5. Associations between prenatal and postnatal average carbon monoxide (CO) and growth trajectories: Complete model output

Variable	Weight			Length			
	OR	95% CI	p-value	OR	LL	UL	p-value
Prenatal CO, per 1 ppm[a]	1.03	0.93, 1.14	0.59	1.17	1.01, 1.35		0.04
Child CO, per 1 ppm[a]	1.01	0.94, 1.08	0.84	1.03	0.96, 1.1		0.41
Maternal age	0.99	0.98, 1.01	0.24	0.99	0.97, 1.01		0.37
Ethnicity 1 vs 0	1.36	0.90, 2.06	0.15	1.01	0.46, 2.21		0.99
Ethnicity 2 vs 0	2.27	1.42, 3.61	<0.01	1.73	0.91, 3.32		0.10
Ethnicity 3 vs 0	1.06	0.75, 1.50	0.74	0.84	0.53, 1.35		0.47
Ethnicity 4 vs 0	1.88	1.04, 3.39	0.04	1.85	0.76, 4.53		0.18
Ethnicity 5 vs 0	1.2	0.85, 1.69	0.3	1.07	0.67, 1.71		0.79
Wealth Index 2 vs 1	0.86	0.58, 1.27	0.44	0.88	0.54, 1.43		0.60
Wealth Index 3 vs 1	0.98	0.69, 1.39	0.92	1.12	0.73, 1.72		0.59
Wealth Index 4 vs 1	1.06	0.73, 1.52	0.76	1.09	0.72, 1.63		0.69
Wealth Index 5 vs 1	0.93	0.63, 1.36	0.69	0.96	0.59, 1.57		0.87
Female Sex	2.78	2.33, 3.30	<0.01	1.97	1.53, 2.55		<0.01

Variable	Head Circumference				Mid Upper Arm Circumference			
	OR	LL	UL	p-value	OR	LL	UL	p-value
Prenatal CO, per 1 ppm[a]	1.05	0.98, 1.12		0.19	1.07	0.97, 1.19		0.16
Child CO, per 1 ppm[a]	1.09	1.04, 1.13		<0.01	1.03	0.97, 1.10		0.35
Maternal age	0.98	0.96, 0.99		0.01	1	0.99, 1.02		0.82
Ethnicity 1 vs 0	0.94	0.59, 1.49		0.79	1.54	1.02, 2.32		0.04
Ethnicity 2 vs 0	1.53	0.98, 2.4		0.06	0.86	0.51, 1.46		0.58
Ethnicity 3 vs 0	0.97	0.52, 1.82		0.93	0.84	0.53, 1.32		0.45
Ethnicity 4 vs 0	1.22	0.76, 1.97		0.41	1.16	0.57, 2.35		0.69
Ethnicity 5 vs 0	0.75	0.53, 1.07		0.11	0.74	0.50, 1.09		0.13
Wealth Index 2 vs 1	0.89	0.6, 1.34		0.59	0.85	0.58, 1.24		0.4
Wealth Index 3 vs 1	1.21	0.81, 1.81		0.36	0.95	0.63, 1.42		0.8
Wealth Index 4 vs 1	0.89	0.56, 1.41		0.62	0.98	0.66, 1.47		0.94
Wealth Index 5 vs 1	1	0.6, 1.66		0.99	1.01	0.67, 1.54		0.95
Female Sex	2.92	2.22, 3.84		<0.01	1.89	1.51, 2.37		<0.01

Variable	Length-for-Age Z-score				Weight-for-Age Z-score			
	OR	LL	UL	p-value	OR	LL	UL	p-value
Prenatal CO, per 1 ppm[a]	1.15	1.01, 1.32		0.03	1.00	0.87, 1.14		0.94
Child CO, per 1 ppm[a]	0.98	0.94, 1.02		0.25	1.00	0.93, 1.08		0.93
Maternal age	0.99	0.98, 1.01		0.50	1.00	0.98, 1.01		0.56

	OR	LL, UL	p-value	OR	LL, UL	p-value
Ethnicity 1 vs 0	1.10	0.57, 2.14	0.78	1.33	0.93, 1.89	0.11
Ethnicity 2 vs 0	1.41	0.83, 2.4	0.21	2.15	1.52, 3.05	<0.01
Ethnicity 3 vs 0	0.81	0.55, 1.18	0.27	1.14	0.79, 1.64	0.48
Ethnicity 4 vs 0	1.68	0.74, 3.77	0.21	1.97	1.08, 3.62	0.03
Ethnicity 5 vs 0	1.02	0.69, 1.52	0.91	1.22	0.91, 1.62	0.18
Wealth Index 2 vs 1	0.85	0.59, 1.22	0.38	0.84	0.58, 1.23	0.37
Wealth Index 3 vs 1	1.20	0.83, 1.73	0.34	0.97	0.72, 1.32	0.86
Wealth Index 4 vs 1	1.14	0.77, 1.69	0.51	0.93	0.68, 1.28	0.67
Wealth Index 5 vs 1	0.90	0.55, 1.46	0.66	0.92	0.63, 1.35	0.68
Female Sex	0.58	0.47, 0.71	<0.01	0.76	0.63, 0.91	<0.01

Weight-for-length z-score			
	OR	LL, UL	p-value
Prenatal CO, per 1 ppm[a]	0.95	0.85, 1.06	0.38
Child CO, per 1 ppm[a]	0.97	0.89, 1.06	0.49
Maternal age	0.99	0.98, 1.01	0.26
Ethnicity 1 vs 0	1.21	0.79, 1.87	0.38
Ethnicity 2 vs 0	1.90	1.00, 3.60	0.05
Ethnicity 3 vs 0	1.29	0.92, 1.81	0.14
Ethnicity 4 vs 0	1.31	0.84, 2.06	0.23
Ethnicity 5 vs 0	1.20	0.77, 1.87	0.42
Wealth Index 2 vs 1	1.07	0.78, 1.46	0.69
Wealth Index 3 vs 1	0.96	0.65, 1.42	0.84
Wealth Index 4 vs 1	1.00	0.69, 1.45	0.99
Wealth Index 5 vs 1	1.13	0.78, 1.64	0.52
Female Sex	1.04	0.81, 1.34	0.74

Note: Analyses are ordinal regression where the ORs may be interpreted as the odds of being in a lower/smaller trajectory per 1ppm increase in average CO exposure. All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).

[a] Per 1 part per million (ppm) increase in average CO exposure, all effects determined with cluster-robust standard errors. All multivariable models include both prenatal and postnatal average CO exposure and adjust for child sex, maternal age, ethnicity, and wealth index.

Table S6. Associations between prenatal and postnatal average carbon monoxide (CO) and growth trajectories: Ordinal regression sensitivity models

Trajectory Measurement [a]	N	Multivariable Model +Maternal BMI at enrollment				N	Multivariable Model +Breastfeeding Duration			
		Prenatal		Postnatal			Prenatal		Postnatal	
		OR (95% CI)	p	*OR* (95% CI)	p		*OR* (95% CI)	p	*OR* (95% CI)	p
Weight	1,142	1·09 (0·77-1·14)	0·63	1·01 (0·95-1·08)	0·66	1,139	1·03 (0·93-1·14)	0·53	1·00 (0·93-1·08)	0·92
Length	1,142	1·17 (1·01-1·35)	0·04	1·03 (0·96-1·11)	0·38	1,139	1·16 (1·00-1·35)	0·04	1·03 (0·96-1·11)	0·39
Head circumference	1,142	1·05 (0·98-1·12)	0·44	1·09 (1·04-1·14)	0·001	1,139	1·05 (0·97-1·13)	0·19	1·08 (1·04-1·13)	<·001
MUAC	1,142	1·08 (0·98-1·19)	0·13	1·03 (0·97-1·10)	0·29	1,139	1·09 (0·99-1·21)	0·09	1·02 (0·95-1·09)	0·55
Weight for length z-score	1,125	0·96 (0·86-1·06)	0·40	0·97 (0·90-1·06)	0·53	1,125	0·96 (0·87-1·07)	0·47	0·96 (0·89-1·05)	0·38
Length for age z-score	1,125	1·15 (1·01-1·32)	0·03	0·98 (0·94-1·02)	0·27	1,125	1·15 (1·01-1·32)	0·04	0·98 (0·94-1·01)	0·22
Weight for age z-score	1,128	1·00 (0·88-1·13)	0·96	1·01 (0·93-1·09)	0·86	1,128	1·01 (0·89-1·14)	0·92	0·99 (0·92-1·07)	0·87

Trajectory Measurement	N	Multivariable Model +Gestational Age at Delivery				N	Multivariable Model +Birth weight[b]			
		Prenatal		Postnatal			Prenatal		Postnatal	
		OR (95% CI)	p	*OR* (95% CI)	p		*OR* (95% CI)	p	*OR* (95% CI)	p
Weight	1,142	1·02 (0·92-1·14)	0·67	1·00 (0·93-1·08)	0·99		--	--	--	--
Length	1,142	1·17 (1·01-1·35)	0·03	1·02 (0·94-1·10)	0·68	1,138	1·16 (1·02-1·32)	0·02	1·02 (0·96-1·09)	0·46
Head circumference	1,142	1·04 (0·97-1·11)	0·31	1·07 (1·02-1·12)	0·003	1,138	1·03 (0·94-1·13)	0·51	1·09 (1·03-1·15)	0·003
MUAC	1,142	1·07 (0·97-1·19)	0·17	1·03 (0·97-1·10)	0·38	1,138	1·05 (0·95-1·16)	0·30	1·03 (0·96-1·10)	0·43
Weight for length z-score	1,125	0·95 (0·86-1·06)	0·39	0·97 (0·89-1·06)	0·51	1,121	0·93 (0·82-1·05)	0·24	0·97 (0·90-1·04)	0·41
Length for age z-score	1,125	1·15 (1·01-1·31)	0·04	*0·97 (0·93-1·00)*	*0·07*	1,121	1·13 (1·00-1·27)	0·048	0·97 (0·92-1·02)	0·30
Weight for age z-score	1,128	0·99 (0·86-1·14)	0·89	1·00 (0·92-1·08)	0·93	1,120	0·95 (0·78-1·14)	0·61	1·00 (0·94-1·06)	0·91

Note: Per 1 part per million increase in average CO exposure. Analyses are ordinal regression where ORs may be interpreted as the odds of being in a lower/smaller trajectory per 1ppm increase in average CO exposure.
Multivariable models include both prenatal and postnatal average CO exposure and adjust for child sex, maternal age, ethnicity, and wealth index with additional adjustment for maternal BMI, breastfeeding duration, gestational age at delivery or birthweight as indicated
[a] All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).
[b] Additional adjustment for birthweight not done for weight trajectory, as birth weight is used in the construction of this trajectory
MUAC = mid upper arm circumference, BMI = body mass index

Table S7: Sex-specific associations between prenatal and postnatal average carbon monoxide (CO) exposure and growth trajectories: Ordinal regression

Trajectory[a]	Child Sex	N	Bivariate Model Prenatal		Bivariate Model Postnatal		Multivariable Model Prenatal			Multivariable Model Postnatal		
			OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	p-int	OR (95% CI)	p	p-int
Weight	Boys	584	1.02 (0.87, 1.21)	0.77	1.00 (0.90, 1.10)	0.93	1.03 (0.88, 1.20)	0.72	0.98	1.00 (0.90, 1.11)	1.00	0.77
	Girls	558	1.03 (0.91, 1.17)	0.64	0.98 (0.88, 1.10)	0.78	1.04 (0.91, 1.19)	0.55		1.03 (0.92, 1.14)	0.66	
Length	Boys	584	1·25 (1·04-1·50)	0·02	0·99 (0·91-1·08)	0·85	1·28 (1·07-1·51)	0·006	0.07	1·00 (0·91-1·09)	0·93	0.10
	Girls	558	1·06 (0·90-1·22)	0·47	1·08 (0·93-1·23)	0·34	1·05 (0·90-1·23)	0·52		1·12 (0·99-1·28)	0·08	
Head Circumference	Boys	584	1·04 (0·91-1·19)	0·59	1·08 (1·04-1·13)	<0·01	1·05 (0·92-1·18)	0·48	0.88	1·09 (1·04-1·14)	<0·001	0.91
	Girls	558	1·04 (0·92-1·18)	0·53	1·08 (1·00-1·17)	0·06	1·03 (0·91-1·17)	0·61		1·08 (0·98-1·19)	0·12	
MUAC	Boys	584	1.09 (0.92, 1.29)	0.31	1.00 (0.93, 1.08)	0.98	1.13 (0.96, 1.32)	0.14	0.40	1.02 (0.95, 1.10)	0.60	0.38
	Girls	558	1.01 (0.92, 1.12)	0.81	1.03 (0.91, 1.18)	0.62	1.02 (0.91, 1.14)	0.77		1.07 (0.93, 1.23)	0.35	
Weight-for-length z-score	Boys	577	0.92 (0.81, 1.04)	0.20	0.96 (0.87, 1.05)	0.38	0.92 (0.80, 1.05)	0.22	0.40	0.95 (0.86, 1.05)	0.36	0.27
	Girls	548	1.01 (0.89, 1.14)	0.88	0.98 (0.88, 1.10)	0.76	1.02 (0.88, 1.17)	0.80		1.02 (0.91, 1.14)	0.75	
Length-for-age z-score	Boys	577	1·20 (0·97-1·48)	0·09	0·97 (0·93-1·02)	0·20	1·22 (1·01-1·48)	0·04	0.34	0·98 (0·93-1·02)	0·34	0.93
	Girls	548	1·06 (0·91-1·21)	0·47	0·95 (0·84-1·07)	0·40	1·08 (0·89-1·30)	0·44		0·98 (0·86-1·12)	0·79	
Weight-for-age z-score	Boys	577	1.00 (0.85, 1.18)	0.97	0.99 (0.90, 1.10)	0.88	1.01 (0.86, 1.18)	0.91	0.79	1.00 (0.90, 1.10)	0.93	0.79
	Girls	548	0.98 (0.83, 1.16)	0.83	0.99 (0.87, 1.13)	0.91	0.99 (0.84, 1.17)	0.93		1.02 (0.89, 1.16)	0.82	

Note: Per 1 part per million increase in CO, all effects determined with cluster-robust standard errors. P-interaction term generated by introducing an interaction term into the main multivariable model. Sex-stratified OR and 95% CI presented. Analyses are ordinal regression where ORs may be interpreted as the odds of being in a lower/smaller trajectory per 1ppm increase in average CO exposure. Sex-stratified multivariable models include both prenatal and postnatal average CO exposure and adjust for maternal age, ethnicity, and wealth index.
[a] All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).
MUAC = mid upper arm circumference; p-int = p-interaction

Table S8. Associations between prenatal and postnatal average carbon monoxide (CO) and lowest z-score trajectory as compared to others: Complete model output

Variable	Length-for-age z-score[b]				Weight-for-length z-score			
	OR	LL	UL	p-value	OR	LL	UL	p-value
Prenatal CO, per 1 ppm[a]	1.25	1.08, 1.45		<0.01	1.06	0.87, 1.28		0.56
Child CO, per 1 ppm[a]	0.98	0.84, 1.14		0.75	1.03	0.94, 1.13		0.47
Maternal age	1.00	0.96, 1.03		0.81	0.97	0.93, 1.02		0.28
Ethnicity 1 vs 0	1.11	0.27, 4.53		0.89	1.11	0.40, 3.10		0.84
Ethnicity 2 vs 0	1.81	0.73, 4.53		0.2	2.85	1.15, 7.05		0.02
Ethnicity 3 vs 0	0.51	0.19, 1.38		0.19	0.84	0.20, 3.61		0.82
Ethnicity 4 vs 0	2.28	0.97, 5.35		0.06	1.72	0.68, 4.34		0.25
Ethnicity 5 vs 0	0.92	0.41, 2.04		0.83	1.35	0.51, 3.61		0.54
Wealth Index 2 vs 1	0.62	0.3, 1.28		0.19	1.57	0.70, 3.51		0.27
Wealth Index 3 vs 1	0.89	0.46, 1.73		0.74	0.94	0.53, 1.64		0.82
Wealth Index 4 vs 1	0.71	0.38, 1.33		0.28	1.1	0.37, 3.29		0.87
Wealth Index 5 vs 1	0.66	0.29, 1.51		0.32	0.72	0.28, 1.82		0.49
Female Sex	0.36	0.24, 0.54		<0.01	0.58	0.33, 1.02		0.06

Variable	Weight-for-age z-score			
	OR	LL	UL	p-value
Prenatal CO, per 1 ppm[a]	0.99	0.84, 1.17		0.93
Child CO, per 1 ppm[a]	1.00	0.92, 1.10		0.92
Maternal age	1.00	0.97, 1.02		0.73
Ethnicity 1 vs 0	1.11	0.54, 2.30		0.78
Ethnicity 2 vs 0	2.01	1.09, 3.71		0.03
Ethnicity 3 vs 0	0.86	0.43, 1.75		0.68
Ethnicity 4 vs 0	2.08	1.05, 4.11		0.04
Ethnicity 5 vs 0	1	0.57, 1.75		0.99
Wealth Index 2 vs 1	1.43	0.69, 2.96		0.33

Wealth Index 3 vs 1	1.45	0.76, 2.79	0.26
Wealth Index 4 vs 1	1.2	0.58, 2.50	0.62
Wealth Index 5 vs 1	1.57	0.75,	0.23
Female Sex	0.61	0.41	0.01

[a] Per 1 part per million (ppm) increase in average CO exposure, all effects determined with cluster-robust standard errors. Lowest weight-for-length, length-for-age and weight-for age z-score trajectories were at or below -2 at each time point consistent with commonly used definitions of wasted, stunted and underweight, respectively. All models include both prenatal and postnatal average CO exposure and adjust for child sex, maternal age, ethnicity, and wealth index.

[b] Logistic regression where ORs may be interpreted as the odds of being in the lowest z-score trajectory as compared to others per 1ppm increase in average CO exposure, respectively.

Table S9. Associations between prenatal and postnatal average carbon monoxide (CO) and assignment to the lowest z-score trajectory: Logistic regression sensitivity models

Lowest Trajectory Assignment	N	Multivariable Model +Maternal BMI at enrollment					N	Multivariable Model +Breastfeeding Duration				
		Prenatal		Postnatal				Prenatal		Postnatal		
		OR (95% CI)	p	OR (95% CI)	p			OR (95% CI)	p	OR (95% CI)	p	
Weight-for-length z-score	1,125	1.05 (0.87, 1.27)	0.58	1.03 (0.94, 1.13)	0.53		1,125	1.05 (0.86, 1.28)	0.59	1.03 (0.94, 1.14)	0.51	
Length-for-age z-score	1,125	1.25 (1.10, 1.42)	<0.01	0.98 (0.86, 1.11)	0.75		1,125	1.24 (1.08, 1.41)	<0.01	1.00 (0.86, 1.17)	0.97	
Weight-for-age z-score	1,128	0.99 (0.84, 1.16)	0.91	1.00 (0.92, 1.09)	0.93		1,128	0.98 (0.83, 1.15)	0.81	1.01 (0.92, 1.11)	0.79	

Lowest Trajectory Assignment	N	Multivariable Model +Gestational Age at Delivery					N	Multivariable Model +Birthweight				
		Prenatal		Postnatal				Prenatal		Postnatal		
		OR (95% CI)	p	OR (95% CI)	p			OR (95% CI)	p	OR (95% CI)	p	
Weight-for-length z-score	1,125	1.06 (0.87, 1.28)	0.58	1.03 (0.94, 1.12)	0.54		1,121	1.04 (0.85, 1.29)	0.69	1.02 (0.94, 1.12)	0.60	
Length-for-age z-score	1,125	1.25 (1.11, 1.41)	<0.01	0.97 (0.85, 1.10)	0.60		1,121	1.27 (1.11, 1.44)	<0.01	0.96 (0.85, 1.08)	0.51	
Weight-for-age z-score	1,128	0.99 (0.83, 1.17)	0.87	0.98 (0.89, 1.08)	0.65		1,120	0.91 (0.73, 1.14)	0.41	0.99 (0.90, 1.09)	0.84	

Note: Per 1 part per million (ppm) increase in average CO exposure, all effects determined with cluster-robust standard errors. Lowest weight-for-length, length-for-age and weight-for age z-score trajectories were at or below -2 at each time point consistent with commonly used definitions of wasted, stunted and underweight, respectively.[12] Analyses are logistic regression where ORs may be interpreted as the odds of being in the lowest z-score trajectory as compared to other trajectories per 1ppm increase in average CO exposure, respectively. Multivariable models include both prenatal and postnatal average CO exposure and adjust for child sex, maternal age, ethnicity, and wealth index with additional adjustment for maternal BMI, breastfeeding duration, gestational age at delivery or birthweight as indicated.

BMI = body mass index

Table S10: Sex-specific associations between prenatal and postnatal average carbon monoxide (CO) and lowest z-score trajectory assignment: Logistic regression

Lowest Trajectory Assignment[a]	Child Sex	N	Bivariate Model Prenatal		Bivariate Model Postnatal		Multivariable Model Prenatal		p-int	Postnatal		p-int
			OR (95% CI)	p	*OR* (95% CI)	p	*OR* (95% CI)	p		*OR* (95% CI)	p	
Weight-for-length z-score	Boys	578	1.12 (0.88-1.42)	0.38	1.03 (0.94-1.13)	0.51	1.11 (0.90-1.38)	0.33	0.48	1.05 (0.97-1.13)	0.25	0.53
	Girls	547	0.95 (0.66-1.35)	0.76	0.91 (0.63-1.32)	0.62	0.98 (0.71-1.36)	0.90		0.91 (0.63-1.33)	0.64	
Length-for-age z-score	Boys	577	1.37 (1.13-1.66)	<.001	0.98 (0.88-1.08)	0.65	1.40 (1.17-1.66)	<.001	0.04	1.00 (0.90-1.11)	0.99	0.42
	Girls	548	0.99 (0.77-1.26)	0.92	0.82 (0.54–1.23)	0.33	1.01 (0.79-1.31)	0.88		0.80 (0.51-1.27)	0.34	
Weight-for-age z-score	Boys	579	1.37 (1.13-1.66)	0.002	0.98 (0.88-1.08)	0.65	0.97 (0.78-1.21)	0.79	0.46	1.01 (0.91-1.12)	0.86	0.70
	Girls	549	1.03 (0.89-1.21)	0.67	0.94 (0.77-1.15)	0.53	1.03 (0.85-1.25)	0.73		0.94 (0.73-1.21)	0.62	

Note: Per 1 part per million increase in average CO exposure, all effects determined with cluster-robust standard errors. Lowest weight-for-length, length-for-age and weight-for age z-score trajectories were at or below -2 at each time point consistent with commonly used definitions of wasted, stunted and underweight, respectively. P-interaction (p-int) term generated by introducing an interaction term into the multivariable model. Sex-stratified OR and 95% CI presented. Analyses are logistic regression where ORs may be interpreted as the odds of being in the lowest z-score trajectory as compared to other trajectories per 1ppm increase in average CO exposure, respectively. Multivariable models include both prenatal and postnatal average CO exposure and adjust for maternal age, ethnicity, and wealth index.

[a] Of the N=584 boys in the overall study, N= 29 were in the lowest weight-for-length z-score trajectory, N=83 were in the lowest length-for-age z-score trajectory , and N=77 were in the lowest weight-for-age z-score trajectory . Of the N=560 girls, N=17 were in the lowest weight-for-length z-score trajectory , N=32 were in the lowest length-for-age z-score trajectory and N=48 were in the lowest weight-for-age z-score trajectory.

Table S11. Associations between prenatal and postnatal average particulate matter (PM$_{2.5}$) and growth trajectories: Ordinal regression sensitivity models

Trajectory Measurement[a]	N	Multivariable Model +Maternal BMI at enrollment				N	Multivariable Model +Breastfeeding Duration			
		Prenatal		Postnatal			Prenatal		Postnatal	
		OR (95% CI)	p	*OR* (95% CI)	p		*OR* (95% CI)	p	*OR* (95% CI)	p
Weight	358	0.99 (0.94, 1.04)	0.69	1.02 (0.94, 1.10)	0.64	358	1.00 (0.94, 1.05)	0.86	1.02 (0.94, 1.11)	0.67
Length	358	1.07 (1.01, 1.12)	0.01	0.98 (0.91, 1.05)	0.52	358	1.07 (1.02, 1.12)	0.008	0.98 (0.91, 1.05)	0.54
Head circumference	358	1.03 (0.97, 1.08)	0.33	0.99 (0.93, 1.06)	0.81	358	1.03 (0.97, 1.08)	0.33	0.99 (0.93, 1.06)	0.79
MUAC	358	1.02 (0.97, 1.07)	0.50	1.07 (1.00, 1.14)	0.047	358	1.02 (0.97, 1.08)	0.43	1.07 (1.00, 1.14)	0.04
Weight for length z-score	356	0.95 (0.91, 1.00)	0.04	1.09 (1.01, 1.19)	0.03	356	0.95 (0.91, 1.00)	0.07	1.10 (1.01, 1.20)	0.04
Length for age z-score	356	1.04 (0.99, 1.09)	0.11	0.97 (0.91, 1.03)	0.28	356	1.04 (1.00, 1.09)	0.08	0.97 (0.91, 1.03)	0.30
Weight for age z-score	356	1.00 (0.95, 1.05)	0.91	1.02 (0.95, 1.09)	0.58	356	1.00 (0.95, 1.05)	0.93	1.02 (0.95, 1.09)	0.57

Trajectory Measurement	N	Multivariable Model +Gestational Age at Delivery				N	Multivariable Model +Birthweight[b]			
		Prenatal		Postnatal			Prenatal		Postnatal	
		OR (95% CI)	p	*OR* (95% CI)	p		*OR* (95% CI)	p	*OR* (95% CI)	p
Weight	358	0.99 (0.94, 1.05)	0.79	1.02 (0.94, 1.11)	0.64		--	--	--	--
Length	358	1.07 (1.02, 1.12)	0.007	0.98 (0.91, 1.05)	0.56	357	1.06 (1.01, 1.12)	0.01	0.98 (0.91, 1.06)	0.63
Head circumference	358	1.03 (0.97, 1.08)	0.32	0.99 (0.93, 1.06)	0.81	357	1.02 (0.97, 1.07)	0.42	1.00 (0.93, 1.06)	0.89
MUAC		1.02 (0.97, 1.07)	0.47	1.07 (1.00, 1.14)	0.04	357	1.01 (0.96, 1.07)	0.67	1.07 (1.01, 1.14)	0.03
Weight for length z-score	356	0.95 (0.91, 1.00)	0.06	1.09 (1.01, 1.19)	0.03	355	0.95 (0.90, 1.00)	0.03	1.10 (1.01, 1.19)	0.02
Length for age z-score	356	1.04 (1.00, 1.09)	0.08	0.97 (0.91, 1.03)	0.30	355	1.04 (0.98, 1.09)	0.18	0.97 (0.92, 1.03)	0.36
Weight for age z-score	356	1.00 (0.95, 1.05)	0.99	1.02 (0.95, 1.10)	0.56	355	0.99 (0.94, 1.04)	0.65	1.03 (0.97, 1.10)	0.33

Note: Per 10 µg/m^3 increase in PM$_{2.5}$ exposure, all effects determined with cluster-robust standard errors. Analyses are ordinal regression where ORs may be interpreted as the odds of being in a lower/smaller trajectory per 10µg/m^3 increase in PM$_{2.5}$ exposure. Multivariable models include both prenatal and postnatal PM$_{2.5}$ exposure and adjust for child sex, maternal age, ethnicity, wealth index with additional adjustment for maternal BMI, breastfeeding duration, gestational age at delivery or birthweight as indicated.
[a] All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).
[b] Additional adjustment for birthweight not done for weight trajectory, as birth weight is used in the construction of this trajectory.
MUAC= mid upper arm circumference, BMI=body mass index

Table S12: Sex-specific associations between prenatal and postnatal average particulate matter (PM$_{2.5}$) exposure and growth trajectories: Ordinal regression

Trajectory[b]	Child Sex	N	Bivariate Model Prenatal		Bivariate Model Postnatal		Multivariable Model[a] Prenatal			Multivariable Model[a] Postnatal		
			OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	p-int	OR (95% CI)	p	p-int
Weight	Boys	193	1.00 (0.82, 1.21)	0.97	1.04 (0.95, 1.14)	0.43	1.03 (0.85, 1.25)	0.77	0.11	1.01 (0.89, 1.16)	0.85	0.97
	Girls	165	0.84 (0.65, 1.09)	0.20	1.03 (0.77, 1.38)	0.84	0.76 (0.53, 1.11)	0.16		0.98 (0.73, 1.32)	0.92	
Length	Boys	193	1·02 (0·95-1·10)	0·50	1·00 (0·92-1·09)	0·98	1·04 (0·97-1·10)	0·27	0.13	1·00 (0·92-1·07)	0·89	0.88
	Girls	165	1·13 (1·05-1·22)	0·002	1·00 (0·91-1·10)	0·97	1·14 (1·06-1·21)	<·001		0·96 (0·84-1·07)	0·44	
MUAC	Boys	193	1·01 (0·95-1·08)	0·72	1·00 (0·92-1·09)	0·99	1·04 (0·97-1·11)	0·27	0.79	1·02 (0·91-1·12)	0·78	0.10
	Girls	165	1·05 (0·97-1·12)	0·22	1·15 (1·03-1·29)	0·02	0·99 (0·91-1·06)	0·76		1·16 (1·03-1·30)	0·02	
Head circumference	Boys	193	0.87 (0.69, 1.09)	0.23	1.12 (1.02, 1.22)	0.01	0.92 (0.71, 1.19)	0.52	0.92	1.11 (1.00, 1.23)	0.05	0.48
	Girls	165	0.97 (0.55, 1.71)	0.93	1.24 (0.98, 1.56)	0.07	0.90 (0.53, 1.52)	0.69		1.15 (0.94, 1.42)	0.18	
Weight for length z-score	Boys	192	0·96 (0·91-1·02)	0·21	1·04 (0·94-1·14)	0·44	0·96 (0·90-1·03)	0·27	0.79	1·06 (0·97-1·16)	0·19	0.45
	Girls	164	0·96 (0·90-1·02)	0·26	1·10 (0·99-1·23)	0·09	0·94 (0·88-1·00)	0·04		1·16 (1·04-1·29)	0·01	
Length for age z-score	Boys	192	1·02 (0·97-1·08)	0·39	0·97 (0·89-1·06)	0·48	1·05 (1·00-1·09)	0·04	0.82	0·95 (0·87-1·04)	0·28	0.76
	Girls	164	1·05 (0·96-1·15)	0·30	1·01 (0·93-1·09)	0·88	1·05 (0·96-1·13)	0·32		0·99 (0·90-1·07)	0·75	
Weight-for-age z-score	Boys	192	1.00 (0.83, 1.20)	0.96	1.04 (0.95, 1.13)	0.44	1.02 (0.85, 1.23)	0.81	<0.01	1.02 (0.89, 1.16)	0.82	0.58
	Girls	164	0.68 (0.54, 0.85)	<0.01	0.96 (0.74, 1.25)	0.77	0.59 (0.41, 0.85)	0.01		0.89 (0.67, 1.20)	0.45	

Note: Per 10 μg/m^3 increase in PM$_{2.5}$, all effects determined with cluster-robust standard errors. P-interaction term generated by introducing an interaction term into the multivariable model. Sex-stratified OR and 95% CI presented.

[a] Multivariable models include both prenatal and postnatal average PM$_{2.5}$ exposure and adjust for maternal age, ethnicity, wealth index.

[b] All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).

MUAC = mid upper arm circumference

Table S13: Associations between cookstove intervention arm and anthropometric growth trajectories: Multivariable Ordinal Regression sensitivity models

Trajectory Measurement[a]	# Participants			Multivariable Model +Maternal BMI				Multivariable Model +Breastfeeding Duration			
				Improved Biomass vs Control (3-Stone Fire)		LPG vs Control (3-Stone Fire)		Improved Biomass vs Control (3-Stone Fire)		LPG vs Control (3-Stone Fire)	
	Control	Improved Biomass	LPG	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Weight	414	430	300	1·09 (0·77-1·53)	0·63	0·91 (0·61-1·37)	0·66	1·04 (0·74-1·48)	0·81	0·90 (0·59-1·36)	0·60
Length	414	430	300	0·99 (0·51-1·92)	0·97	0·81 (0·44-1·51)	0·51	0·98 (0·50-1·90)	0·94	0·78 (0·42-1·46)	0·44
Head circumference	414	430	300	0·77 (0·49-1·21)	0·26	0·57 (0·37-0·93)	0·02	0·77 (0·49-1·21)	0·26	0·59 (0·37-0·94)	0·02
MUAC	414	430	300	0·94 (0·57-1·53)	0·79	0·46 (0·23-0·91)	0·03	0·92 (0·56-1·51)	0·73	0·46 (0·23-0·94)	0·03
Weight for length z-score	408	420	299	0·95 (0·61-1·47)	0·81	0·93 (0·59-1·46)	0·74	0·92 (0·59-1·44)	0·73	0·93 (0·58-1·49)	0·76
Length for age z-score	409	420	298	1·17 (0·64-2·13)	0·61	0·98 (0·56-1·72)	0·95	1·16 (0·63-2·12)	0·64	0·96 (0·55-1·68)	0·89
Weight for age z-score	411	420	299	1·20 (0·89-1·63)	0·24	1·00 (0·72-1·39)	0·99	1·16 (0·86-1·57)	0·33	1·01 (0·72-1·41)	0·95

	# Participants			Multivariable Model +Gestational Age at Delivery				Multivariable Model +Birthweight[b]			
				Improved Biomass vs Control (3-Stone Fire)		LPG vs Control (3-Stone Fire)		Improved Biomass vs Control (3-Stone Fire)		LPG vs Control (3-Stone Fire)	
	Control	Improved Biomass	LPG	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Weight	414	430	300	1·07 (0·75-1·51)	0·71	0·90 (0·60-1·35)	0·60	--	--	--	--
Length	414	430	300	1·00 (0·51-1·95)	0·99	0·81 (0·44-1·50)	0·51	0·96 (0·48-1·93)	0·91	0·79 (0·40-1·56)	0·50
Head circumference	414	430	300	0·78 (0·49-1·24)	0·29	0·59 (0·37-0·92)	0·02	0·75 (0·47-1·19)	0·23	0·56 (0·34-0·94)	0·03
MUAC	414	430	300	0·92 (0·56-1·51)	0·74	0·45 (0·22-0·91)	0·02	0·93 (0·57-1·52)	0·78	0·45 (0·22-0·92)	0·03
Weight for length z-score	408	420	299	0·92 (0·59-1·44)	0·73	0·89 (0·56-1·43)	0·63	0·94 (0·61-1·46)	0·79	0·91 (0·58-1·44)	0·69
Length for age z-score	409	420	298	1·18 (0·64-2·18)	0·59	0·98 (0·56-1·72)	0·94	1·17 (0·61-2·25)	0·64	0·98 (0·51-1·86)	0·94
Weight for age z-score	411	420	299	1·18 (0·87-1·60)	0·29	0·98 (0·71-1·35)	0·88	1·19 (0·87-1·61)	0·28	1·01 (0·72-1·42)	0·96

Note: Multivariable models adjust for child sex, maternal age, ethnicity, and wealth index with additional adjustment for maternal BMI, breastfeeding duration, gestational age at delivery or birthweight as indicated. Z-score trajectory multivariable models adjust for maternal age, ethnicity, and wealth index; Z-scores calculated using child sex. All models with cluster-robust standard errors.

[a] All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).

[b] Additional adjustment for birthweight not done for weight trajectory, as birth weight is used in the construction of this trajectory

MUAC = mid upper arm circumference, BMI = body mass index, LPG = liquefied petroleum gas

Table S14. Sex-specific associations between cookstove intervention arm and anthropometric growth trajectories

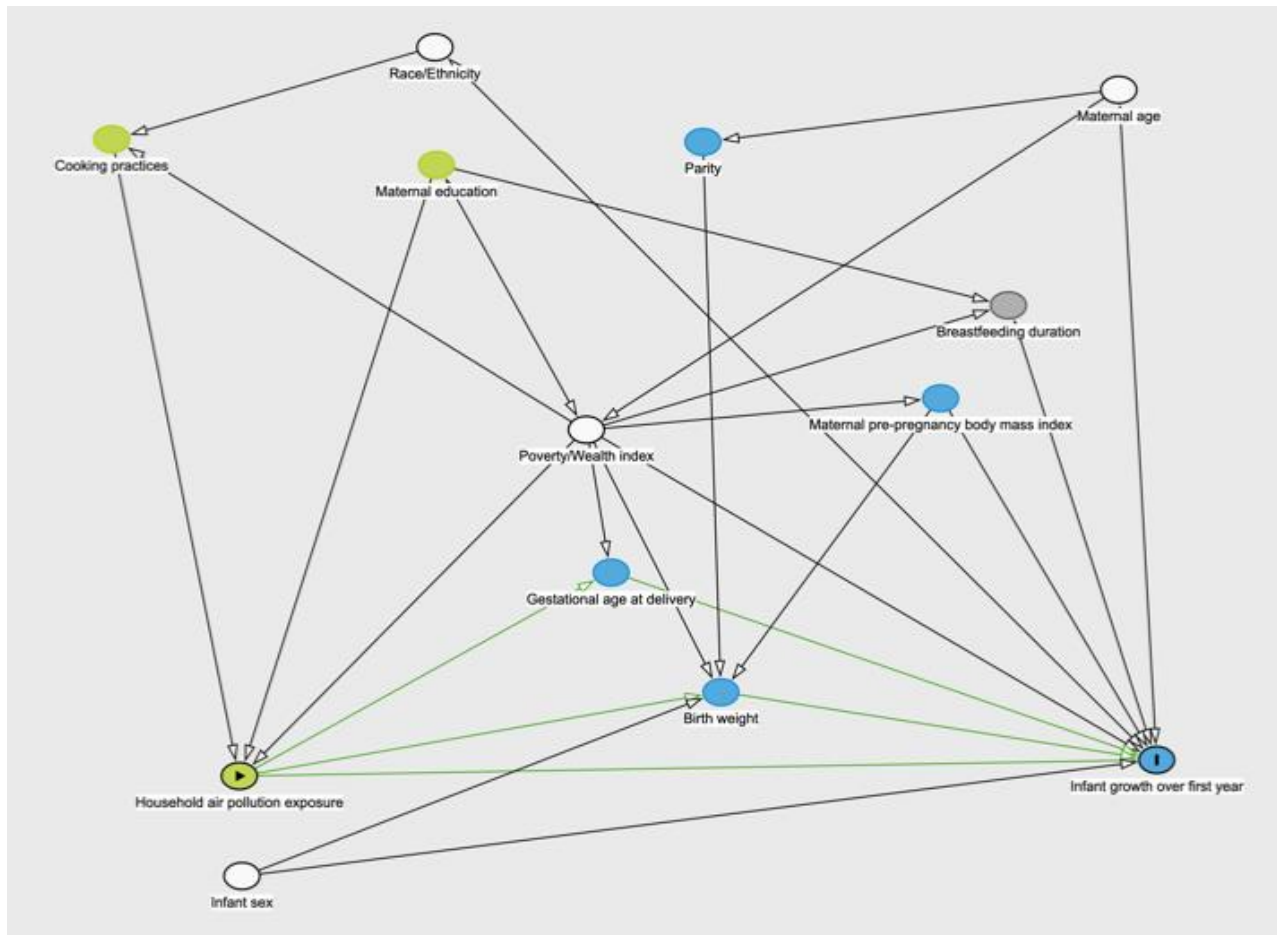| Trajectory[b]	# Participants			Bivariate Model					Multivariable Model[a]						
	Control	Improved Biomass	LPG	Improved Biomass vs Control (3-Stone Fire)		LPG vs Control (3-Stone Fire)		Improved Biomass vs Control (3-Stone Fire)		p-int	LPG vs Control (3-Stone Fire)		p-int		
				OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p		OR (95% CI)	p			
Weight															
Boys	199	238	147	1.30 (0.89, 1.90)	0.18	1.23 (0.70, 2.15)	0.47	1.27 (0.87, 1.83)	0.21	0.07	1.12 (0.67, 1.88)	0.66	0.08		
Girls	215	192	153	0.90 (0.59, 1.37)	0.62	0.83 (0.54, 1.26)	0.38	0.84 (0.54, 1.30)	0.43		0.70 (0.44, 1.12)	0.14			
Length															
Boys	199	238	147	1·21 (0·62-2·36)	0·57	1·21 (0·60-2·45)	0·60	1·16 (0·59-2·29)	0·67	0.11	1·07 (0·53-2·15)	0·78	0.03		
Girls	215	192	153	0·77 (0·34-1·72)	0·53	0·63 (0·31-1·27)	0·20	0·78 (0·37-1·68)	0·53		0·55 (0·31-1·00)	0·051			
Head circumference															
Boys	199	238	147	0·93 (0·58-1·48)	0·76	1·04 (0·57-1·91)	0·89	0·91 (0·56-1·46)	0·68	0.23	0·90 (0·52-1·56)	0·70	<0.01		
Girls	215	192	153	0·65 (0·35-1·24)	0·19	0·42 (0·24-0·75)	0·004	0·64 (0·36-1·17)	0·15		0·38 (0·22-0·65)	<·001			
Mid Upper Arm Circumference															
Boys	199	238	147	0·94 (0·50-1·75)	0·84	0·45 (0·21-0·96)	0·04	0·97 (0·53-1·79)	0·93	0.69	0·45 (0·20-1·01)	0·054	0.83		
Girls	215	192	153	0·87 (0·52-1·45)	0·60	0·43 (0·21-0·89)	0·02	0·85 (0·52-1·40)	0·52		0·46 (0·21-0·97)	0·04			
Weight-for-length z-score															
Boys	199	238	147	1.15 (0.74, 1.78)	0.53	0.95 (0.53, 1.71)	0.86	1.08 (0.66, 1.77)	0.76	0.25	0.87 (0.49, 1.54)	0.63	0.71		
Girls	215	192	153	0.78 (0.45, 1.37)	0.39	1.05 (0.60, 1.84)	0.86	0.74 (0.40, 1.37)	0.34		0.90 (0.53, 1.54)	0.71			
Length-for-age z-score															
Boys	199	238	147	1.25 (0.65, 2.41)	0.50	1.32 (0.71, 2.47)	0.38	1.26 (0.63, 2.50)	0.51	0.46	1.25 (0.66, 2.37)	0.50	0.10		
Girls	215	192	153	1.05 (0.56, 1.97)	0.88	0.79 (0.44, 1.42)	0.43	1.04 (0.57, 1.89)	0.90		0.75 (0.42, 1.34)	0.33			
Weight-for-age z-score															
Boys	199	238	147	1.29 (0.94, 1.75)	0.11	1.23 (0.72, 2.11)	0.44	1.27 (0.93, 1.72)	0.13	0.43	1.14 (0.69, 1.88)	0.62	0.30		
Girls	215	192	153	1.09 (0.70, 1.70)	0.71	0.95 (0.67, 1.35)	0.79	1.05 (0.70, 1.57)	0.81		0.84 (0.60, 1.18)	0.32			

Note:

[a] Multivariable models include both prenatal and postnatal average $PM_{2·5}$ exposure and adjust for maternal age, ethnicity, and wealth index. All models with cluster-robust standard errors. P-interaction term generated by introducing an interaction term into the multivariable model. Sex-stratified OR and 95% CI presented.
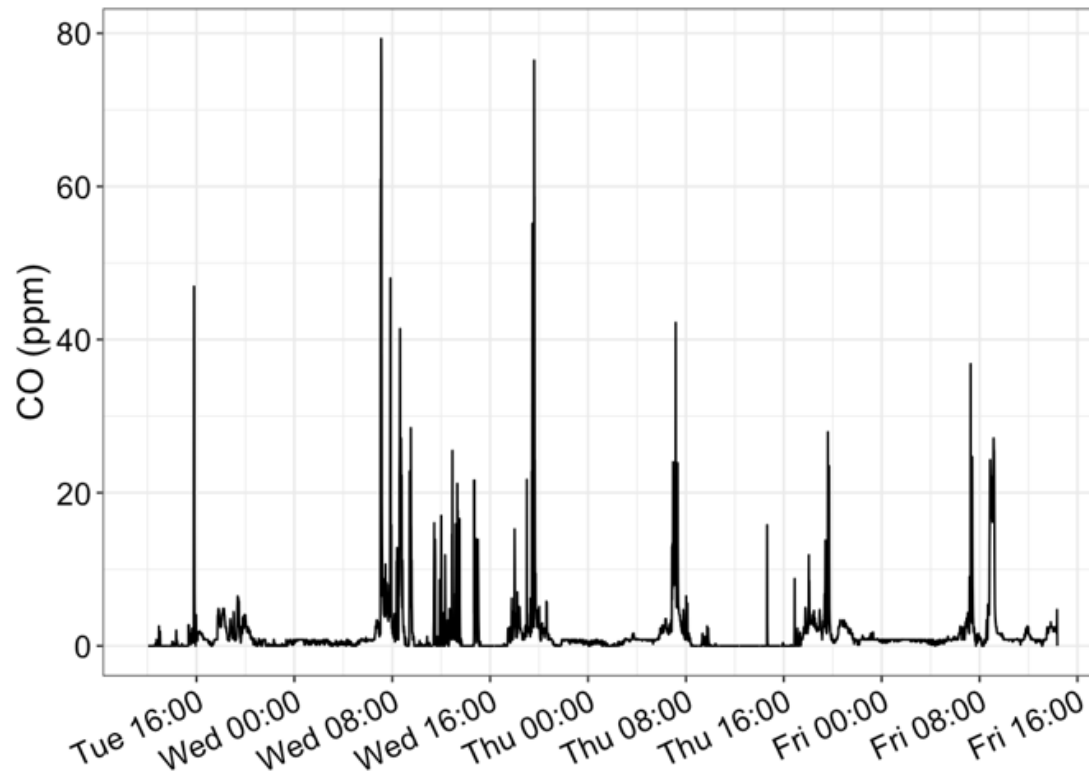
[b] All trajectories include 4 groups except length (3 groups) and head circumference (3 groups).
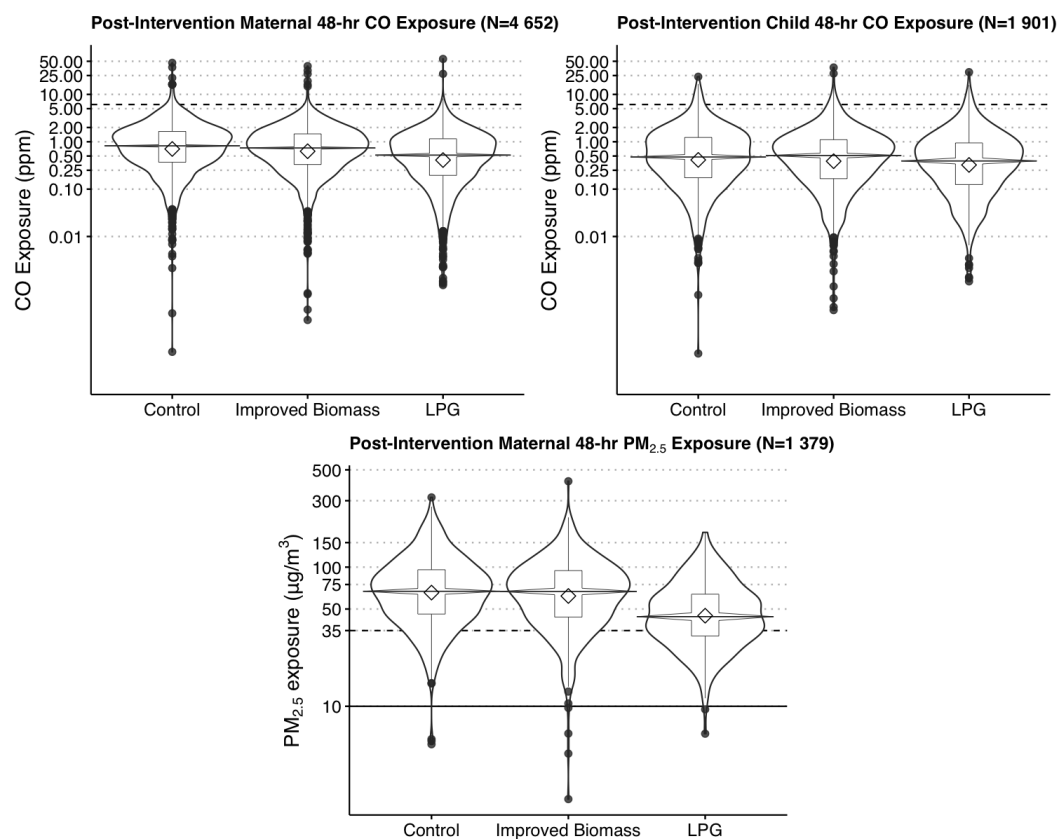
LPG = liquefied petroleum gas

Figure S1. Directed Acyclic Graph illustrating implied conditional dependencies amongst study variables. The green circle with black inset triangle represents the exposure of interest (prenatal and postnatal household air pollution exposure). The blue circle with the vertical line represents the outcome of interest (infant growth). Green lines represent unbiased causal pathways. Black lines represent neither unbiasing causal pathways nor potentially biased paths. White circles represent adjusted variables in the minimally-sufficient adjustment set (infant sex, race/ethnicity, wealth index, maternal age). Sensitivity models additionally adjust for gestational age at delivery, birth weight, breastfeeding duration or maternal body mass index. DAGgity v3.0 available at http://www.dagitty.net/
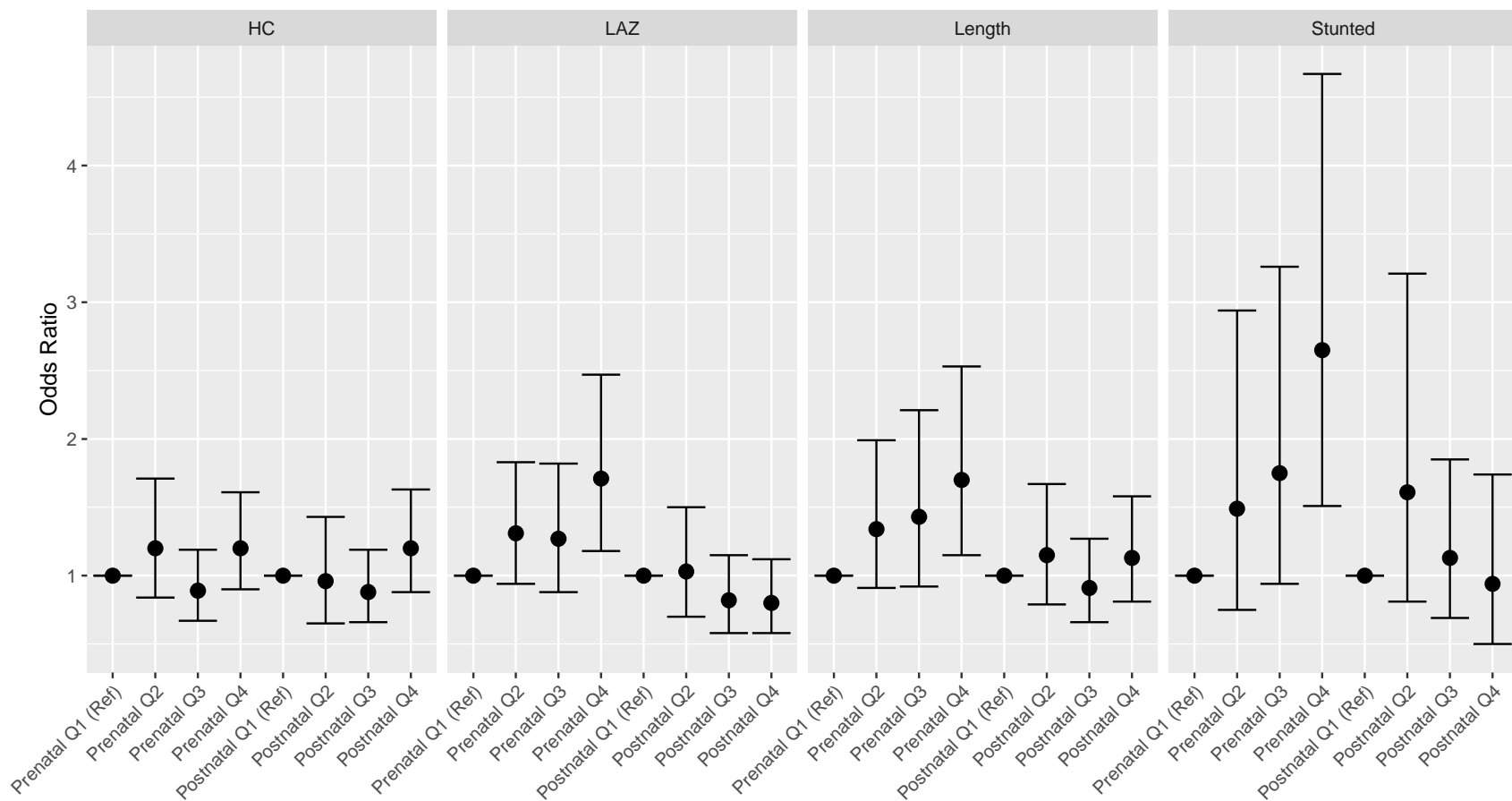
Figure S2. This figure demonstrates a representative plot of a maternal prenatal 72-hour personal carbon monoxide (CO) exposure in parts per million (ppm) over time. The Lascar EL-CO-USB Data Logger was worn in the participant's breathing zone and measured CO levels every 10 seconds which were then averaged into 1-minute averages. Reported cooking periods correspond with elevated CO exposures; outside of these cooking episodes the CO exposures were near zero. The first 48-hours were used in analyses and for this session the 48-hour average CO exposure was 1.62ppm (range 0-79.3ppm).

Figure S3. Post intervention exposure by study arm for (A) 48-hr maternal CO measurements, (B) 48-hr children CO measurements, and (C) 48-hr maternal PM2.5. Violin plots display mirrored density along the variable range. Boxplots depict the median – extended by a notch for clarity – with lower and upper hinges corresponding with the 25th and 75th percentile. Whiskers extend 1.5 times the interquartile range from the hinge. Outliers beyond the whiskers are depicted as points. Diamonds represent distribution means. In plots A, B, and D the WHO guideline for CO exposure is drawn in a dotted line and in plot C the WHO guidelines for PM2.5 exposure are drawn in a dotted line (interim guideline: 35) and a solid line (guideline: 10). The y-axis is log-transformed to improve readability because of the clustering of exposure levels at lower values.

Figure S4. This figure shows associations between interquartile change in prenatal and postnatal average carbon monoxide (CO) exposure and head circumference (HC), length-for-age z-score (LAZ), length and lowest length-for-age z-score (stunted). Here we show a linear relationship between quartile of CO exposure and LAZ (P_{trend} =0.01), length (P_{trend} =0.01), and stunted (P_{trend} <0.01). We note that while postnatal CO exposure is associated with smaller head circumference trajectory in the primary analyses, we do not see a linear trend in these analyses by interquartile change in CO exposure.