Supplementary Material

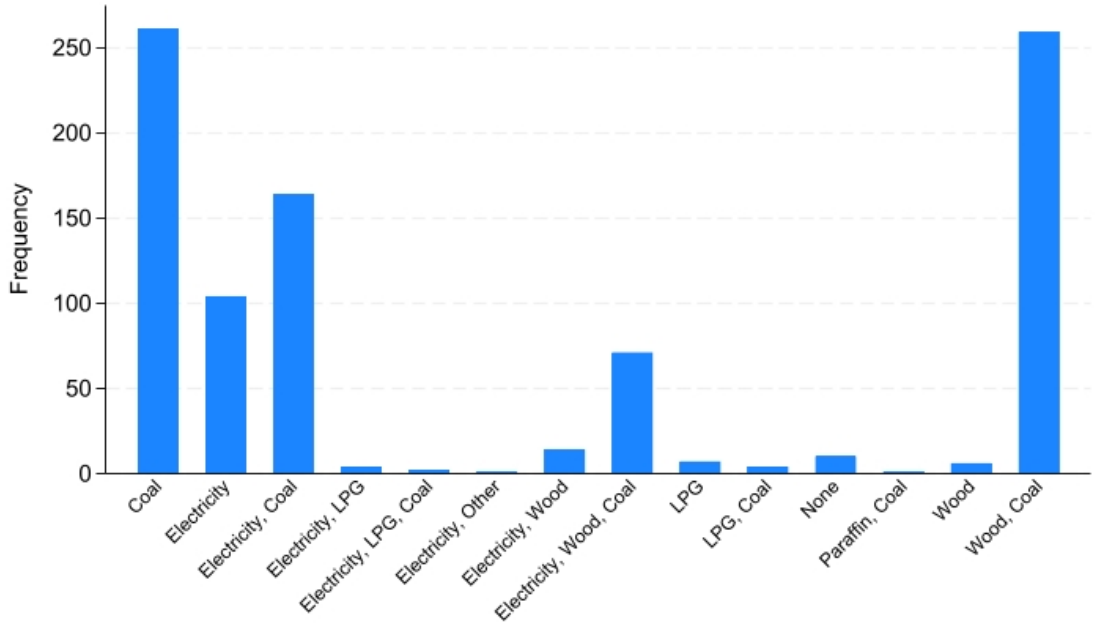

Figure S1 Additional fuels listed for cooking according to frequency of occurrence.

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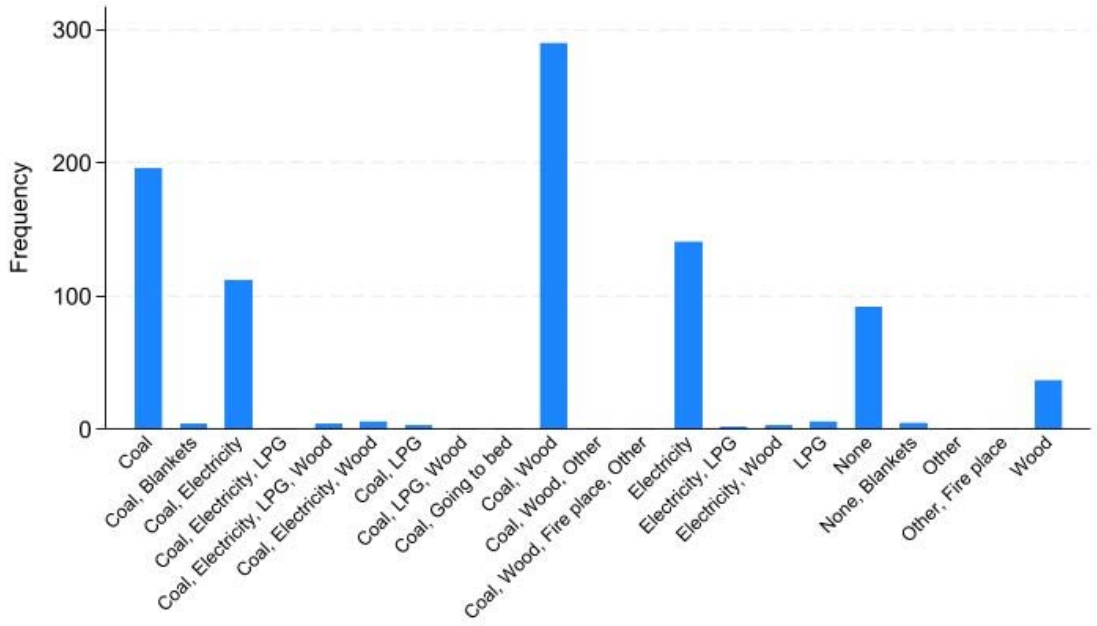

Figure S2 Additional fuels listed for heating according to frequency of occurrence.

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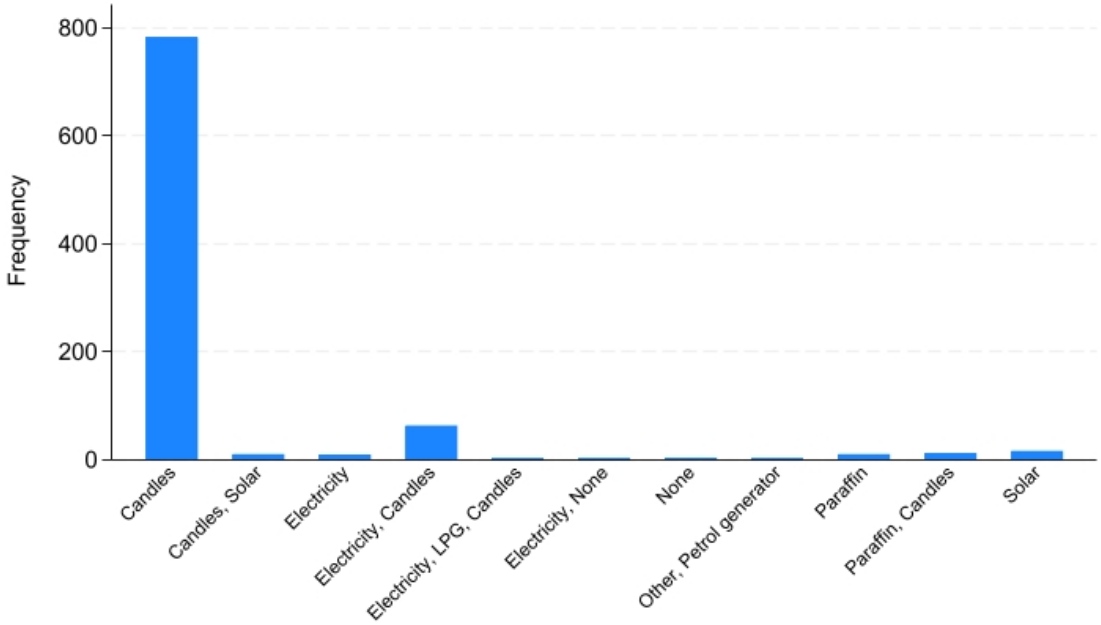

Figure S3 Additional fuels listed for lighting according to frequency of occurrence.

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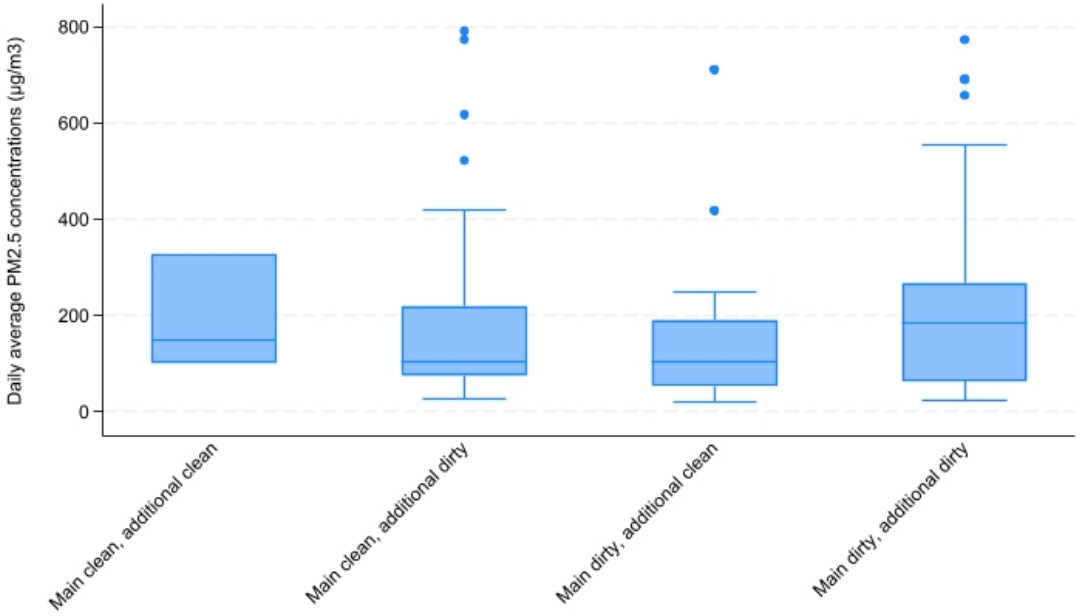

Figure S4 Boxplots illustrating daily average indoor and ambient $PM_{2.5}$ concentrations ($\mu g/m^3$) measured in eMzinoni and KwaZamokuhle between July 2019 and February 2020 per fuel use combination used for cooking. Box plot key: The line inside the box represents the median. The box's top and bottom are the first and third quartiles, respectively. Whiskers extend to data within 1.5 times the interquartile range. Points outside the whiskers are potential outliers. (Results of Kruskal -Wallis test: χ^2-statistic = 2.043, P-value = 0.5636, degrees of freedom = 3).

#

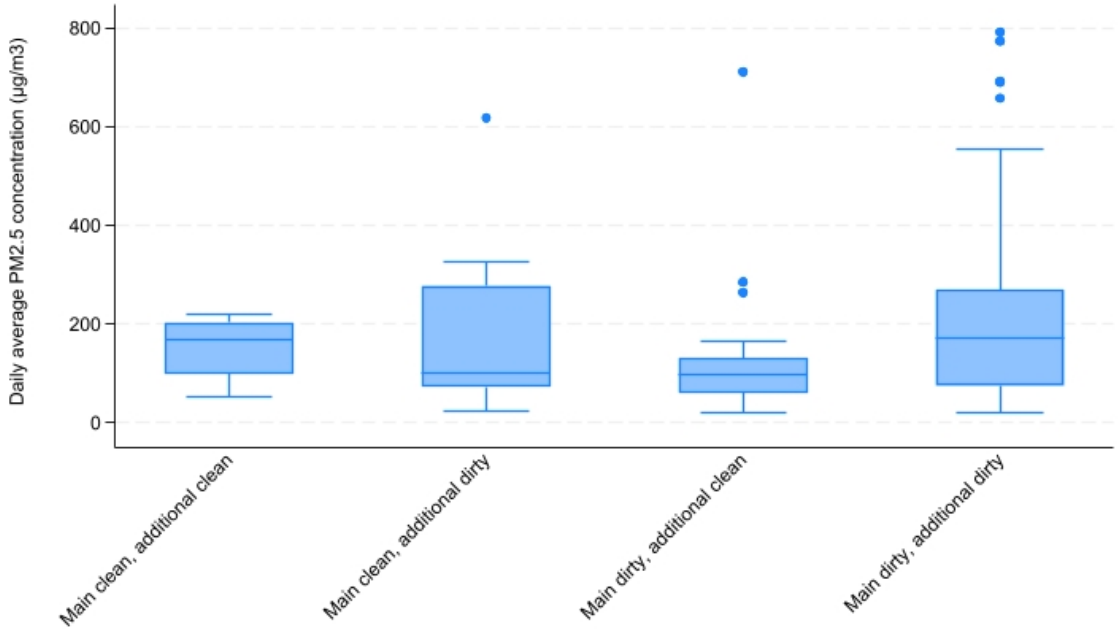

Figure S5 Boxplots illustrating daily average indoor and ambient $PM_{2.5}$ concentrations ($\mu g/m^3$) measured in eMzinoni and KwaZamokuhle between July 2019 and February 2020 per fuel use combination used for heating. Box plot key: The line inside the box represents the median. The box's top and bottom are the first and third quartiles, respectively. Whiskers extend to data within 1.5 times the interquartile range. Points outside the whiskers are potential outliers. (Results of Kruskal -Wallis test: χ^2-statistic = 4.616, P-value = 0.2021, degrees of freedom = 3).

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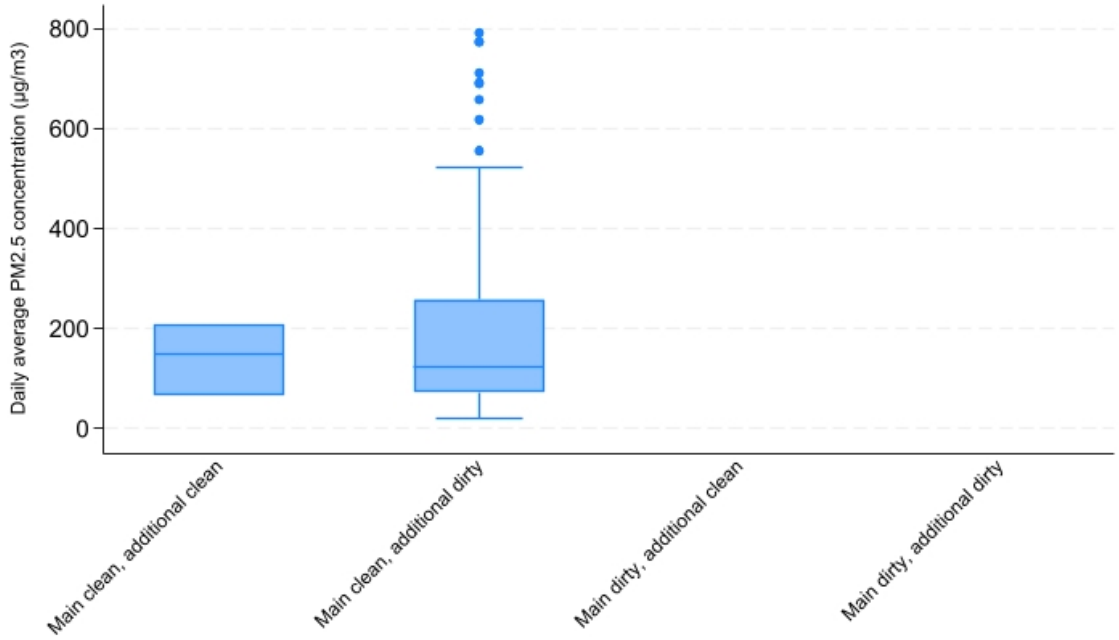

Figure S6 Boxplots illustrating daily average indoor and ambient $PM_{2.5}$ concentrations ($\mu g/m^3$) measured in eMzinoni and KwaZamokuhle between July 2019 and February 2020 per fuel use combination used for litghing. Box plot key: The line inside the box represents the median. The box's top and bottom are the first and third quartiles, respectively. Whiskers extend to data within 1.5 times the interquartile range. Points outside the whiskers are potential outliers. (Results of Kruskal -Wallis test: χ^2-statistic = 0.005, P-value = 0.9431, degrees of freedom = 1).

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Table S1 Questions from the household and general health survey used for this study.

Question	Response options
Demographics and socio-economic status	
What is your age (in years)?	[Number of years]
What is the highest qualification for PERSON NAME?	Currently in main school Finished main school Currently in high school Finished high school Currently studying towards a tertiary qualification degree diploma Completed tertiary qualification degree diploma Other
What is the total monthly income (in Rand) for this household? (Fieldworker: you can skip this question if the respondent is not willing to disclose their income.)	[Amount in ZAR]
Which of the following best describes the situation of PERSON NAME?	Retired person pensioner Unable to work due to disability Unemployed not wishing to work Unemployed looked for work in past 3 months Unemployed not looking for work but will accept work Housewife homemaker Self-employed e.g., selling goods hair salon etc Part time employed including seasonal work Paid full time employment School pupil full time student School going age not going to school Too young for school Is in a crèche daycare centre during the day
How many people are part of this household?	Open questions

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Fuel use patterns	
Main energy use	
Which fuel do you use most of the time to cook? (Tick one option only)	Electricity Gas Paraffin Wood Coal Other
Which fuel do you use most of the time to heat your house? (Tick one option only)	Electricity Gas Paraffin Wood Coal Other
Which fuel do you use most of the time for lighting? (Tick one option only)	Electricity Gas Paraffin Other
Additional energy use	
Do you sometimes use other fuels to cook? (Tick as many options as necessary)	Electricity Gas Paraffin Wood Coal Other None
Please specify what other fuels you use for cooking:	Open question
Do you sometimes use other fuels to heat your house? (Tick as many options as necessary)	Electricity Gas Paraffin Wood

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	Coal Other None
Please specify what other fuels you use for heating your house:	Open question
Do you sometimes use other fuels for lighting? (Tick as many as necessary.)	Electricity Gas Paraffin Other Candles Solar energy None
Please specify what other fuels you use for lighting:	Open question

Table S2 Percent difference in median and average $PM_{2.5}$ concentrations when comparing fuel combinations for cooking and heating.

Fuel combination	Average	Median
Cooking		
Main dirty, additional dirty & Main dirty, additional clean	-21.72 %	-43.55 %
Main dirty, additional clean & Main clean, additional dirty	+2.31 %	0 %
Heating		
Main dirty, additional dirty & Main dirty, additional clean	-41.26 %	-43.60 %
Main dirty, additional clean & Main clean, additional dirty	+28.24 %	+5.16 %

*A very small sample used exclusively clean fuel combinations for cooking, heating and lighting. For this reason, the exclusively clean fuel combination was excluded from this analysis. As it would not be considered representative.

Table S3 Participants' cooking fuel use choices by certain characteristics.

Characteristics	N	Exclusively clean fuels n (%)	Main clean, additional polluting fuel n (%)	Main polluting, additional clean fuel n (%)	Exclusively polluting fuels n (%)	Pearson chi2	df	P-value	Kramer's V
Age	N = 908								
18-29 years	n = 203	5 (2.46)	109 (53.69)	15 (7.39)	74 (36.45)	6.20	6	0.401	-
30-58 years	n = 497	19 (3.82)	275 (55.33)	46 (9.26)	157 (31.59)				
60+ years	n = 208	10 (4.81)	110 (52.88)	26 (12.50)	62 (29.81)				
Education	N = 908								
Currently in main or high school	n = 18	0 (0.00)	8 (44.44)	2 (11.11)	8 (44.44)	40.28	12	**< 0.001****	0.1216
Finished main school or high school	n = 441	17 (3.85)	279 (63.27)	41 (9.30)	104 (23.58)				
Studying towards a diploma/ degree	n = 9	1 (11.11)	4 (44.44)	2 (22.22)	2 (22.22)				
Completed tertiary education	n = 32	2 (6.25)	13 (40.63)	1 (3.13)	16 (50.00)				
Other	n = 408	14 (3.43)	190 (46.57)	41 (10.05)	163 (39.95)				
Income	N = 471					51.44	21	**< 0.001****	0.1908
<663	n = 41	0 (0.00)	22 (53.66)	2 (4.88)	17 (41.46)				

664 - 945	n = 30	0 (0.00)	17 (56.67)	1 (3.33)	12 (40.00)				
946 - 1 417	n = 42	0 (0.00)	23 (54.76)	3 (7.14)	16 (38.10)				
1 418 - 2 000	n = 161	4 (2.48)	94 (58.39)	21 (13.04)	42 (26.09)				
2 001 - 5 000	n = 130	7 (5.38)	64 (49.23)	23 (17.69)	36 (27.69)				
5 001 -10 000	n = 31	2 (6.45)	18 (58.06)	3 (9.68)	8 (25.81)				
10 001 - 20 000	n = 27	1 (3.70)	8 (29.63)	0 (0.00)	18 (66.67)				
20 001 - 50 000	n = 9	2 (22.22)	2 (22.22)	0 (0.00)	5 (55.56)				
Employment	N = 908								
Unemployed	n = 760	23 (3.03)	411 (54.08)	76 (10.00)	250 (32.89)	7.9324	3	**0.047***	0.0935
Employed	n = 148	11 (5.39)	83 (68.14)	11 (5.39)	43 (21.08)				
Household member number	N = 908								
<2	n = 127	1 (0.79)	76 (59.84)	16 (12.60)	34 (26.77)				
2-4	n = 297	16 (5.39)	163 (54.88)	23 (7.74)	95 (31.99)	13.5776	15	0.558	-
5-6	n = 269	11 (4.09)	146 (54.28)	25 (9.29)	87 (32.34)				
6-7	n = 139	5 (3.60)	71 (51.08)	16 (11.51)	47 (33.81)				
7-8	n = 58	1 (1.72)	28 (48.28)	6 (10.34)	23 (39.66)				

>10	n = 18	0 (0.00)	10 (55.56)	1 (5.56)	7 (38.89)				
Town	N = 908								
eMzinoni	n = 456	22 (4.82)	315 (69.08)	66 (14.47)	53 (11.62)	182.9924	3	**< 0.001****	0.4489
KwaZamokuhle	n = 452	12 (2.65)	179 (39.60)	21 (4.65)	240 (53.10)				

Table S4 Participants' heating fuel use choices by certain characteristics.

Characteristics	N	Exclusively clean fuels n (%)	Main clean, additional polluting fuel n (%)	Main polluting, additional clean fuel n (%)	Exclusively polluting fuels n (%)	Pearson chi2	df	P-value	Kramer's V
Age	N = 908								
18-29 years	n = 203	6 (2.96)	37 (18.23)	44 (21.67)	116 (57.14)	4.2581	6	0.642	-
30-58 years	n = 497	14 (2.82)	83 (16.70)	116 (23.34)	284 (57.14)				
60+ years	n = 208	5 (2.40)	38 (18.27)	60 (28.85)	105 (50.48)				
Education	N = 908								
Currently in main or high school	n = 18	1 (5.56)	4 (22.22)	2 (11.11)	11 (61.11)	44.8607	12	**< 0.001****	0.1283
Finished main school or high school	n = 441	12 (2.72)	101 (22.9)	113 (25.62)	215 (48.75)				
Studying towards a diploma/ degree	n = 9	2 (22.22)	0 (0.00)	2 (22.22)	5 (55.56)				
Completed tertiary education	n = 32	2 (6.25)	6 (18.75)	3 (9.38)	21 (65.63)				
Other	n = 408	8 (1.96)	47 (11.52)	100 (24.51)	253 (62.01)				
Income	**N = 471**					26.1267	21	0.202	**-**

<663	n = 41	2 (4.88)	6 (14.63)	8 (19.51)	25 (60.98)				
664 - 945	n = 30	1 (3.33)	5 (16.67)	7 (23.33)	17 (56.67)				
946 - 1 417	n = 42	0 (0.00)	6 (14.29)	8 (19.05)	28 (66.67)				
1 418 - 2 000	n = 161	3 (1.86)	34 (21.12)	35 (21.74)	89 (55.28)				
2 001 - 5 000	n = 130	3 (2.31)	18 (13.85)	33 (25.38)	76 (58.46)				
5 001 -10 000	n = 31	2 (6.45)	10 (32.26)	4 (12.90)	15 (48.39)				
10 001 - 20 000	n = 27	1 (3.70)	0 (0.00)	4 (14.81)	22 (81.48)				
20 001 - 50 000	n = 9	0 (0.00)	1 (11.11)	0 (0.00)	8 (88.89)				
Employment	**N = 908**								
Unemployed	n = 760	18 (2.37)	131 (17.24)	192 (25.26)	419 (55.13)	4.8359	3	0.184	-
Employed	n = 260	7 (2.69)	139 (53.46)	28 (10.77)	86 (33.08)				
Household member number	**N = 908**								
<2	n = 127	1 (0.79)	19 (14.96)	37 (29.13)	70 (55.12)				
2-4	n = 297	12 (4.04)	59 (19.87)	69 (23.23)	157 (52.86)	13.2668	15	0.582	-
5-6	n = 269	7 (2.60)	46 (17.10)	70 (26.02)	146 (54.28)				
6-7	n = 139	3 (2.16)	24 (17.27)	31 (22.30)	81 (58.27)				

7-8	n = 58	1 (1.72)	8 (13.79)	9 (15.52)	40 (68.97)				
>10	n = 18	1 (5.56)	2 (11.11)	4 (22.22)	11 (61.11)				
Town	N = 908								
eMzinoni	n = 456	16 (3.51)	140 (30.70)	165 (36.18)	135 (29.61)	260.5064	3	**< 0.001****	0.5356
KwaZamokuhle	n = 452	9 (1.99)	18 (3.98)	55 (12.17)	370 (81.86)				

Table S5 Participants' lighting fuel use choices by certain characteristics.

Characteristics	N	Exclusively clean fuels n (%)	Main clean, additional polluting fuel n (%)	Main polluting, additional clean fuel n (%)	Exclusively polluting fuels n (%)	Pearson chi2	df	P-value	Kramer's V
Age	**N = 908**								
18-29 years	n = 203	6 (2.96)	197 (97.04)	0 (0.00)	0 (0.00)	2.7715	6	0.837	-
30-58 years	n = 497	14 (2.82)	481 (96.78)	1 (0.20)	1 (0.20)				
60+ years	n = 208	9 (4.33)	199 (95.67)	0 (0.00)	0 (0.00)				
Education	**N = 908**								
Currently in main or high school	n = 18	1 (5.56)	17 (94.44)	0 (0.00)	0 (0.00)	4.6698	12	0.968	-
Finished main school or high school	n = 441	15 (3.40)	424 (96.15)	1 (0.23)	1 (0.23)				
Studying towards a diploma/ degree	n = 9	1 (11.11)	8 (88.89)	0 (0.00)	0 (0.00)				
Completed tertiary education	n = 32	1 (3.13)	31 (96.88)	0 (0.00)	0 (0.00)				
Other	n = 408	11 (2.70)	397 (97.30)	0 (0.00)	0 (0.00)				
Income	**N = 471**			-	-	5.8028	7	0.563	-
<663	n = 41	0 (0.00)	41 (100.00)						

664 - 945	n = 30	0 (0.00)	30 (100.00)						
946 - 1 417	n = 42	1 (2.38)	41 (97.62)						
1 418 - 2 000	n = 161	8 (4.97)	153 (95.03)						
2 001 - 5 000	n = 130	3 (2.31)	127 (97.69)						
5 001 -10 000	n = 31	2 (6.45)	29 (93.55)						
10 001 - 20 000	n = 27	1 (3.70)	26 (96.30)						
20 001 - 50 000	n = 9	0 (0.00)	9 (100.00)						
Employment	**N = 908**								
Unemployed	n = 760	20 (2.63)	738 (97.11)	1 (0.13)	1 (0.13)	5.1349	3	0.162	-
Employed	n = 148	9 (6.08)	139 (93.92)	0 (0.00)	0 (0.00)				
Household member number	**N = 908**								
<2	n = 127	8 (6.30)	118 (92.91)	1 (0.79)	0 (0.00)				
2-4	n = 297	8 (2.69)	288 (96.97)	0 (0.00)	1 (0.34)				
5-6	n = 269	7 (2.60)	262 (97.40)	0 (0.00)	0 (0.00)	14.5847	15	0.482	-
6-7	n = 139	3 (2.16)	136 (97.84)	0 (0.00)	0 (0.00)				
7-8	n = 58	3 (5.17)	55 (94.83)	0 (0.00)	0 (0.00)				
>10	n = 18	0 (0.00)	18 (100.00)	0 (0.00)	0 (0.00)				
Town	**N = 908**					9.9339	3	**0.019**	0.1046

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eMzinoni	n = 456	22 (4.82)	432 (94.74)	1 (0.22)	1 (0.22)
KwaZamokuhle	n = 452	7 (1.55)	445 (98.45)	0 (0.00)	0 (0.00)

Multinomial logistic regression - Determinants of fuel combinations

Binary predictor variables:

Household member number:

1-4 = 0

>5 = 1

Monthly income:

Below upper-bound poverty line = 0

Above upper-bound poverty line = 1

Employment status:

Unemployed = 0

Employed = 1

Education:

No school or did not finish primary school = 0

Anything more than finished primary school = 1

Fuel combinations as outcome variables:

Main clean + additional clean

Main clean + additional dirty

Main dirty + additional clean

Main dirty + additional dirty

Un-adjusted

1) Cooking:

Table S6 Multinomial logistic regression for cooking fuel combination vs age category ('18-29' is the reference category).

cook_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
group(age) : base ~s	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
3o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	.664	.342	-0.79	.427	.242	1.823	
60+ years	.505	.285	-1.21	.225	.167	1.525	
Constant	21.8	9.97	6.74	0	8.895	53.427	***
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	.807	.471	-0.37	.714	.257	2.535	
60+ years	.867	.552	-0.22	.822	.249	3.017	
Constant	3	1.549	2.13	.033	1.09	8.254	**
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	.558	.291	-1.12	.264	.201	1.553	
60+ years	.419	.241	-1.52	.13	.136	1.291	
Constant	14.8	6.839	5.83	0	5.983	36.608	***

Mean dependent var	2.704	SD dependent var	0.964
Pseudo r-squared	0.003	Number of obs	908
Chi-square	6.160	Prob > chi2	0.405
Akaike crit. (AIC)	1907.513	Bayesian crit. (BIC)	1950.814

*** p<.01, ** p<.05, * p<.1

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Table S7 Multinomial logistic regression for cooking fuel combination vs employment ('unemployed' is the reference category).

cook_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~e	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~e	1	.	.	.	.	.	
1	.422	.163	-2.23	.025	.198	.899	**
Constant	17.87	3.829	13.46	0	11.742	27.196	***
RECODE of person_e~e	1	.	.	.	.	.	
1	.303	.148	-2.45	.014	.116	.788	**
Constant	3.304	.786	5.02	0	2.073	5.268	***
RECODE of person_e~e	1	.	.	.	.	.	
1	.36	.145	-2.54	.011	.164	.791	**
Constant	10.87	2.368	10.95	0	7.092	16.66	***

Mean dependent var	2.704	SD dependent var	0.964
Pseudo r-squared	0.004	Number of obs	908
Chi-square	6.871	Prob > chi2	0.076
Akaike crit. (AIC)	1900.802	Bayesian crit. (BIC)	1929.670

*** p<.01, ** p<.05, * p<.1

Table S8 Multinomial logistic regression for cooking fuel combination vs town ('eMzinoni' is the reference category).

cook_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
: base Emzinoni	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	1.042	.386	0.11	.912	.504	2.155	
Constant	14.318	3.157	12.07	0	9.294	22.059	***
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	.583	.255	-1.23	.218	.247	1.376	
Constant	3	.739	4.46	0	1.852	4.86	***
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	8.302	3.235	5.43	0	3.868	17.817	***
Constant	2.409	.611	3.47	.001	1.465	3.96	***

Mean dependent var	2.704	SD dependent var	0.964
Pseudo r-squared	0.103	Number of obs	908
Chi-square	194.501	Prob > chi2	0.000
Akaike crit. (AIC)	1713.172	Bayesian crit. (BIC)	1742.039

*** p<.01, ** p<.05, * p<.1

Table S9 Multinomial logistic regression for cooking fuel combination vs income ('under poverty line' is the reference category).

Cook_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of monthly_~	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of monthly_~	1	.	.	.	.	.	
1	0	0	-0.02	.983	0	.	
Constant	29928114	2.079e+10	0.02	.98	0	.	
RECODE of monthly_~	1	.	.	.	.	.	
1	0	.001	-0.02	.984	0	.	
Constant	2896794.3	2.013e+09	0.02	.983	0	.	
RECODE of monthly_~	1	.	.	.	.	.	
1	0	0	-0.02	.983	0	.	
Constant	21722879	1.509e+10	0.02	.981	0	.	

Mean dependent var	2.732	SD dependent var	0.959
Pseudo r-squared	0.017	Number of obs	471
Chi-square	16.603	Prob > chi2	0.001
Akaike crit. (AIC)	997.658	Bayesian crit. (BIC)	1022.587

*** p<.01, ** p<.05, * p<.1

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Table S10 Multinomial logistic regression for cooking fuel combination vs household member number ('1-4' is the reference category).

cook_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of househol~O	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of househol~O	1	.	.	.	.	.	
1	1.067	.378	0.18	.855	.532	2.138	
Constant	14.059	3.529	10.53	0	8.596	22.994	***
RECODE of househol~O	1	.	.	.	.	.	
1	1.231	.499	0.51	.608	.556	2.723	
Constant	2.294	.667	2.86	.004	1.298	4.055	***
RECODE of househol~O	1	.	.	.	.	.	
1	1.271	.461	0.66	.508	.625	2.588	
Constant	7.588	1.958	7.85	0	4.576	12.583	***

Mean dependent var	2.704	SD dependent var	0.964
Pseudo r-squared	0.001	Number of obs	908
Chi-square	1.674	Prob > chi2	0.643
Akaike crit. (AIC)	1905.999	Bayesian crit. (BIC)	1934.866

*** p<.01, ** p<.05, * p<.1

Table S11 Multinomial logistic regression for cooking fuel combination vs education ('no education' is the reference category).

cook_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~d	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~d	1	.	.	.	.	.	
1	1.302	.526	0.65	.513	.59	2.873	
Constant	11.889	4.126	7.13	0	6.022	23.473	***
RECODE of person_e~d	1	.	.	.	.	.	
1	.619	.277	-1.07	.284	.257	1.488	
Constant	3.556	1.342	3.36	.001	1.697	7.449	***
RECODE of person_e~d	1	.	.	.	.	.	
1	.942	.386	-0.15	.885	.422	2.105	
Constant	9	3.162	6.25	0	4.52	17.919	***

Mean dependent var	2.704	SD dependent var	0.964
Pseudo r-squared	0.005	Number of obs	908
Chi-square	10.032	Prob > chi2	0.018
Akaike crit. (AIC)	1897.641	Bayesian crit. (BIC)	1926.509

*** p<.01, ** p<.05, * p<.1

2) Heating:

Table S12 Multinomial logistic regression for heating fuel combination vs age category ('18-29' is the reference category).

heat_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
group(age) : base ~s	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
3o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	.961	.506	-0.07	.94	.343	2.698	
60+ years	1.232	.799	0.32	.747	.346	4.389	
Constant	6.167	2.714	4.13	0	2.603	14.611	***
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1.13	.586	0.24	.814	.408	3.125	
60+ years	1.636	1.043	0.77	.44	.469	5.705	
Constant	7.333	3.191	4.58	0	3.125	17.208	***
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1.049	.525	0.10	.923	.394	2.797	
60+ years	1.086	.674	0.13	.894	.322	3.664	
Constant	19.333	8.094	7.07	0	8.51	43.922	***

Mean dependent var	3.327	SD dependent var	0.857
Pseudo r-squared	0.002	Number of obs	908
Chi-square	4.206	Prob > chi2	0.649
Akaike crit. (AIC)	1962.290	Bayesian crit. (BIC)	2005.591

*** p<.01, ** p<.05, * p<.1

Table S13 Multinomial logistic regression for heating fuel combination vs employment ('unemployed' is the reference category).

heat_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~e	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~e	1	.	.	.	.	.	
1	.53	.261	-1.29	.198	.202	1.393	
Constant	7.278	1.829	7.90	0	4.447	11.912	***
RECODE of person_e~e	1	.	.	.	.	.	
1	.375	.183	-2.00	.045	.144	.978	**
Constant	10.667	2.629	9.60	0	6.58	17.292	***
RECODE of person_e~e	1	.	.	.	.	.	
1	.528	.243	-1.39	.166	.214	1.302	
Constant	23.278	5.603	13.08	0	14.523	37.311	***

Mean dependent var	3.327	SD dependent var	0.857
Pseudo r-squared	0.002	Number of obs	908
Chi-square	4.615	Prob > chi2	0.202
Akaike crit. (AIC)	1955.881	Bayesian crit. (BIC)	1984.748

*** p<.01, ** p<.05, * p<.1

Table S14 Multinomial logistic regression for heating fuel combination vs town ('eMzinoni' is the reference category).

heat_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
: base Emzinoni	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	.229	.111	-3.04	.002	.088	.593	***
Constant	8.75	2.309	8.22	0	5.216	14.677	***
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	.593	.264	-1.18	.239	.248	1.417	
Constant	10.312	2.7	8.91	0	6.173	17.228	***
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	4.872	2.088	3.69	0	2.103	11.287	***
Constant	8.437	2.231	8.07	0	5.025	14.167	***

Mean dependent var	3.327	SD dependent var	0.857
Pseudo r-squared	0.144	Number of obs	908
Chi-square	280.185	Prob > chi2	0.000
Akaike crit. (AIC)	1680.311	Bayesian crit. (BIC)	1709.178

*** p<.01, ** p<.05, * p<.1

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Table S15 Multinomial logistic regression for heating fuel combination vs income ('under poverty line' is the reference category).

heat_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of monthly_~	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of monthly_~	1	.	.	.	.	.	
1	1.235	.89	0.29	.769	.301	5.071	
Constant	5.667	3.549	2.77	.006	1.661	19.336	***
RECODE of monthly_~	1	.	.	.	.	.	
1	1.101	.78	0.14	.891	.275	4.411	
Constant	7.667	4.706	3.32	.001	2.302	25.534	***
RECODE of monthly_~	1	.	.	.	.	.	
1	1	.681	0.00	1	.263	3.798	
Constant	23.333	13.757	5.34	0	7.347	74.103	***

Mean dependent var	3.374	SD dependent var	0.853
Pseudo r-squared	0.001	Number of obs	471
Chi-square	0.532	Prob > chi2	0.912
Akaike crit. (AIC)	983.267	Bayesian crit. (BIC)	1008.196

*** p<.01, ** p<.05, * p<.1

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Table S16 Multinomial logistic regression for heating fuel combination vs household member number ('1-4' is the reference category).

heat_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of househol~O	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of househol~O	1	.	.	.	.	.	
1	1.111	.479	0.24	.807	.478	2.585	
Constant	6	1.797	5.98	0	3.335	10.793	***
RECODE of househol~O	1	.	.	.	.	.	
1	1.165	.492	0.36	.718	.509	2.667	
Constant	8.154	2.396	7.14	0	4.584	14.504	***
RECODE of househol~O	1	.	.	.	.	.	
1	1.327	.544	0.69	.491	.594	2.964	
Constant	17.462	4.98	10.03	0	9.985	30.537	***

Mean dependent var	3.327	SD dependent var	0.857
Pseudo r-squared	0.001	Number of obs	908
Chi-square	1.548	Prob > chi2	0.671
Akaike crit. (AIC)	1958.948	Bayesian crit. (BIC)	1987.815

*** p<.01, ** p<.05, * p<.1

Table S17 Multinomial logistic regression for heating fuel combination vs education ('no education' is the reference category).

heat_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~d	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~d	1	.	.	.	.	.	
1	.984	.529	-0.03	.977	.343	2.824	
Constant	6.4	3.078	3.86	0	2.494	16.425	***
RECODE of person_e~d	1	.	.	.	.	.	
1	.464	.241	-1.48	.14	.168	1.285	
Constant	15.4	7.107	5.92	0	6.233	38.05	***
RECODE of person_e~d	1	.	.	.	.	.	
1	.848	.433	-0.32	.747	.311	2.309	
Constant	23	10.507	6.86	0	9.394	56.31	***

Mean dependent var	3.327	SD dependent var	0.857
Pseudo r-squared	0.007	Number of obs	908
Chi-square	14.570	Prob > chi2	0.002
Akaike crit. (AIC)	1945.926	Bayesian crit. (BIC)	1974.793

*** p<.01, ** p<.05, * p<.1

3) Lighting:

Table S18 Multinomial logistic regression for lighting fuel combination vs age category ('18-29' is the reference category).

light_combination_~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
group(age) : base ~s	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
3o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1.046	.518	0.09	.927	.396	2.762	
60+ years	.673	.361	-0.74	.461	.235	1.927	
Constant	32.833	13.607	8.42	0	14.573	73.972	***
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1091507.9	1.741e+09	0.01	.993	0	.	
60+ years	.681	1529.059	-0.00	1	0	.	
Constant	0	0	-0.01	.992	0	.	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1091507.9	1.741e+09	0.01	.993	0	.	
60+ years	.681	1529.059	-0.00	1	0	.	
Constant	0	0	-0.01	.992	0	.	

Mean dependent var	1.971	SD dependent var	0.191
Pseudo r-squared	0.012	Number of obs	908
Chi-square	3.454	Prob > chi2	0.750
Akaike crit. (AIC)	302.469	Bayesian crit. (BIC)	345.770

*** p<.01, ** p<.05, * p<.1

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Table S19 Multinomial logistic regression for lighting fuel combination vs employment ('unemployed' is the reference category).

light_combination_~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~e	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~e	1	.	.	.	.	.	
1	.419	.172	-2.11	.034	.187	.938	**
Constant	36.9	8.362	15.92	0	23.666	57.534	***
RECODE of person_e~e	1	.	.	.	.	.	
1	0	0	-0.00	.999	0	.	
Constant	.05	.051	-2.92	.003	.007	.373	***
RECODE of person_e~e	1	.	.	.	.	.	
1	0	0	-0.00	.999	0	.	
Constant	.05	.051	-2.92	.003	.007	.373	***

Mean dependent var	1.971	SD dependent var	0.191
Pseudo r-squared	0.016	Number of obs	908
Chi-square	4.689	Prob > chi2	0.196
Akaike crit. (AIC)	295.235	Bayesian crit. (BIC)	324.102

*** p<.01, ** p<.05, * p<.1

Table S20 Multinomial logistic regression for lighting fuel combination vs town ('eMzinoni' is the reference category).

light_combination_~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
: base Emzinoni	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	3.237	1.422	2.67	.007	1.369	7.656	***
Constant	19.635	4.291	13.62	0	12.794	30.135	***
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	0	.003	-0.01	.989	0	.	
Constant	.045	.046	-3.02	.003	.006	.337	***
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	0	.003	-0.01	.989	0	.	
Constant	.045	.046	-3.02	.003	.006	.337	***

Mean dependent var	1.971	SD dependent var	0.191
Pseudo r-squared	0.039	Number of obs	908
Chi-square	11.096	Prob > chi2	0.011
Akaike crit. (AIC)	288.828	Bayesian crit. (BIC)	317.695

*** p<.01, ** p<.05, * p<.1

Table S21 Multinomial logistic regression for lighting fuel combination vs income ('under poverty line' is the reference category).

light_combination_~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of monthly_~	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of monthly_~	1	.	.	.	.	.	
1	.219	.228	-1.46	.145	.029	1.687	
Constant	112	112.499	4.70	0	15.64	802.068	***

Mean dependent var	1.968	SD dependent var	0.176
Pseudo r-squared	0.025	Number of obs	471
Chi-square	3.269	Prob > chi2	0.071
Akaike crit. (AIC)	133.652	Bayesian crit. (BIC)	141.962

*** p<.01, ** p<.05, * p<.1

Table S22 Multinomial logistic regression for lighting fuel combination vs household member number ('1-4' is the reference category).

light_combination_~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of househol~O	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of househol~O	1	.	.	.	.	.	
1	1.428	.542	0.94	.348	.679	3.004	
Constant	25.374	6.467	12.69	0	15.397	41.816	***
RECODE of househol~O	1	.	.	.	.	.	
1	0	.001	-0.01	.989	0	.	
Constant	.063	.064	-2.69	.007	.008	.471	***
RECODE of househol~O	1	.	.	.	.	.	
1	0	.001	-0.01	.989	0	.	
Constant	.063	.064	-2.69	.007	.008	.471	***

Mean dependent var	1.971	SD dependent var	0.191
Pseudo r-squared	0.014	Number of obs	908
Chi-square	3.938	Prob > chi2	0.268
Akaike crit. (AIC)	295.986	Bayesian crit. (BIC)	324.853

*** p<.01, ** p<.05, * p<.1

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Table S23 Multinomial logistic regression for lighting fuel combination vs education ('no education' is the reference category).

light_combination_~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~d	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~d	1	.	.	.	.	.	
1	1.131	.478	0.29	.772	.494	2.589	
Constant	27.63	9.945	9.22	0	13.646	55.942	***
RECODE of person_e~d	1	.	.	.	.	.	
1	316136.09	2.881e+08	0.01	.989	0	.	
Constant	0	0	-0.02	.986	0	.	
RECODE of person_e~d	1	.	.	.	.	.	
1	316136.09	2.881e+08	0.01	.989	0	.	
Constant	0	0	-0.02	.986	0	.	

Mean dependent var	1.971	SD dependent var	0.191
Pseudo r-squared	0.004	Number of obs	908
Chi-square	1.247	Prob > chi2	0.742
Akaike crit. (AIC)	298.676	Bayesian crit. (BIC)	327.544

*** p<.01, ** p<.05, * p<.1

Adjusted

Note:

All three models that were run are best fit according to AIC, BIC and log-likelihood selection criteria

Independent variables/ confounders:

** Education, age, employment status, town, household member number, monthly income

1) Cooking:

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Table S24 Multinomial logistic regression for cooking fuel combination vs covariates.

cook_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~d	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
group(age) : base ~s	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
3o	1	.	.	.	.	.	
RECODE of person_e~e	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
: base Emzinoni	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
RECODE of househol~O	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
RECODE of monthly_~	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~d	1	.	.	.	.	.	
1	1.594	1.063	0.70	.484	.431	5.892	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	2.924	2.333	1.35	.179	.612	13.963	
60+ years	.981	.861	-0.02	.982	.176	5.475	
RECODE of person_e~e	1	.	.	.	.	.	
1	.204	.14	-2.31	.021	.053	.785	**
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	1.34	.775	0.51	.613	.431	4.164	
RECODE of househol~O	1	.	.	.	.	.	
1	1.162	.631	0.28	.782	.401	3.368	
RECODE of monthly_~	1	.	.	.	.	.	
1	0	0	-0.02	.983	0	.	
Constant	1337398	9.159e+	0.02	.981	0	.	

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RECODE of person_e~d	1	.	.	.	.	.	
1	.776	.565	-0.35	.728	.186	3.233	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	3.132	2.808	1.27	.203	.54	18.155	
60+ years	.879	.881	-0.13	.897	.123	6.264	
RECODE of person_e~e	1	.	.	.	.	.	
1	.204	.158	-2.05	.04	.045	.93	**
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	.996	.631	-0.01	.995	.287	3.451	
RECODE of househol~O	1	.	.	.	.	.	
1	1.215	.724	0.33	.744	.378	3.907	
RECODE of monthly_~	1	.	.	.	.	.	
1	0	.001	-0.02	.984	0	.	
Constant	2513762	1.722e+	0.02	.983	0	.	
	.2	09					
RECODE of person_e~d	1	.	.	.	.	.	
1	1.031	.712	0.04	.965	.266	3.992	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1.684	1.369	0.64	.521	.342	8.286	
60+ years	.545	.494	-0.67	.504	.092	3.224	
RECODE of person_e~e	1	.	.	.	.	.	
1	.155	.111	-2.60	.009	.038	.632	***
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	4.822	2.865	2.65	.008	1.505	15.449	***
RECODE of househol~O	1	.	.	.	.	.	
1	1.125	.629	0.21	.834	.376	3.364	
RECODE of monthly_~	1	.	.	.	.	.	
1	0	0	-0.02	.983	0	.	
Constant	1004239	6.878e+	0.02	.981	0	.	
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Mean dependent var	2.732	SD dependent var	0.959
Pseudo r-squared	0.078	Number of obs	471
Chi-square	78.438	Prob > chi2	0.000
Akaike crit. (AIC)	971.823	Bayesian crit. (BIC)	1071.539

*** p<.01, ** p<.05, * p<.1

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2) Heating:

Table S25 Multinomial logistic regression for heating fuel combination vs covariates.

heat_combination_e~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~d	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
group(age) : base ~s	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
3o	1	.	.	.	.	.	
RECODE of person_e~e	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
: base Emzinoni	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
RECODE of househol~O	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
RECODE of monthly_~	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~d	1	.	.	.	.	.	
1	1.393	1.182	0.39	.696	.264	7.354	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1.751	1.601	0.61	.54	.292	10.507	
60+ years	1.177	1.395	0.14	.891	.115	12.025	
RECODE of person_e~e	1	.	.	.	.	.	
1	.209	.156	-2.10	.036	.048	.902	**
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	.236	.161	-2.11	.035	.062	.902	**
RECODE of househol~O	1	.	.	.	.	.	
1	1.13	.734	0.19	.851	.317	4.033	
RECODE of monthly_~	1	.	.	.	.	.	
1	1.05	.816	0.06	.95	.229	4.821	

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Constant	7.626	10.644	1.46	.145	.495	117.573	
RECODE of person_e~d	1	.	.	.	.	.	
1	.761	.631	-0.33	.741	.15	3.863	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1.288	1.147	0.28	.776	.225	7.383	
60+ years	.981	1.144	-0.02	.987	.1	9.645	
RECODE of person_e~e	1	.	.	.	.	.	
1	.219	.16	-2.08	.038	.052	.919	**
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	.936	.603	-0.10	.918	.265	3.307	
RECODE of househol~O	1	.	.	.	.	.	
1	1.339	.853	0.46	.647	.384	4.664	
RECODE of monthly_~	1	.	.	.	.	.	
1	.93	.707	-0.10	.924	.209	4.131	
Constant	12.422	16.975	1.84	.065	.853	180.871	*
RECODE of person_e~d	1	.	.	.	.	.	
1	1.234	.998	0.26	.794	.253	6.02	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	1.189	1.019	0.20	.84	.222	6.381	
60+ years	1.118	1.26	0.10	.921	.123	10.179	
RECODE of person_e~e	1	.	.	.	.	.	
1	.258	.178	-1.96	.049	.067	.997	**
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	2.677	1.662	1.59	.113	.792	9.042	
RECODE of househol~O	1	.	.	.	.	.	
1	1.449	.893	0.60	.547	.433	4.847	
RECODE of monthly_~	1	.	.	.	.	.	
1	.985	.723	-0.02	.984	.234	4.15	
Constant	12.531	16.575	1.91	.056	.938	167.453	*

Mean dependent var	3.374	SD dependent var	0.853
Pseudo r-squared	0.089	Number of obs	471

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Chi-square	86.665	Prob > chi2	0.000
Akaike crit. (AIC)	933.133	Bayesian crit. (BIC)	1032.850

*** p<.01, ** p<.05, * p<.1

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3) Lighting:

Table S26 Multinomial logistic regression for lighting fuel combination vs covariates.

light_combination_~d	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RECODE of person_e~d	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
group(age) : base ~s	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
3o	1	.	.	.	.	.	
RECODE of person_e~e	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
: base Emzinoni	1	.	.	.	.	.	
2o	1	.	.	.	.	.	
RECODE of househol~O	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
RECODE of monthly_~	1	.	.	.	.	.	
1o	1	.	.	.	.	.	
o	1	.	.	.	.	.	
RECODE of person_e~d	1	.	.	.	.	.	
1	.502	.338	-1.02	.306	.135	1.875	
group(age) : base ~s	1	.	.	.	.	.	
30-59 years	.571	.634	-0.50	.614	.065	5.031	
60+ years	.18	.209	-1.47	.141	.018	1.762	
RECODE of person_e~e	1	.	.	.	.	.	
1	.295	.213	-1.69	.091	.072	1.216	*
: base Emzinoni	1	.	.	.	.	.	
KwaZamokuhle	3.538	2.368	1.89	.059	.953	13.135	*
RECODE of househol~O	1	.	.	.	.	.	
1	1.259	.707	0.41	.682	.419	3.783	
RECODE of monthly_~	1	.	.	.	.	.	
1	.294	.323	-1.11	.266	.034	2.537	

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Constant	285.908	465.983	3.47	.001	11.719	6975.026	***

Mean dependent var	1.968	SD dependent var	0.176
Pseudo r-squared	0.114	Number of obs	471
Chi-square	15.203	Prob > chi2	0.033
Akaike crit. (AIC)	133.719	Bayesian crit. (BIC)	166.958

*** p<.01, ** p<.05, * p<.1

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151 Table S27 Output of GBM for fuel combinations vs COPD.

Variable	Relative importance	Scaled importance	Percentage
Heating	106.67	1	0.77
Lighting	28.82	0.270209	0.21
Cooking	2.63	0.024612	0.02

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Table S28 Output of GBM for fuel combinations vs allergen sensitivity.

Variable	Relative importance	Scaled importance	Percentage
Cooking	134.57	1	0.73
Heating	49.42	0.37	0.27
Lighting	0.00	0.00	0.00