

# How Do Household Energy Transitions Work?\*

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# 1 Introduction

China is deploying an ambitious policy to transition up to 70% of households in northern China from residential coal heating to electric or gas “clean” space heating, including a large-scale roll out across rural and peri-urban Beijing, referred to in this document as China’s Coal Ban and Heat Pump (CBHP) subsidy policy. To meet this target the Beijing municipal government announced a two-pronged program that designates coal-restricted areas and simultaneously offers subsidies to night-time electricity rates and for the purchase and installation of electric-powered heat pumps to replace traditional coal-heating stoves. The policy was piloted in 2015 and, starting in 2016, was rolled out on a village-by-village basis. The variability in when the policy was applied to each village allowed us to treat the roll-out of the program as a quasi-randomized intervention and evaluate its impacts on air quality and health. Household air pollution is a well-established risk factor for adverse health outcomes over the entire lifecourse, yet there is no consensus that clean energy interventions can improve these health outcomes based on evidence from randomized trials (Lai et al. 2024). Households may be differentially affected by the CBHP due to factors such as financial constraints and user preferences, and there is uncertainty about whether and how the policy may affect indoor and outdoor air pollution, as well as heating behaviors and health outcomes.

## 1.1 Subheading

### 1.1.1 Sub-subheading

### 1.1.2 Personal exposure

Table ?@tbl-a-het-personal shows limited evidence that the *ATT*s across cohorts and time demonstrate meaningful heterogeneity.

Table 1: Missing values by enrollment cohort and outcome

		Never enrolled (N=1880)		Enrolled 2019 (N=642)		Enrolled 2020 (N=446)		Enrolled 2021 (N=173)	
		N	Pct.	N	Pct.	N	Pct.	N	Pct.
<b>Respiratory symptoms:</b>									
Any symptoms	Missing	23	1.2	4	0.6	5	1.1	1	0.6
	Valid response	1857	98.8	638	99.4	441	98.9	172	99.4
Cough	Missing	23	1.2	4	0.6	5	1.1	1	0.6
	Valid response	1857	98.8	638	99.4	441	98.9	172	99.4
Phlegm	Missing	23	1.2	4	0.6	5	1.1	1	0.6
	Valid response	1857	98.8	638	99.4	441	98.9	172	99.4
Wheezing	Missing	23	1.2	4	0.6	5	1.1	1	0.6
	Valid response	1857	98.8	638	99.4	441	98.9	172	99.4
Shortness of breath	Missing	24	1.3	4	0.6	5	1.1	2	1.2
	Valid response	1856	98.7	638	99.4	441	98.9	171	98.8
Chest trouble	Missing	24	1.3	4	0.6	5	1.1	1	0.6
	Valid response	1856	98.7	638	99.4	441	98.9	172	99.4
<b>Blood pressure:</b>									
Brachial SBP	Missing	30	1.6	11	1.7	17	3.8	1	0.6
	Valid response	1850	98.4	631	98.3	429	96.2	172	99.4
Central SBP	Missing	30	1.6	12	1.9	17	3.8	1	0.6
	Valid response	1850	98.4	630	98.1	429	96.2	172	99.4
Brachial DBP	Missing	30	1.6	11	1.7	17	3.8	1	0.6
	Valid response	1850	98.4	631	98.3	429	96.2	172	99.4
Central DBP	Missing	30	1.6	12	1.9	17	3.8	1	0.6
	Valid response	1850	98.4	630	98.1	429	96.2	172	99.4
<b>Biomarkers:</b>									
IL6	Missing	8	0.6	4	0.9	1	0.3	0	0
TNF	Missing	8	0.6	4	0.9	1	0.3	0	0
CRP	Missing	8	0.6	4	0.9	1	0.3	0	0
MDA	Missing	11	0.9	4	0.9	1	0.3	0	0
FeNO	Missing	15	0.8	0	0.0	0	0.0	0	0.0
	Not sampled	1341	71.3	448	69.8	383	85.9	111	64.2
	Valid response	524	27.9	194	30.2	63	14.1	62	35.8
<b>Environmental outcomes:</b>									
Personal PM	Missing	13	0.7	4	0.6	6	1.3	0	0.0
	Not sampled	984	52.3	343	53.4	239	53.6	84	48.6
	Valid response	883	47.0	295	46.0	201	45.1	89	51.4
Indoor PM	Missing	60	3.2	11	1.7	16	3.6	4	2.3
	Not sampled	1502	79.9	518	80.7	360	80.7	135	78.0
	Valid response	318	16.9	113	17.6	70	15.7	34	19.7
Indoor temperature	Missing	33	1.8	10	1.6	16	3.6	1	0.6
	Valid response	1847	98.2	632	98.4	430	96.4	172	99.4

## **Abbreviations and other terms**

ATT

Lai PS, Lam NL, Gallery B, Lee AG, Adair-Rohani H, Alexander D, et al. 2024. Household Air Pollution Interventions to Improve Health in Low- and Middle-Income Countries: An Official American Thoracic Society Research Statement. *American Journal of Respiratory and Critical Care Medicine* 209:909–927; doi:[10.1164/rccm.202402-0398ST](https://doi.org/10.1164/rccm.202402-0398ST).