How Do Household Energy Transitions Work?

Jill Baumgartner (Co-PI)   Sam Harper (Co-PI)
On behalf of the Beijing Household Energy Transitions Team

2024-07-29

Table of contents

Table 1: Table caption.

	Overall			Indoor			
Sample	Wave 1	Wave 2	Wave 4	Wave 1	Wave 2	Wave 3	Wave 4
New recruitment	977	196	68	0	300	0	52
Wave 1 households	-	866	780	-	0	0	0
Wave 2 households	-	-	162	-	-	246	248
Total recruitment	977	1062	1010	0	300	246	300

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

First table (see Table 1)

Problem table:

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.

Table 2: Treatment effect on outdoor and indoor $PM_{2.5}$, personal exposure to $PM_{2.5}$ and black carbon, and measures of indoor temperature. Outdoor and indoor $PM_{2.5}$ were derived from sensor measurements after being adjusted based on co-located gravimetric $PM_{2.5}$ measurements. 24h indicates the mean $PM_{2.5}$ concentrations during the 24 hours when personal exposure samples were collected in each village. 'Seasonal' indicates the seasonal mean $PM_{2.5}$ concentrations in each village, from Jan. 15th to Mar. 15th.

		DiD		Adjusted DiD	
		ATT	(95% CI)	ATT[a]	(95% CI)
Air pollution					
Personal	PM2.5	-2.09	(-29.38, 25.2)	1.95	(-23.34, 27.23)
	Black carbon	-0.46	(-1.73, 0.81)	-0.43	(-1.67, 0.81)
Indoor	Daily	-19.1	(-60.56, 22.35)	-14.2	(-53.94, 25.54)
	Seasonal	-35.11	(-59.36, -10.85)	-36.19	(-60.74, -11.65)
Outdoor	Daily	-0.11	(-5.86, 5.64)	-1.73	(-9.26, 5.81)
	Seasonal	3.14	(-3.1, 9.38)	0.36	(-6.27, 6.99)
Indoor temperature					
Point	Mean	1.96	(0.96, 2.96)	1.96	(0.96, 2.96)
Seasonal	Mean (all)	0.64	(0, 1.29)	0.64	(0, 1.29)
	Mean (daytime)	0.82	(-0.08, 1.72)	0.82	(-0.08, 1.72)
	Mean (heating season)	1.8	(0.96, 2.64)	1.8	(0.96, 2.64)
	Mean (daytime heating season)	1.85	(0.97, 2.73)	1.85	(0.97, 2.73)
	Min. (all)	3.83	(2.26, 5.39)	3.83	(2.26, 5.39)
	Min. (heating season)	3.72	(2.19, 5.25)	3.72	(2.19, 5.25)

Note: ATT = Average Treatment Effect on the Treated, DiD = Difference-in-Differences, ETWFE = Extended Two-Way Fixed Effects.

[a] ETWFE models for air pollution outcomes were adjusted for household size, smoking, outdoor temperature, and outdoor humidity. Temperature models not additionally adjusted.