

Effectiveness of Indoor Air Pollution Reduction on the Health of Chronic Respiratory Diseases Patients: A Case Study in Ho Chi Minh City

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INTRODUCTION AND OBJECTIVE

Respiratory diseases are one of the most common diseases in Vietnam and have a high mortality rate. Indoor air pollution is caused by the outdoor air pollution, daily activities, and ineffective ventilation due to the tubed housing structures (Figure 1), which increases the accumulation of pollutants such as PM_{2.5}, CO, NO₂... leading to an increase in the incidence of diseases [1]. This is part of the PRD project: "Multidisciplinary actions to control and reduce chronic respiratory diseases (CRD) in Vietnam" in collaboration between Belgian and Vietnamese Universities.



Figure 1. Tube house in Ho Chi Minh city, VietNam

METHODOLOGY

The study was conducted in **five tube houses** of patients with CRD. **PM_{2.5}** and **CO** levels were measured using a commercial device (Quest-EVM_7™) combined with collecting information on **daily activities** (cooking, opening doors/windows, parking indoors) and **patient health** using the AQLQ (Impact: 1 = severe, 7 = no) and ACQ (Control: 0 = good, 6 = poor) surveys, with a 0.5-point change considered clinically significant.



Figure 2. Measurement of pollution parameters and CRD patients survey

Solutions were made, such as installing kitchen hoods and ventilation fans, using motorcycle covers... One year after these changes, pollution levels were assessed. The data set was analyzed using the Wilcoxon Rank-Sum test, and the results of the AQLQ and ACQ questionnaires were compared.



Figure 3. Ventilation fan, motorcycle covers, and cooker hood

RESULTS

After 1 year, PM_{2.5} decreased by 10 - 30 µg/m³ depending on the house (Figure 4), sometimes exceeding the standard (50 µg/m³). However, the PM_{2.5} concentration also depends on the house's cleaning process and furniture storage, so there are still times when it remains unchanged or high.

CO showed a more pronounced reduction, dropping by 0.4 - 5.2 ppm (Figure 5) and below the standard (9 ppm), highlighting the renovation's effectiveness.

Patient surveys showed decreased ACQ scores and increased AQLQ scores (Table 1), indicating that patients had fewer symptoms, required less medication, felt more comfortable, and could participate in daily activities more efficiently.

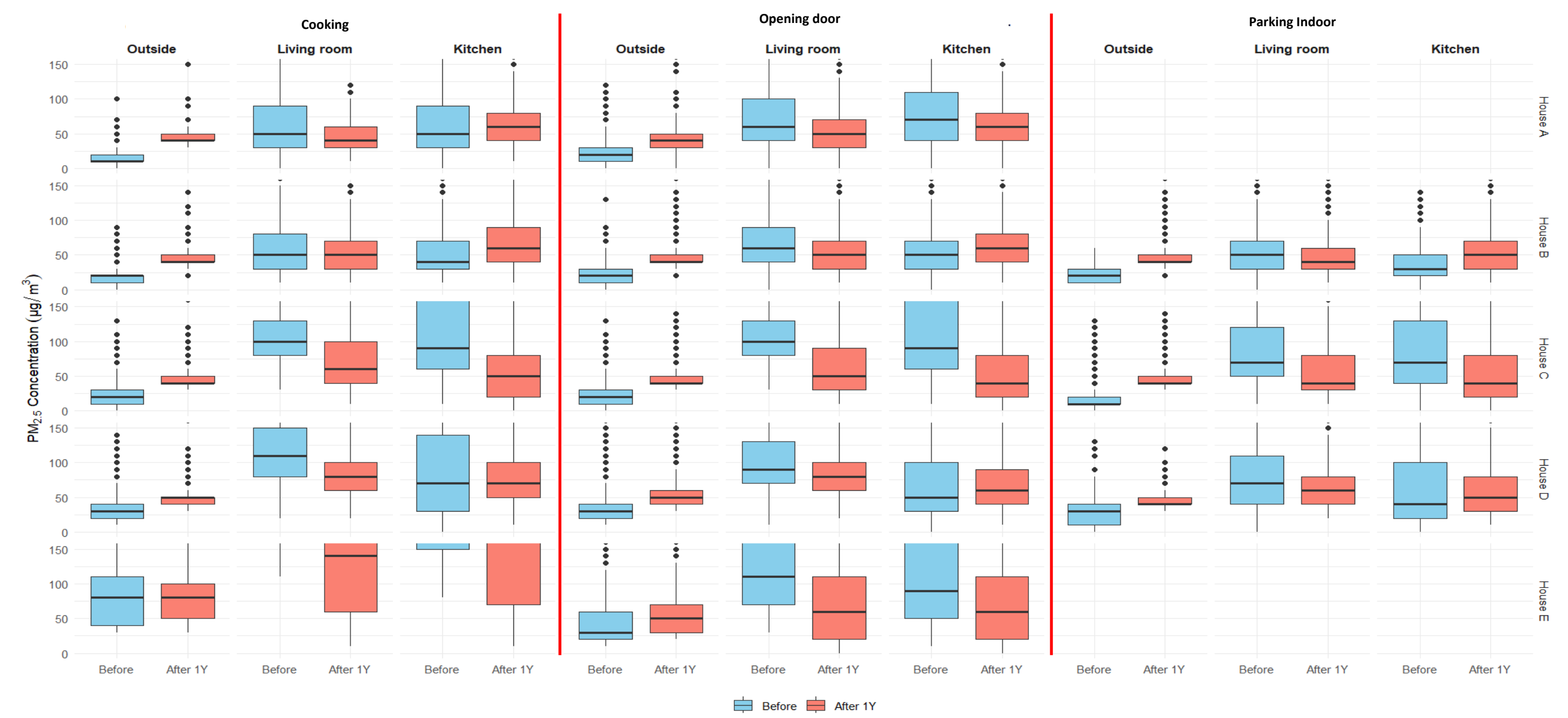


Figure 4. PM_{2.5} concentrations before and after 1 year

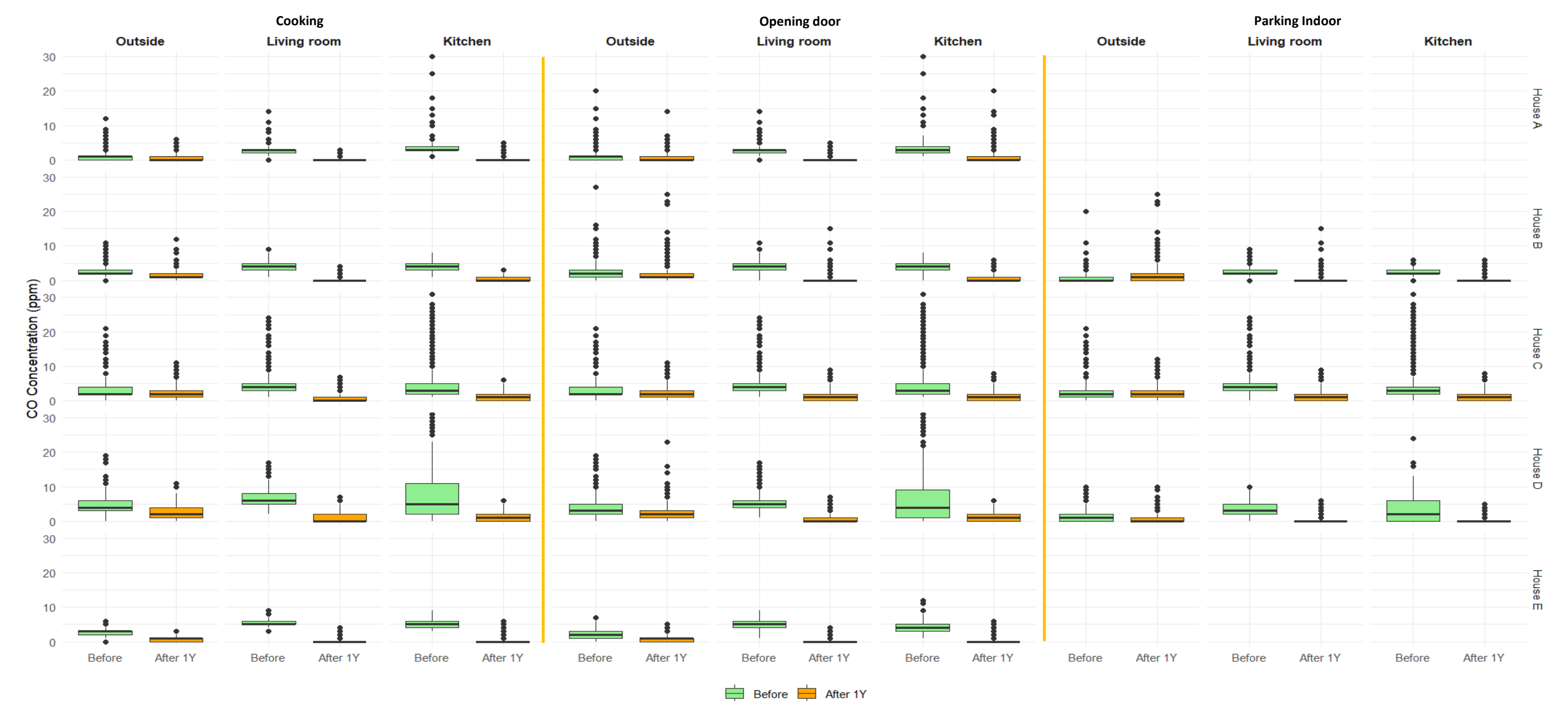


Figure 5. CO concentrations before and after 1 year

Table 1. AQLQ and ACQ survey results before and after 1 year

	Patient	A		B		C		D		E	
		Before	After	Before	After	Before	After	Before	After	Before	After
Asthma Quality of Life Questionnaire (AQLQ)	Symptoms	5.17	6.83	5.75	6.42	6	6.42	4.92	6.92	5.25	6.92
	Limitation of activities	3.45	5.09	5.2	6.27	4	5.55	4.09	6.18	4.55	6.36
	Emotional function	2.8	5.6	5.2	6.6	4.8	5.8	4.6	6.8	6.4	7
	Effect of Environment	2.75	6.75	3.25	6.25	2.25	5.5	2.75	6.25	3.25	6
Asthma Control Questionnaire (ACQ)	Levels of Asthma control	1.2	0	0	0.2	1	0.4	3.2	0	1.2	0.2
	Number of medical visits	2	0	0	0	0	0	0	0	0	0
	Exacerbation										
	Severe	0	0	0	0	0	0	0	0	0	0
	Average	2	0	0	0	0	0	0	0	0	0
Minor	2	0	3	0	1	0	12	0	0	0	

CONCLUSION

Indoor air pollution has a significant impact on the health of occupants, increasing symptoms in respiratory patients and causing millions of deaths each year [2]. Adequate ventilation contributes significantly to reducing indoor air pollution [3]. Residents, especially those with CRD patients, need to change their lifestyle habits and practice indoor air pollution reduction solutions regularly and consistently to maintain good health and stability.

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