Article

Modeling the Impact of an Indoor Air Filter on Air Pollution Exposure Reduction and Associated Mortality in Urban Delhi Household

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Supplementary Information

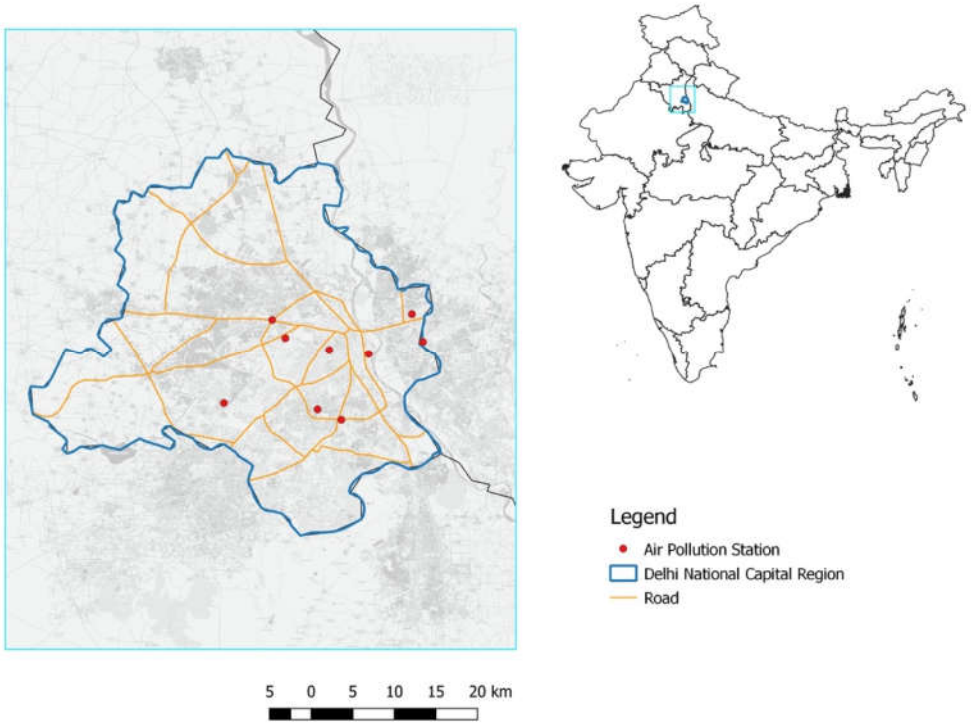

Figure S1. Map of study area and ambient air monitoring stations.

Table S1. Ambient air pollution station and corresponding longitude and latitude.

Station Name	Longitude	Latitude
Anand Vihar	77.316032	28.646835
Dwarka	77.0719006	28.5710274
IHBAS	77.3025234	28.6811736
ITO	77.2494387	28.6316945
Mandir Marg	77.201067	28.636429
Punjabi Bagh	77.186937	28.563262

RK Puram	77.131023	28.674045
Shadipur	77.1473105	28.6514781
Siri Fort	77.2159377	28.5504249

Table S2. Details of CONTAM simulation models.

Model Number	Filter $PM_{2.5}$ Removal Efficiency (% $PM_{2.5}$ removal)	Air Filter Use (hours/day)	Smoker Presence
1	HEPA (99%)	8	No
2	HEPA (99%)	15	No
3	HEPA (99%)	24	No
4	Medium efficiency (65%)	8	No
5	Medium efficiency (65%)	15	No
6	Medium efficiency (65%)	24	No
7	Low efficiency (30%)	8	No
8	Low efficiency (30%)	15	No
9	Low efficiency (30%)	24	No
10	HEPA (99%)	8	Yes
11	HEPA (99%)	15	Yes
12	HEPA (99%)	24	Yes
13	Medium efficiency (65%)	8	Yes
14	Medium efficiency (65%)	15	Yes
15	Medium efficiency (65%)	24	Yes
16	Low efficiency (30%)	8	Yes
17	Low efficiency (30%)	15	Yes
18	Low efficiency (30%)	24	Yes
19	No filter Use	0	Yes
20	No filter use	0	No

Table S3. Microenvironment schedule of occupants and user schedule for air filter.

	Schedule and Location
8-hour air filter use	Living room: 7:00–9:00, 14:00–16:00, 19:00–21:00; Bedroom: 21:00–22:00
15-hour air filter use	Living room: 7:00–21:00; Bedroom: 21:00–22:00
All day air filter use	Living room: 7:00–21:00; Bedroom: 21:00–7:00 (next day)
Occupants schedule	Bathroom: 6:00–7:00, Kitchen: 7:00–7:30, 12–12:30, 17:30–18:30; Living room: 7:30–12:00, 12:30–17:30, 18:30–22:00; Bedroom: 21:00–7:00;

Table S4. Sensitivity analysis with different window opening times, window sizes, floors, and time spent outdoors.

Simulation Inputs Modified for Sensitivity Analysis	Daily AER (/h), min–max (mean)	Annual Mean $PM_{2.5}$ Exposure ($\mu g/m^3$)
Original Model [1]	0.3–4.5 (1.5)	29
17 hours of windows open per day (7:00–24:00)	0.3–5.2 (1.7)	37
24 hours of windows open per day (0:00–24:00)	0.4–6.3 (1.9)	43
24 hours of windows open per day (0:00–24:00) and 1 m^2 windows cross-sectional opening area	0.5–11.1 (3.3)	58
4th floor	0.3–4.7 (1.5)	30
2 hours of outdoor activity per day (14:00–16:00)	0.3–4.5 (1.5)	38

[1] 24 h HEPA filter use, without smoker 11 hours of window open per day (7:00–18:00), 0.8 m^2 windows cross-sectional opening area, 1st floor apartment, all-day indoor occupant schedule.

Estimating the burden averted due to various air filtration scenarios

Estimates of averted mortality were calculated using standard Global Burden of Disease Methods [1]. Background disease data for Delhi were manually extracted from the IHME GBD Compare India website [2] for five causes of death—chronic obstructive pulmonary disease, ischemic heart disease, stroke, and lung cancer (for all ages), and ALRI in those under five years old. Extracting chronic disease endpoints for adults only was not possible, as age categories overlapped. Cases in ages under 20 represented a small number (less than 0.30%) of the mortality for each of these diseases.

For each of the CONTAM-modeled exposures, relative risks were derived from curves generated using publicly available parameters provided by IHME and described in Burnett et al. [3]. Population attributable fractions (PAFs) were estimated and pre- and post-intervention burdens were calculated by multiplying the disease specific PAF by the mortality attributed to each background disease. The post-intervention disease burden was subtracted from the pre-intervention burden to estimate the averted burden for each scenario.

References

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2. ICMR; PHFI; IHME Indian Council of Medical Research, Public Health Foundation of India, and Institute for Health Metrics and Evaluation Available online: http://vizhub.healthdata.org/gbd-compare/india (accessed on 6 December 2018).
3. Burnett, R.T.; Pope, C.A., III; Ezzati, M.; Olives, C.; Lim, S.S.; Mehta, S.; Shin, H.H.; Singh, G.; Hubbell, B.; Brauer, M.; et al. An Integrated Risk Function for Estimating the Global Burden of Disease Attributable to Ambient Fine Particulate Matter Exposure. *Environ. Health Perspect.* **2014**.