Around 3 billion of population continue to use unclean fuels for household activities, and most of them belong to low- and middle-income countries. Household air pollution (HAP) contributes for an estimated 2.3 million premature mortality and morbidity burden each year. In the hallmark Household Air Pollution Intervention Network (HAPIN) trial, 3,195 pregnant women from households of Guatemala, India, Peru, Rwanda, who were using biomass fuels for cooking, were randomly assigned to either receive free liquefied petroleum gas (LPG) stoves and an 18-month supply of LPG (approximately 500 days) or to the control group - continued with traditional stove use. The primary and secondary outcomes of trial are being analyzed and in pipeline for publication to larger public.

However, there exists a knowledge gap on evaluating the longer-term impact of such cleaner fuel interventions to reduce exposure to household air pollution and for exposure-response for neurodevelopment in children. Hence the current - HAPIN 5-500 study has been implemented using the grant aided by National Institute of Health to address the knowledge gap.

The follow-up of original HAPIN trial cohorts will address the following three aims

Aim 1. To determine the effects of a 500-day LPG stove and fuel intervention (gestation and first year of life) on child development and growth through age 5 with annual assessments at 36, 48, and 60 months to evaluate the intervention effects using the MDAT (Malawi Developmental Assessment Tool) scale and linear growth through 60 months.

Aim 2. To characterize personal exposures to fine particulate matter (PM 2.5) and black carbon through age 5 and determine the longer-term effects of the intervention on exposure.

Aim 3. To evaluate exposure-response between exposure during several critical periods of development and growth by examining the several periods of exposure relevant for child development, including during gestation and early life of the children born to the pregnant women enrolled in the HAPIN study.

There are 2175 eligible children in 3 countries – Guatemala, Rwanda and India. A total of 774 in India from two study sites in India – Kallakurichi and Nagapattinam districts are being followed up at 36, 48 and 60 months for physical growth outcomes – Anthropometry (height and weight), neurodevelopmental outcomes using MDAT and personal exposure measurements of PM2.5 using UPAS and post intervention stove use monitoring. The study has been conducted since Sep-2022 and will end with the final 5-year assessment in June-2025.

List of Publication-2022

S.No	Title of paper	Name/s of the author/s	Name of the journal	ISSN number	Impact Factor
1.	Resources and Geographic Access to Care for Severe Paediatric Pneumonia in Four Resource-limited Settings	William Checkley., Suzanne M Simkovich., Sarada S Garg., Kalpana Balakrishnan., Thangavel G	American Journal of Respiratory and Critical Care Medicine	1073-449X	30.53
2.	Pollution and health: a progress update	Richard Fuller., Philip J Landrigan., Kalpana Balakrishnan., Stephan Bose-oreilly., Michael Brauer	The Lancet Planetary Health	2542-5196	28.75
3.	Particulates and anaemia in India	Ajay Pillarisetti., KALPANA BALAKRISHNAN	Nature Sustainability	2398-9629	27.16
4.	Association of ambient and household air pollution with lung function in young adults in an peri-urban area of South-India: A cross-sectional study	Otavio T Ranzani., Santhi Bhogadi., Carles Milà., Bharati Kulkarni., Kalpana Balakrishnan., Sankar S., Judith Garcia-aymerich., Julian D Marshall., Sanjay Kinra., Cathryn Tonne	Environment International	0160-4120	13.35
5.	Mortality Associated with Ambient PM2.5 Exposure in India: Results from the Million Death Study	Joy Chakma., Geetha Menon., Rajesh Dikshit., Patrick E Brown., Yurie Izawa., KALPANA BALAKRISHNAN., Sze Hang Fu., R S Dhaliwal., Peter S Rodriguez., Guowen Huang., Rehana Begum., Howard Hu., George Dâ€™Souza., Randeep Guleria., Prabhat Jha	Environmental Health Perspectives	0091-6765	11.04
6.	Exposure Contrasts of Pregnant Women during the Household Air Pollution Intervention Network Randomized Controlled Trial	Michael Johnson., KALPANA BALAKRISHNAN., Ghislaine Rosa., Anaité Díaz-Artiga., KRISHNENDU MUKHOPADHYAY., Luke Naeher., Ephrem Dusabimana., SANKAR S., Florien Ndagijimana., Katherine A Kearns	Environmental Health Perspectives	0091-6765	11.04
7.	The relationship between greenspace and personal exposure to PM 2.5 during walking trips in Delhi, India	William Mueller., Paul Wilkinson., James Milner., Miranda Loh., Sotiris Vardoulakis., Zoë Petard., D K Arvind., Mark Cherrie., Naveen Chand V P., Kalpana Balakrishnan	Environmental Pollution	0269-7491	9.99
8.	Effects of a Liquefied Petroleum Gas Stove	John P Mccracken., Wenlu Ye., Kalpana	Hypertension	0194-911X	9.9

	Intervention on Gestational Blood Pressure: Intention-to-Treat and Exposure-Response Findings From the HAPIN Trial	Balakrishnan., Ghislaine Rosa., Joshua P Rosenthal., Michael Johnson., Kyle Steenland			
9.	Biomass using tribal women exhibited respiratory symptoms, hypertensive risks and abnormal pulmonary function	Pradip Mitra., Deep Chakraborty., Sukanta Nayek., Soumya Kundu., Debojyoti Mishra., Utpal Dan., Naba Kumar Mondal	Chemosphere	0045-6535	8.94
10.	Association between personal exposure to household air pollution and gestational blood pressure among women using solid cooking fuels in rural Tamil Nadu, India	Thomas Clasen., Wenlu Ye., Ajay Pillarisetti., Kyle Steenland., Thangavel G., Jennifer L Peel., Kalpana Balakrishnan., Shirin Jabbarzadeh., William Checkley	Environmental Research	0013-9351	8.43
11.	Monitoring of polycyclic aromatic hydrocarbons emitted from kerosene fuel burning and assessment of health risks among women in selected rural and urban households of South India	Krishnendu Mukhopadhyay., Deep Chakraborty., Srinivasan Natarajan., Sankar S., Kalpana Balakrishnan	Environmental Geochemistry and Health	0269-4042	4.9
12.	Facing the Realities of Pragmatic Design Choices in Environmental Health Studies: Experiences from the Household Air Pollution Intervention Network Trial	Stella M Hartinger., John P Mccracken., Lindsay J Underhill., Laura Nicolaou., Lisa M Thompson., Thomas F Clasen., Joshua Rosenthal., William Checkley., Shakir Hossen., Ghislaine Rosa., Anaite Diaz-artiga., Kalpana Balakrishnan., Suzanne M Simkovich., Victor G Davila Roman., Miles A Kirby., Jennifer L Peel	International Journal of Environmental Research and Public Health	1661-7827	4.61
13.	Indoor and Ambient Air Pollution in Chennai, India during COVID-19 Lockdown: An Affordable Sensors Study	Ajay Pillarisetti., Adithi R Upadhya., Balachandar Veerappan., Krishnendu Mukhopadhyay., Sankar S., Ronak Sutaria., Kalpana Balakrishnan., Naveen Puttaswamy., V Sreekanth., Sudhakar Saidam	Aerosol and Air Quality Research	1680-8584	4.53
14.	Inhaled silica nanoparticles cause chronic kidney disease in rats	Jason Glaser., Richard J Johnson., Fumihiko Sasai., Marvin Gonzalez-quiroz., Sirirat Anutrakululchai., Ricardo Leiva., Gangadhar Taduri., Vidhya Venugopal., Magdalena Madero., Julia Wijkstrom	American Journal of Physiology - Renal Physiology	1931-857X	4.1
15.	Occupational Heat Stress, Heavy Workload and Adverse Renal Health Outcomes–A Cross-	Rekha S., Vidhya Venugopal., Latha P K	Safety and Health at Work	2093-7911	4.05

	Sectional Study Among Stone Quarry Workers in South India				
16.	Occupational heat exposures, physiological responses and renal health outcomes among agricultural workers in South India	Latha P K., Vidhya Venugopal., Shamnugam Rekha	Safety and Health at Work	2093-7911	4.05
17.	Study to Assess the Impacts of Heat Stress on Productivity Losses in India	Vidhya Venugopal., Wenjia Cai., Mengzhen Zhao., Rekha Shanmugam., Latha P K	Safety and Health at Work	2093-7911	4.05
18.	Inter- versus Intracity Variations in the Performance and Calibration of Low-Cost PM2.5 Sensors: A Multicity Assessment in India	Pratima Singh., Sagnik Dey., Pratyush Agrawal., Naveen Puttaswamy., Sofiya Rao., KALPANA BALAKRISHNAN	ACS Earth and Space Chemistry	2472-3452	3.56
19.	Household air pollution and COPD: cause and effect or confounding by other aspects of poverty?	Mortimer K., de Oca M.M., Salvi S., Balakrishnan K., Hadfield R.M., Ramirez-Venegas A., Halpin D.M.G., Obianuju B.O., MeiLan K.H., Padilla R.P., Kirenga B., Balmes J.R.	International Journal of Tuberculosis and Lung Disease	1027-3719	3.43
20.	Implementing a ventilation index for assessing indoor air PM2.5 concentrations in biomass-using households	Rengaraj Ramasamy., Krishnendu Mukhopadhyay	Environmental Monitoring and Assessment	0167-6369	3.31
21.	Phthalate Esters from Packaged Milk and Associated Human Health Risk: A Monte Carlo Probabilistic Simulation Approach	Rita Mondal., Deep Chakraborty., Dipanjali Majumdar	Mapan - Journal of Metrology Society of India	0970-3950	1.45
22.	Characterisation of Indoor Volatile Organic Compounds and Its Association with Respiratory Symptoms Among Children Living in Solid Fuel Using Households in Tamil Nadu, India	Srinivasan Natarajan., Krishnendu Mukhopadhyay., Dhanasekaran Thangaswamy., Amudha Natarajan., Deep Chakraborty	Mapan - Journal of Metrology Society of India	0970-3950	1.45
23.	Child Survival and Early Lifetime Exposures to Ambient Fine Particulate Matter in India: A Retrospective Cohort Study	Jiawen Liao., Yang Liu., Kyle Steenland., Ajay Pillarisetti., Lisa M Thompson., Sagnik Dey., Kalpana Balakrishnan., Thomas Clasen	Environmental Health Perspectives	1552-9924	11.04
24.	Rising Temperatures and Its Impacts on Thermal Comfort and Productivity—A Case Study from Select Workplaces in Southern India	P K Latha., Rekha Shanmugam., Manikandan Krishnamoorthy., Vidhya Venugopal	Lecture Notes in Civil Engineering	2366-2557	
25.	Prevalence of vitamin D deficiency among South Indian pregnant women	Maruthy K N., Sheela Ravinder S., Padmavathi R., Maheshkumar K.,	JOURNAL OF FAMILY MEDICINE AND	2249-4863	30.53

		Mohan Kumar M., Sankar S., Kalpana Balakrishnan	PRIMARY CARE		
26.	Visualizing Field Data Collection Procedures of Exposure and Biomarker Assessments for the Household Air Pollution Intervention Network Trial in India	Karthikeyan D. Rajamani, Sankar Sambandam, Krishnendu Mukhopadhyay, Naveen Puttaswamy, Gurusamy Thangavel, Durairaj Natesan, Rengaraj Ramasamy, Saritha Sendhil, Amudha Natarajan, Vigneswari Aravindalochan, Ajay Pillarisetti, Michael Johnson, Joshua Rosenthal, Kyle Steenland, Ricardo Piedhrahita, Jennifer Peel, Maggie L. Clark, Dana Boyd Barr, Sarah Rajkumar, Bonnie Young, Shirin Jabbarzadeh, Ghislaine Rosa, Miles Kirby, Lindsay J. Underhill, Anaite Diaz-Artiga, Amy Lovvorn, William Checkley, Thomas Clasen, Kalpana Balakrishnan	JoVE Journal of Visualized Experiments		
27.	Liquefied Petroleum Gas or Biomass for Cooking and Effects on Birth Weight	T.F. Clasen, Chang L.M.,..K. Balakrishnan,…V. Arabindlochanan,.S. Garg,...K. Mukhopadhyay,…N, Puttasamy,…S. Sambandam,. G. Thangavel,…J.L. Peel for the HAPIN Investigators	The New England Journal of Medicine		
28.	Mapping development and health effects of cooking with solid fuels in low-income and middle-income countries, 2000-18: a geospatial modelling study	Local Burden of Disease Household Air Pollution Collaborators	Lancet Global Health		

Book Chapters

S.no	Name of the book	Name of the Publisher	Name of the chapter	Date/Year published	ISBN No
1	Innovative Trends in Hydrological and Environmental Systems	Springer	Rising Temperatures and Its Impacts on Thermal Comfort and Productivity—A Case Study from Select Workplaces in Southern India	2022	978-981-19-0304-5

2	Environmental Management	N.B,Publications	Exposure to polycyclic Aromatic Hydrocarban (PAHs) due to burning of Biomass Fuels and Associated Human Health Effects: A Brief Review	2022	978-93-91550-73-8
3	Indoor Air Quality Assessment for Samart Environments	J.Saint et.al	Optimization of household Ventilation with Improved cookstove: An Amicable approach to Strength Indoor Air Quality and Public Health	2022