



The SRIHER-CLARKSON UNIVERSITY Collaboration

Exposure to indoor and outdoor airborne pollutants is one of the leading risk factors contributing to burden of disease in India. The interrelated nature of ambient and household exposures, and the resultant health effects requires their joint consideration while framing policy actions in India. In addition, the dependence of air quality on our choice of energy sources and on the state of the atmosphere makes it critical to understand the connection between climate and air quality. Interventions that reduce (climate relevant) emissions and (health relevant) exposures would fit well within a co-benefits framework whereby benefits could accrue for health and climate at national and global scales. To develop such interventions, there is a critical need for personnel with inter-disciplinary expertise in Indian Institutions.

The Indo-US Knowledge initiative aims to address the above-mentioned national needs through Indo-US collaboration between two well-recognized research groups at Clarkson University (CU), USA and Sri Ramachandra Institute for Higher Education and Research (SRIHER), India. As part of this initiative, SRIHER and CU have partnered with the Indian Council for Medical Research, to develop and deploy a suite of inter-disciplinary short courses on air quality, human health, and climate change, conduct multi-lateral visits between scientists of the three institutions, and initiate novel research programs at the three institutions concerning the development and validation of low-cost air quality sensors.

Short Description of Course

The short courses being developed as part of the collaboration are being offered to wider network participants in India from academic and Governmental collaborating institutions of ICMR and SRIHER. They target doctoral students, faculty, and scientists in public/environmental health disciplines to provide knowledge on **application** of the science of air pollution and its interrelated consequences on **human health and climate change**, especially in India. They provide a mixture of lectures and hands-on activities using electricity generation as an example to highlight the interconnections between the three topics.

Activities and Learning Outcomes

- Identify primary source of air pollutants and trends that contribute to human health and climate change impacts
- Access and analyze air quality data from CPCB (India) and Airnow (US EPA)
- Navigate and use the WHO Air Q+ software to assess impacts of air pollutants on health – general and specifics for Cardiovascular and Respiratory Disease
- Use low-cost optical sensors to measure PM_{2.5} at different sources
- Engage in a role-play activity that models how decisions related to India's future electric power generation will affect climate and human health impacts



Dr Suresh Dhaniyala, Bayard D. Clarkson Distinguished Professor Mechanical & Aeronautical Engineering / Co-Director of CARES (Center for Air Resources Engineering and Science), Clarkson University, USA with SRU university Vice Chancellor JSN Murthy, Dean(Research) SPThyagarajan and Dr. Kalpana Balakrishnan Associate dean of Research and Director, Center for Advanced Research On Environmental Health, SRIHER at the launch of the MOU in 2016.

Training Workshops:

- Training Workshop on Air Pollution, Climate Change and Human Health in India: Interlinked Challenges”, Clarkson-SRU-ICMR Knowledge Initiative Project, SRMC&RI(DU) from Dec 18 to 20,2017.
- Clarkson-SRU-ICMR Indo-US Knowledge Initiative Project Training Workshop on Air pollution, climate change and human health in India: Interlinked Challenges” ,SRMC&RI(DU) from January 8-10, 2019
- Training Workshop on Air Pollution, Climate Change and Human Health in India: Interlinked Challenges”, Clarkson-SRU-ICMR Knowledge Initiative Project, Clarkson University, Potsdam, New York from August 5-9, 2019.

Participants:

1.	Dr. Krishnendu Mukhopadhyay	SRIHER
2.	Dr. Naveen Puttaswamy	SRIHER
3.	Dr. Tanvir Kaur	ICMR
4.	Dr. Rajnarayan Tiwari	NIREH,ICMR
5.	Dr. Swasthi Shubam	NIREH, ICMR
6.	Dr. Sindhuprava Rana	NIREH, ICMR
7.	Dr. Asim Saha	ROHC, ICMR
8.	Dr. Ankit Viramgani	NIOH, ICMR

Research Projects:

- Project entitled “Air Pollution, Health and Climate in India: Building Capacities for Health Research and Program Evaluation“ Funded by Indo-US Knowledge Initiative, USIEF

Publications:

- Suresh Dhaniyala, Praney Dubey, Kalpana Balakrishnan, "Air Quality in rural India : Role of Ultrafine Particles from cookstoves " in J. of Air and Waste Management Association, 2011 8: 14-18.



The SRIHER-Indian Council of Medical Research, ICMR Collaboration

This has been one of the most engaging and involving collaboration that SRU has been privileged to have over the last 9 years. It was first initiated through informal exchanges with the National Institute of Occupational Health that were responsible for SRU meriting the recognition as a WHO-CC in Research and Training and Occupational Health in 2007. Since then the collaboration was extended with formal MOU with NIE in 2010, for the conduct of the newly developed MPH program at both institutions. Since 2010, ICMR has supported the development of the Center for Advanced Research for Environmental Health: Air Pollution under the leadership of Professor. Balakrishnan. The team at SRIHER was extended the fullest levels of technical and administrative support by ICMR not only for the successful execution but also widespread dissemination through research publications. Salient features of this collaboration are 7 publications in Lancet that were co-authored by the SRIHER-ICMR team as part of the Capstone papers being published for the Global Burden of Disease 2015 exercise. The formulation of the MOU represents a major step forward in our inter-institutional collaboration. This will enable SRU to expand its contributions to national health programmes and policies under the stewardship of ICMR while fostering inter-institutional research collaborations amongst institutions of national eminence.

Air pollution in the household and ambient environment is among the leading contributors to the burden of ill health in India. The Indian Council for Medical Research (ICMR) has set up a Center for Advanced Research on Air Quality, Climate and Health at Sri Ramachandra University in Chennai, Tamil Nadu to strengthen the scientific evidence base for health effects of air pollution and increase the momentum on air quality actions in India. This builds on earlier work commissioned by the ICMR to examine the health effects of household and ambient air pollution in rural-urban cohorts of pregnant women, children and adults in Thiruvallur and Kancheepuram Districts of Tamil Nadu.

The Center is headed by Professor. Kalpana Balakrishnan, an eminent global environmental health expert at SRU. The Center has been sanctioned 4 major international projects to be executed in initial 5 year term with others under advanced stages of review. The projects will

(I) establish relationships between fine particulate matter, respiratory health (lung function) and early stage cardiovascular disease (CVD) markers (blood pressure, endothelial dysfunction, arterial stiffness and intima-media thickness in Tamil Nadu, with funding from the UN Foundation (Global Alliance for Clean Cookstoves) and Public Health Institute

(II) compare the feasibility, cost, and effectiveness of alternate strategies to increase LPG adoption and sustained use with specific focus on pregnant women in Maharashtra, with funding from the Implementation Science Network of the US National Institutes of Health

(III) partner with ICMR to conduct a randomized controlled trial of LPG stove and fuel distribution in 800 households in Tamil Nadu as part of global multi-centric effort being conducted in India, Guatemala, Peru and

Rwanda to deliver rigorous evidence regarding potential health benefits of clean fuel use for pregnant women, young children and adult women with funding by the US National Institutes of Health

(IV) partner with ICMR to develop and deploy a suite of inter-disciplinary short courses on air quality, human health, and climate change with funding by the The Indo-US Knowledge Initiative.

The projects involve collaboration with an extensive network of eminent US universities including Emory University, Johns Hopkins University, Colorado State University, Tufts University, Clarkson University in addition to an on-going partnership with long term SRU collaborators at the University of California, Berkeley.

The funding available through these projects and the long history of formal collaborations between SRU and ICMR allow an unprecedented opportunity for augmenting scientific outputs as well as scientific capacities in the domain of air quality, climate and health.



Dr Soumya Swaminathan , Director General of Indian Council Of Medical Research at the launch of the new Center for Advanced Research on Air Quality, Climate and Health at SRU , with Vice Chancellor JSN Murthy, Dean(Research) SPTHyagarajan and Dr. Kalpana Balakrishnan

SRIHER-ICMR Research Projects

- Project entitled “Prenatal Exposure to Air Toxics and Birth outcome assessment in rural and Urban Tamil Nadu” funded by Indian Council of Medical Research
- Project entitled “Impact of meteorological changes and air pollution on respiratory health & morbidity: A retrospective multicentric study” funded by Indian Council of Medical Research.
- Project entitled “Exposures to Volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons associated with use of Kerosene as a Household Fuel through integrated environmental and bio-monitoring in rural and urban Tamil Nadu: a follow-up study on air toxics in the ICMR-CAR cohort” funded by Indian Council of Medical Research.
- Project entitled “Center for Advanced Research on Environmental Health: Air Pollution” funded by Indian Council of Medical Research.

SRIHER-ICMR Publications

Journal Articles and Editorials

1. Sanchez M, Ambros A, Milà C, Salmon M, Balakrishnan K, Sambandam S, Sreekanth V, Marshall JD, Tonne C. Development of land-use regression models for fine particles and black carbon in peri-urban South India, 2018. *Science of the Total Environment*. 4;634:77-86. doi: 10.1016/j.scitotenv.2018.03.308
2. Balakrishnan K , Ghosh S, Thangavel G , Sambandam S , Mukhopadhyay K , Puttaswamy N , Sadasivam A , Ramaswamy P , Johnson P , Kuppuswamy R , Natesan D , Maheshwari U , Natarajan A , Rajendran G , Ramasami R , Madhav S , Manivannan S , Nargunanadan S , Natarajan S , Saidam S , Chakraborty M , Balakrishnan L , Thanasekaraan V. Exposures to fine particulate matter (PM_{2.5}) and birthweight in a

rural-urban, mother-child cohort in Tamil Nadu, India. Environmental Research 2018, doi: 10.1016/j.envres.2017.11.050

3. Saraswathy Manivannan, Vidhya Venugopal, Anupma Jyothi Kindo1, Rajarajeswari Kuppuswamy Method for assessment of indoor household dampness for its use in epidemiological studies in tropical settings, 2017. Annals of Tropical Medicine and Public Health, ISSN 1755-6783.
4. Rajarajeswari K1*, Venugopal V2 and Saraswathy M3 Challenges and Opportunities in Dietary Assessment of Pregnant Women in Tamil Nadu, 2017, Indian Journal of Nutrition, 2017 ISSN: 2395-2326
5. Kalpana Balakrishnan, Sankar Sambandam, Padmavathi Ramaswamy, Santu Ghosh, Vettriselsvi Venkatesan, Gurusamy Thangavel, Krishnendu Mukhopadhyay, Priscilla Johnson, Solomon Paul, Naveen Puttaswamy, Rupinder S Dhaliwal, D K Shukla, SRU-CAR Team 1 Establishing integrated rural-urban cohorts to assess air pollution-related health effects in pregnant women, children and adults in Southern India: an overview of objectives, design and methods in the Tamil Nadu Air Pollution and Health Effects (TAPHE) study. BMJ Open 2015, ISSN 2044-6055

Invited Presentations at Major Conferences, Workshops and Meetings

- *Plenary Speaker* at Indo-US (ICMR-CDC) meeting on Air Quality and Health, February 24-26, 2016, New Delhi. Talk entitled "Assessing health effects of air pollution in India: A summary of recent progress in research evidence".
- *Invited Speaker* at Tufts University Global Health Symposium organized on the occasion of World Health Day. Talk entitled "Integrating air pollution in chronic disease cohorts: Opportunities within the TAPHE and PURSE-HIS cohorts in Chennai, Tamil Nadu", April 7, Boston, USA
- *Invited Speaker* at Inter-Ministerial Round Table at the International Conference on Climate and Health at World Health Organisation, Geneva, Switzerland. Talk entitled "Interfacing Climate and Air Quality Actions in India, August 2014.
- *Invited Speaker* at Environmental Health Seminar Series at Duke University, USA. Talk entitled "Examining health effects of air pollution in longitudinal cohorts in India: Opportunities for International collaboration", North Carolina, USA, March 2014

Member:

- Member, Scientific Advisory Committee, National Institute of Occupational Health, ICMR, Govt. of India.
- Member, Scientific Advisory Committee, National Institute for Research on Environmental Health, ICMR, Govt. of India.
- Member, Steering Committee on Health Related Issues in Air Pollution, Ministry of Health and Family Welfare, Govt. Of India
- Member, Expert Group on Uniform Air Quality Indices for Indian Cities, Central Pollution Control Board, Govt. Of India



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