



RFIQ 21-3: STUDIES OF AIR POLLUTION AND HEALTH EFFECTS IN INDIA

INTRODUCTION

This Request for Statements of Information and Qualification (RFIQ) 21-3 seeks to identify scientific teams to conduct epidemiologic studies of exposure to air pollution and cardiovascular and respiratory disease or other relevant health outcomes in India.

The Health Effects Institute (HEI) intends to fund up to two studies, conditional on the quality of potential research projects and availability of funds. The objective of this RFIQ is to assess the feasibility of such studies and the qualifications of potential teams as an initial step in the funding process. Interested candidates should inform HEI of potential ideas for research, their qualifications, and the availability of relevant and accessible air pollution and health data using the Statement of Information and Qualification, described below.

The deadline for submission of the Statement is January 14, 2021.

BACKGROUND AND RATIONALE

Air pollution is among the largest contributors to the overall burden of disease in India. In 2019 alone, exposure to air pollution was linked to 1.67 million (95% uncertainty interval 1.42–1.92) deaths, and 53.5 million (46.6–60.9) lost years of healthy life across the country (Pandey et al., 2021). The current Indian epidemiologic evidence is broadly consistent with the larger international literature linking exposure to major causes of disease and death (MoHFW 2015, Gordon et al., 2018). Nonetheless, there is growing recognition of the need to enhance the Indian evidence base on air pollution and health, to better understand the effects of air pollution in the Indian population, to inform policy decisions and to enable further comparisons with the existing worldwide scientific evidence on air pollution and health.

Epidemiologic studies of exposures to air pollution and their effects on health are critical to characterize the health burden for India's population and to motivate air quality progress. New studies on health effects of air pollution in Indian populations are needed to demonstrate how exposure to air pollution influences critical health outcomes, such as cause-specific mortality and children's health; to identify the most important sources, levels, and patterns of health-damaging human exposure; and to examine whether actions taken to reduce exposure lead to public health benefits. Addressing these needs will require support for the design and conduct of key new studies and for the expansion of the capacity to conduct research in India.

The body of evidence on health effects of air pollution in India continues to grow. Several completed and ongoing studies in India funded through national and international agencies (e.g., CARRS¹, TAPHE², DAPHNE³, CHAI⁴, MUDHRA⁵, LASI-DAD⁶, and PURSE-HIS⁷) are studying the effects of exposure to air pollution on human health. In addition, several multicentre, international studies — for example, PURE⁸ (Yusuf et al., 2020) and HAPIN⁹ (Clasen et al., 2020) — are investigating the association between air pollution and health outcomes in Indian populations. At the same time, significant advances have been made to improve assessment of exposure to air pollution (Tonne et al., 2017; Salmon et al., 2018; Dey et al., 2020; Mandal et al., 2020; Nori-Sarma et al., 2020; Sambandam et al., 2020; Sanchez et al., 2020).

Recent studies in India have reported positive associations between ambient PM_{2.5} and carotid intima-media

¹ CARRS = Center for cArdiometabolic Risk Reduction In South Asia

² TAPHE = Tamil Nadu Air Pollution and Health Effects

³ DAPHNE = Delhi Air Pollution: Health aNd Effects

⁴ CHAI = Cardiovascular Health effects of Air pollution in Andhra Pradesh, India

⁵ MUDHRA = The Mysuru studies of Determinants of Health in Rural Adults

⁶ LASI-DAD = Longitudinal Aging Study in India Diagnostic Assessment of Dementia

⁷ PURSE-HIS = Protection of Endovascular Disease and Prevalence of Risk Factors and Holistic Intervention Study

⁸ PURE = Prospective Urban Rural Epidemiology

⁹ HAPIN = Household Air Pollution Investigation Network



thickness, a surrogate marker for atherosclerosis (Ranzani et al., 2020), and blood pressure (Curto et al., 2019; Prabhakaran et al., 2020a). A study in New Delhi, India found a positive association between short-term exposures to PM_{2.5} and an increase in daily nonaccidental mortality (Krishna et al., 2021). However, cohort studies are not yet common in the country for studying the effects of environmental risk factors and have largely focused on adverse birth outcomes (Balakrishnan et al., 2018). To date, no Indian studies of long-term exposure and mortality have been conducted. To estimate effects of long-term exposure on annual average mortality and life-expectancy, studies of cohorts or dynamic populations are needed in which large numbers of individuals exposed to different levels of air pollution are observed for years and their mortality rates are compared. Recently, scientists have begun to utilize surveillance datasets to characterize health effects (Joshi et al., 2021); others have used national survey datasets (e.g., National Family and Health Survey) to study the association between exposure to air pollutants, especially PM_{2.5} and health outcomes (Mehta et al., 2021).

These studies demonstrate a growing capacity to conduct high-quality air pollution epidemiologic research, but they have been largely focused on effects of short- and medium-term exposure (i.e., a few hours to a few months) to air pollution and related health effects. Very few studies in India to date have assessed the effects of long-term exposure (i.e., annual or several years) to air pollution on mortality (e.g., all-cause or cause-specific mortality), at the center of large health burdens and economic costs of air pollution (Prabhakaran et al., 2020b). Furthermore, there is limited geographic coverage to date, and several outcomes with significant health burden in India (e.g., diabetes, lung cancer, neurocognitive outcomes, and tuberculosis) are often not included in analyses. Considering severe air pollution episodes in Northern India in recent years, estimates of the impact of periodic high short-term exposures during winter episodes are also lacking.

TOPICS OF INTEREST

Studies considered responsive to this RFIQ can address one or more of the following aspects of air pollution and health:

- Exposure to air pollution during high-pollution events (i.e., air pollution episodes) and mortality or other health outcomes
- Exposure to air pollution and health outcomes in the first 1,000 days after birth (fetal growth, birth weight, lung growth, child development and stunting, cognitive development, etc.)
- Long-term exposure to air pollution and all-cause and cause-specific mortality (e.g., mortality due to cardiovascular disease, respiratory diseases such as chronic obstructive pulmonary disease [COPD], stroke, cancer, and diabetes)
- Short-term exposure to air pollution and mortality due to cardiovascular disease, COPD, stroke, cancer, diabetes, etc.
- Long-term exposure to air pollution and incidence of cardiovascular disease and respiratory diseases, such as COPD, stroke, cancer, diabetes, etc.

KEY CONSIDERATIONS

Epidemiologic research on the effects of long-term exposure to air pollution can be difficult and expensive to conduct, requiring either the retrospective collection of information on historical levels of exposure to air pollution and other risk factors for disease and mortality, or the prospective collection of exposure and covariate data and observation of study populations for extended periods. A potentially cost-efficient approach to the study of the effects of long-term exposure would be to add air pollution exposure assessments to existing studies of populations for which high quality health and covariate data have been, or are being, collected.

This RFIQ is meant to identify and support applications of existing data and not to support new data collection, establishments of cohorts, etc. Thus, preference will be given to applications that rely on air quality and health data that are readily available (i.e., without the need for data collection) and whose quality can be tested and verified. There are no preferences with respect to specific health outcomes of interest. A strong statistical analytic plan demonstrating the ability of the proposed study to answer the research questions will be required in later stages.

Given budget constraints and practical considerations, HEI does not expect that any applications will meet all the objectives but will aim to fund complementary studies that address the breadth and depth of the objectives. Applicants need to show that the proposed work submitted to the RFIQ can be clearly distinguished from the ongoing work funded by other institutions.

STUDY DURATION AND BUDGET

It is expected that the period of performance of studies, including report writing, will not exceed 2.5 years, with most studies lasting between 1–2 years. For this reason, populations currently under active observation and where air quality and health data are readily available will be strongly preferred. HEI will also consider proposals for cross-sectional assessments or analysis of subsets of data in established cohorts or examination of air pollution episodes that could subsequently be followed for more extended periods.

HEI encourages interested applicants to describe projects of varying lengths and budgets, with total budgets between USD 75,000–200,000 for each funded study.

ABOUT HEI

The Health Effects Institute (HEI) is a research institution with more than 40 years of experience conducting high-quality studies of air pollution and health around the world. We bring together leading scientists, strong oversight, and review of research studies in leveraged capacity building partnerships. HEI is a leader in the conduct and oversight of major studies of both long-term and short-term exposures to air pollution and health in the United States and around the world. Many studies continue to be cited as leading examples of evidence to support the control of air pollution. For more information, visit www.healtheffects.org.

REFERENCES

- Balakrishnan K, Ghosh S, Thangavel G, Sambandam S, Mukhopadhyay K, Puttaswamy N, et al. 2018. Exposures to fine particulate matter (PM_{2.5}) and birthweight in a rural-urban, mother-child cohort in Tamil Nadu, India. *Environ Res* 161:524–531; <https://doi.org/10.1016/j.envres.2017.11.050>.
- Clasen T, Checkley W, Peel JL, Balakrishnan K, McCracken JP, Rosa G, et al. 2020. Design and rationale of the HAPIN study: A multicountry randomized controlled trial to assess the effect of liquefied petroleum gas stove and continuous fuel distribution. *Environ Health Perspect* 128:047008; <https://doi.org/10.1289/EHP6407>.
- Dey S, Purohit B, Balyan P, Dixit K, Bali K, Kumar A, et al. 2020. A satellite-based high-resolution (1-km) ambient PM_{2.5} database for India over two decades (2000–2019): Applications for air quality management. *Remote Sens* 12:3872; <https://doi.org/10.3390/rs12233872>.
- Epstein MB, Bates MN, Arora NK, Balakrishnan K, Jack DW, Smith KR. 2013. Household fuels, low birth weight, and neonatal death in India: The separate impacts of biomass, kerosene, and coal. *Int J Hyg Environ Health* 216:523–532; <https://doi.org/10.1016/j.ijheh.2012.12.006>.
- Gordon T, Balakrishnan K, Dey S, Rajagopalan S, Thornburg J, Thurston G, et al. 2018. Air pollution health research priorities for India: Perspectives of the Indo-U.S. communities of researchers. *Environ Int* 119:100–108; <https://doi.org/10.1016/j.envint.2018.06.013>.
- India State-Level Disease Burden Initiative Air Pollution Collaborators. 2021. Health and economic impact of air pollution in the states of India: The Global Burden of Disease Study 2019. *Lancet Planet Health* 5:e25–38; [https://doi.org/10.1016/S2542-5196\(20\)30298-9](https://doi.org/10.1016/S2542-5196(20)30298-9).
- Joshi P, Ghosh S, Dey S, Dixit K, Choudhary RK, Salve HR, et al. 2021. Impact of acute exposure to ambient PM_{2.5} on non-trauma all-cause mortality in the megacity Delhi. *Atmospheric Environment* 259:118548; <https://doi.org/10.1016/j.atmosenv.2021.118548>.
- Mandal S, Madhipatla KK, Guttikunda S, Kloog I, Prabhakaran D, Schwartz JD. 2020. Ensemble averaging based assessment of spatiotemporal variations in ambient PM_{2.5} concentrations over Delhi, India, during 2010–2016. *Atmospheric Environment* 224:117309; <https://doi.org/10.1016/j.atmosenv.2020.117309>.
- Mehta U, Dey S, Chowdhury S, Ghosh S, Hart JE, Kurpad A. 2021. The association between ambient PM_{2.5} exposure and anemia outcomes among children under five years of age in India. *Environ Epidemiol* 5:e125; <https://doi.org/10.1097/EE9.000000000000125>.
- MoHFW (Ministry of Health and Family Welfare). 2015. Report of the Steering Committee on Air Pollution and Health Related Issues. New Delhi: Ministry of Health and Family Welfare. Available:

- https://main.mohfw.gov.in/sites/default/files/5412023661450432724_0.pdf [accessed 4 November 2021].
- Nori-Sarma A, Thimmulappa RK, Venkataramana GV, Fauzie AK, Dey SK, Venkareddy LK, et al. 2020. Low-cost NO₂ monitoring and predictions of urban exposure using universal kriging and land-use regression modelling in Mysore, India. *Atmospheric Environment* 226:117395; <https://doi.org/10.1016/j.atmosenv.2020.117395>.
- Prabhakaran D, Mandal S, Krishna B, Magsumbol M, Singh K, Tandon N, et al. 2020. Exposure to particulate matter is associated with elevated blood pressure and incident hypertension in urban India. *Hypertension* 76:1289–1298; <https://doi.org/10.1161/HYPERTENSIONAHA.120.15373>.
- Prabhakaran P, Jaganathan S, Walia GW, Wellenius GA, Mandal S, Kumar K, et al. 2020. Building capacity for air pollution epidemiology in India." *Environ Epidemiol* 4:e117; <https://doi.org/10.1097/EE9.000000000000117>.
- Salmon M, Milà C, Bhogadi S, Addanki S, Madhira P, Muddepaka N, et al. 2018. Wearable camera-derived microenvironments in relation to personal exposure to PM_{2.5}. *Environ Int* 117:300–307; <https://doi.org/10.1016/j.envint.2018.05.021>.
- Sambandam S, Mukhopadhyay K, Sendhil S, Ye W, Pillarisetti A, Gurusamy T, et al. 2020. Exposure contrasts associated with a liquefied petroleum gas (LPG) intervention at potential field sites for the Multi-Country Household Air Pollution Intervention Network (HAPIN) Trial in India: Results from Pilot Phase Activities in Rural Tamil Nadu. *BMC Public Health* 201:1799; <https://doi.org/10.1186/s12889-020-09865-1>.
- Sanchez M, Milà C, Sreekanth V, Balakrishnan K, Sambandam S, Nieuwenhuijsen M, et al. 2020. Personal exposure to particulate matter in peri-urban India: Predictors and association with ambient concentration at residence. *J Expo Sci Environ Epidemiol* 30:596–605; <https://doi.org/10.1038/s41370-019-0150-5>.
- Spears D, Dey S, Chowdhury S, Scovronick N, Vyas S, Apte J. 2019. The association of early-life exposure to ambient PM_{2.5} and later-childhood height-for-age in India: An observational study. *Environ Health* 18:62; <https://doi.org/10.1186/s12940-019-0501-7>.
- Tonne C, Salmon M, Sanchez M, Sreekanth V, Bhogadi S, Sambandam S, et al. 2017. Integrated assessment of exposure to PM_{2.5} in South India and its relation with cardiovascular risk: Design of the CHAI Observational Cohort Study. *J Hyg Environ Health* 220:1081–1088; <https://doi.org/10.1016/j.ijheh.2017.05.005>.
- Yusuf S, Joseph P, Rangarajan S, Islam S, Mente A, Hystad P, et al. 2020. Modifiable Risk factors, cardiovascular disease, and mortality in 155,722 individuals from 21 high-income, middle-income, and low-income countries (PURE): A prospective cohort study. *Lancet* 395:795–808; [https://doi.org/10.1016/S0140-6736\(19\)32008-2](https://doi.org/10.1016/S0140-6736(19)32008-2).

APPLICATION PROCESS

Statements of qualification, including descriptions of the available data and study design, must be submitted using guidance provided in this document.

In issuing this RFIQ, HEI is soliciting Statements of Information and Qualification from scientists interested in conducting the research described above or other potentially relevant projects. In the submitted statements, HEI is specifically seeking information relative to availability of, and access to, data needed to conduct proposed studies, including

- availability of, and access to, monitoring or modeled air quality data or exposure estimates for major air pollutants proposed for analysis, including information on spatiotemporal resolution of the data;
- availability of, and access to, health data on relevant measures of mortality or morbidity, including the key confounders; and
- qualifications of the scientist designated as principal investigator (PI) and other members of the designated research group relative to scientific ability and expertise in conducting studies of this nature.

Please note that HEI requires that all statements be led by investigators based in India.

Also, please note that at this point, HEI is not requesting detailed research proposals; responses to this RFIQ should not exceed 10 pages, and the required font size is **11 point with 1-inch margins**.

Each statement should clearly list the name(s) of the PI(s) or Co-PI(s) and include specific fields of expertise among anticipated collaborators and a brief description of how their expertise would contribute to designing and conducting the study, analyzing the data, and interpreting study findings. Applicants are requested to provide a description of the proposed study (or studies) indicating the study design. Detailed budget pages are not required at this time.

The Statement of Qualifications should include, at a minimum:

- A summary statement of the objective of the proposal
- Datasets available for use, including type of data, data collection period, and any associated QA/QC information
- A project title and proposed timeline, the name(s) of the PI(s) or Co- PI(s), an abstract of 300–500 words, and the estimated budget.

It should also address the following questions:

- What additional knowledge / insights do you expect to generate? What is the overall significance of the project in the Indian and/or global context for which funding is being sought?
- Are we (funder) being asked to fund a particular component of a larger project?
- Is the project a pilot study or seed project leading to a larger one? Or is it a one-off project, complete in itself?
- Are the data currently publicly available? If not, will data be made publicly available upon completion of the project?

EVALUATION PROCESS

Statements of qualification will be reviewed by a panel of experts led by members of the Global Health Oversight Committee to determine relevance and suitability and will be ranked based on scientific merit and responsiveness. A limited number of applicants will then be invited to submit full applications. The number and type of studies ultimately recommended for funding will be contingent on merit as well as programmatic review and the availability of funds.

SUBMISSION AND DEADLINE

Please submit your applications for RFIQ 21-3 via email (funding@healtheffects.org; subject line: PI last name RFIQ 21-3 Statement) no later than **January 14, 2021, 11:59 PM IST**. HEI will acknowledge receipt of the application.

Questions regarding the application should be directed to Dr. Palak Balyan (pbalyan@healtheffects.org) and Dr. Pallavi Pant (ppant@healtheffects.org).

HEI's procedures for conflicts of interest are similar to the guidelines set forth by NIH. Members of HEI's sponsor community are excluded from participating in RFA/RFIQ development, applying for support, application review, and funding decisions.

HEI invites external reviewers (or in the case of a major RFA/RFIQ, Review Panel members) who are unlikely to have a conflict of interest with the proposal(s) they are asked to review. A conflict occurs when the reviewer is named on the application in a major professional role; the reviewer (or close family member) would receive a direct financial benefit if the application is funded; the PI or others on the application with a major role are from the reviewer's institution or institutional component (e.g., department); during the past 3 years the reviewer has been a collaborator or has had other professional relationships (e.g., served as a mentor) with any person on the application who has a major role; the application includes a letter of support or reference letter from the reviewer; or the reviewer is identified as having an advisory role for the project under review. In addition, HEI Staff screen external reviewers for potential conflicts of interest with other applicants who have submitted a proposal under the same RFA/RFIQ.

For Review Panel members and Research Committee or Global Health Oversight Committee members, in some situations it may not be possible to avoid all possible conflicts of interest as outlined above. In such cases, Review Panel and Research Committee members who have a conflict of interest will not be assigned to review the application(s) in question and will be asked to leave the room during the discussion of those application(s). They will also not score or vote on the application(s) at issue and refrain from commenting on them during the overall discussion, and in the case of the Research Committee, from all deliberations regarding recommendation of applications for funding. If several Research or Global Health Oversight Committee members are recused from the overall discussion of applications for such reasons, HEI will invite external consultants to join the Committee to fill in the missing expertise.

This peer review system relies on the professionalism of each reviewer, Review Panel member, and Research and Global Health Oversight Committee member to declare to HEI the existence of any real or apparent conflict of interest. If a reviewer feels unable to provide objective advice for any other reason, they are expected to recuse themselves from the review of the application(s) at issue.

This document was posted at www.healtheffects.org on November 18, 2021.

Health Effects Institute
75 Federal Street, Suite 1400
Boston, MA 02110, USA
Phone: +1 (617) 488 2300
www.healtheffects.org