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NEW STUDY EXAMINES HEALTH EFFECTS OF OUTDOOR AIR POLLUTION IN THE DEVELOPING COUNTRIES OF ASIA

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(Delhi, May 19, 2004) The Public Health and Air Pollution in Asia program (PAPA) of the Health Effects Institute (HEI) today released its initial *Review of the Health Effects of Air Pollution in the Developing Countries of Asia*, a special report prepared by PAPA's International Scientific Oversight Committee. The Review was undertaken in partnership with the Clean Air Initiative for Asian Cities and is intended to help inform regional policy makers about the state of the science concerning air pollution and health in major Asian cities.

The Review, the first systematic identification of all peer reviewed Asian studies on the effects of air pollution on health found that a considerable body of science currently exists across Asia, exceeding scientists' expectations. Over 135 studies assessing the extent of illness and mortality have been completed to date in China, India, Indonesia, Japan, Malaysia, Thailand, Singapore and South Korea. Although they use a variety of study designs, and have not been equally distributed across the region, they provide an important resource for regional policy decisions.

HEI's team of international experts also undertook the first ever meta-analysis of a key subset of the Asian literature, 28 time series studies of air pollution and health. This in-depth analysis found that short-term exposure to air pollution is associated with increases in mortality and morbidity in Asian populations. The investigators found a 0.5% increase in mortality associated with a 10 $\mu\text{g}/\text{m}^3$ increase in PM10, a key measure of pollution, and a 1% increase in hospital respiratory admissions associated with increased levels of NO₂. Given the high levels of air pollution in many Asian cities ($>100\mu\text{g}/\text{m}^3$), the public health impact could be substantial. While the small number of cities available limited the comparisons that can be made at this stage of analysis, the estimated effects are similar to those found in the extensive studies conducted in western countries. A key challenge for the analysis is that the majority of the studies are concentrated in the more developed regions of East Asia. Areas of South and Southeast Asia, many with high levels of air pollution and high poverty are less well studied, limiting the understanding of whether air pollution may have increased effects on the poor. The PAPA program has new research currently underway to help increase the knowledge base in this and other key areas.

PAPA's International Scientific Oversight Committee (ISOC) consists of distinguished international experts in the field of air pollution and health from Asia, Europe and North America, including members of HEI's Research and Review Committees. It is chaired by Dr. Frank Speizer of the Harvard School of Public Health. HEI is an independent research institute with core funding from the USEPA and the worldwide automobile industry marketing in the US that is designed to provide policy makers with highly credible research that is relevant to questions of health and environmental regulation. Its work on the PAPA

Program was initiated to support the Clean Air Initiative for Asian Cities, a partnership of the Asian Development and World Bank to inform measures taken to improve air quality. PAPA is supported with funds from the William and Flora Hewlett Foundation, US AID, industry, and others.

Background

In its recent Global Burden of Disease Report the World Health Organization estimated that urban air pollution contributes to approximately 800,000 deaths worldwide, two thirds of which occur in the developing countries of Asia. This estimate is based largely on the results of research conducted in Europe and North America that has been extrapolated to other countries. While many similarities exist in the constituents of air pollution between Asia and other regions, differences also exist in Asia relative to the nature of air pollution and magnitude of exposure. Population characteristics also vary, with levels of underlying disease, access to health care and other differences creating uncertainties when results from the extensive scientific literature in the developed world are extrapolated to effects on Asian populations.

HEI initiated the PAPA program to help reduce these uncertainties by providing Asian decision makers with estimates of the health effects of air pollution in representative Asian Cities during the next four years. *The Health Effects of Outdoor Air Pollution in the Developing Countries of Asia: A Literature Review* was prepared as a summary and critical review of the epidemiologic evidence on air pollution and health in Asia. It has two objectives: to identify and summarize the epidemiologic studies of outdoor air pollution that have been conducted to date in Asia and to examine in detail a key subset, time series studies that estimate the effect of short term exposure to air pollution on daily mortality and hospital admissions. This review fulfills these goals by providing an initial quantitative summary of short-term effects and identifying gaps in knowledge that should be addressed in future research by HEI and others.

Approach

The Literature review identified and described 138 original epidemiologic studies published in the peer-reviewed literature from 1980-2003. Relevant studies were identified by searches of the scientific literature and were augmented by a review of the leading epidemiologic and preventative medicine journals in the Chinese language literature. The review considered studies from all countries in East, South and Southeast Asia.

Of these studies, the review identified 45 “time series” studies of daily changes in air pollution and mortality or hospital admissions of which 28 were selected for further analysis based on their ability to meet pre-specified quality criteria. These included meeting a minimum data collection period of one year, use of statistical approaches to control for non-air pollution factors that could potentially affect the study outcome and reporting in a manner that allows coherent comparison of approaches and results across cities.

Results and Implications

A sizable body of studies already exists in Asia, and the number of those studies has been growing in recent years, but in part to its fragmented nature this literature has not been systematically used as a resource for policy makers. Most of the 138 studies brought together for the first time in the review describe increased risk or prevalence of a variety of adverse health outcomes in adults and children exposed to outdoor air pollution, often at levels considerably higher than those found in western studies. They assessed a range of pollutants including measures of particulates (TSP, PM10), Sulfur Dioxide, Nitrogen Dioxide, Carbon Monoxide and Ozone. Given the diversity of the study designs and the limited scope for this first stage of the PAPA Program the Review did not, with the exception of the time series studies, assess the quality of each study. Limitations in individual studies exist, and the

Review was not able to broadly investigate the possibility of publication bias – or the tendency of only positive studies to be published in the literature. Nonetheless, several important observations about the Asian literature can be made. The sheer number of studies is impressive, and growing. At the same time, large areas of Asia, including South East Asia, India and some parts of China, often with high levels of pollution and high population density, are understudied. In addition the effect of air pollution on those living in extreme poverty is not well understood despite some studies in western populations indicating greater effects on those of lower socio-economic status.

The detailed analysis of the time series studies of acute effects of air pollution provides new evidence about similarities in between effects observed in Asian populations and those observed in major studies such as the National Morbidity Mortality and Air Pollution Study (NMMAPS) and its European counterpart Air Pollution and Health a European Approach (APHEA). These results are an important first step in understanding affects on local Asian populations in relation to those observed in other parts of the world. However, important limitations exist: the number of Asian studies available for inclusion in the meta-analysis for any particular pollutant is limited due to the relatively small number of individual cities. In addition, analytic methods differed among the studies, limiting the scope of the combined analysis and limiting the ability to fully assess the possible impact of publication bias and other potential biasing factors.

Looking ahead, the PAPA Program is actively working to reduce these and other uncertainties in the new research phase of its work. New studies have recently been initiated in Bangkok; Hong Kong; and Shanghai and Wuhan in China. In addition, studies in India, and Southeast Asia will be initiated in 2005 to increase the geographic representation across Asia. Finally, new studies to assess the impact of poverty on susceptibility to air pollution health effects are being planned. Throughout the program, sustained capacity building efforts will seek to enhance the skill levels and experience of scientists throughout Asia.