

Pearl of Africa Lecture

Stephan Schwander MD, PhD, August 17, 2016:

Title:

Exploring relationships between Air Pollution, Nanoparticles and Tuberculosis

Abstract:

The World Health Organization (WHO) reported that around 7 million people died worldwide in 2012 — one in eight of total global deaths — as a result of air pollution exposure (*WHO, 2014*). In 2009, WHO ranked indoor air pollution and urban outdoor air pollution 10th and 14th, respectively, among 19 leading risk factors for global mortality. In the developing world, air pollution presents a particular threat to the health of millions of people in megacities that are growing in a fast, poorly planned, and unregulated manner. Very little data exist on air pollution levels in Uganda/East Africa, a highly polluted area.

In addition to diseases such as Asthma, chronic obstructive lung disease, and cancer that have a known connection with air pollution, Uganda and other East African countries continue to be burdened by high rates of tuberculosis and Human Immunodeficiency Virus Type 1 (HIV-1) /AIDS that in the context of air pollution may be aggravated.

Epidemiological and toxicological studies have shown that smoking and indoor air pollution exposure increases both the likelihood of tuberculosis (disease) and of infection with *Mycobacterium tuberculosis*, the bacterium that causes tuberculosis. Although the human lungs are the primary portal of entry for both fine urban air pollution particulate matter (PM_{2.5}) and respiratory pathogens such as *Mycobacterium tuberculosis*, studies exploring the role of urban air pollution exposure in the development of tuberculosis have been exceedingly rare to date.

Studies on air pollution health effects need to be linked to carefully designed air pollution exposure studies that require knowledge of air pollution sources and reliable air pollution exposure assessment. We have begun to assess PM_{2.5} effects on pathogen-specific immune responses (innate and adaptive), particularly in the human lungs, in Mexico City and New Jersey. These studies begin to show that PM_{2.5} from urban ambient air, as well as diesel exhaust particles, alter the function of human immune cells that are important in the body's defense system against *Mycobacterium tuberculosis*.

Given the wide geographical scales of both air pollution and *Mycobacterium tuberculosis* infections, new knowledge generated by our research work has far reaching global health implications.

Biosketch:

Stephan Schwander MD PhD is Director of the Center for Global Public Health and Associate Professor in the Department of Environmental and Occupational Health at the School of Public Health at Rutgers University in New Jersey. He is also member of the Environmental and Occupational Health Sciences Institute, the Institute for Infectious and Inflammatory Diseases (i3D) and of the Physiology and Integrative Biology Graduate Program at Rutgers.

Following elective clinical periods in Lima and Pucallpa / Peru Dr. Schwander received his MD from the Johann Wolfgang Goethe University in Frankfurt/Main and his PhD from the University of Hamburg Eppendorf, both in Germany. He did residencies in Pediatrics at two clinics in Hamburg and in Internal and Tropical Medicine at the Bernhard Nocht Institute for Tropical Medicine in Hamburg/Germany.

In 1992/1993 he led a randomized blinded HIV-1/AIDS/tuberculosis treatment study in Kampala, Uganda at the Joint Clinical Research Center (JCRC). Following a 6-year postdoctoral and instructor period focusing on human lung immunity during tuberculosis in the Division of Pulmonary and Critical

Care Medicine at Case Western Reserve University in Cleveland, Ohio he became Assistant Professor at UMDNJ New Jersey Medical School (2001) and its Center for Emerging Pathogens. In 2008 he became Associate Professor, Chair of the Department of Environmental and Occupational Health, and Director of the Center for Global Public Health at Rutgers School of Public Health, where he developed a Master's program in Global Public Health.

With a research focus on tuberculosis and lung immunity, in 2008, Dr. Schwander's lab at Rutgers School of Public Health began to study the impact of air pollution particles, diesel exhaust particles, and nanoparticles on human health and immune responses to *Mycobacterium tuberculosis* with NIH and EPA funding. Dr. Schwander currently leads a multi-institutional research project on the effects of real-world air pollution exposure on human host immunity against *Mycobacterium tuberculosis* in Mexico City and New Jersey. His scientific collaborations are with the National Institutes of Respiratory Diseases in Mexico City, Duke University, and the University of Alberta Edmonton, Canada.