6-29-2016

Environmental Health as an Emerging Community

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June, 2016

Environment and human health

Environment and human health are intertwined. Adverse environment conditions are accountable for a large fraction of global death and disability. It is estimated that 23 percent of 12.6 million global deaths were caused by modifiable environment risks associated with air, ultraviolet, noise, occupational risks, built environment, man-made climate change, etc. Twenty-two percent of the disease burden[1] can be avoided if those risks were removed (Prüss-Ustün, Wolf, Corvalán, Bos, & Neira, 2016).

Recent global climate change has brought grave threats on human health. The Intergovernmental Panel on Climate Change (IPCC) predict with very high degrees of confidence that climate change will exacerbate human diseases that already exist until mid-21 century (Pachauri et al., 2014). The negative effects- illness, injury, and disease - are mediated through complex mechanism that may be direct (heatwaves, extreme weather events, and air quality), indirect (changes in food yields, aeroallergens productions, bacterial growth, vectors activity, and water quality affected by disrupted ecological and biophysical systems),or delayed (Elliott, 2011; McMichael, Montgomery, & Costello, 2012). Examples of direct risks include the increase in cardiovascular or chronic respiratory disease associated with the extreme summer heat in Europe, Asia, and North America (Hajat et al., 2006). An example of indirect impacts would be the rice yields decrease from rising nighttime temperature linked to global warming (Peng et al., 2004).

Environmental health as an emerging community

Under such context, a group of scientists who work on the intersection of environmental science and health science has emerged and formed a loosely coupled community known as "environmental health". According to WHO, "Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social and psychosocial factors in the environment. It also refers to the theory and practice of assessing correcting, controlling and preventing those factors in the environment that can potentially affect adversely the health of present and future generations" (World Health Organization, 1993).

The topics of Environmental health research varies in scales ranging from environmental-attributable altering on genetics of pathogens to global scale disease patterns under climate change. And the nature of environmental health issues are so complicated that demands solutions that no single domain can address(Costello et al., 2009) . Therefore, a group of scientists from various domains such as ecology, biology, chemistry, public health, social science and earth science, etc. are coming together to work towards a common goal of investigate and disseminate knowledge about environment influences on human health in order to promote well-being and prevent diseases and injury. We define such group of

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[1] Disease burden in DALYs- a combined measure of years of life lost due to mortality and years of life lost due to disability. See: http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/

scientists as environmental health research community ("Definitions of Environmental Health | National Environmental Health Association: NEHA," 2016).

Collaboration within environmental health community exists in several modes. Universities with research groups in environmental sciences serve as incubators of new ideas and new generations of researchers. Some prestigious universities such as Columbia University, John Hopkins University, and University of Washington even have an individual department in this area. Organizations such as The National Institute of Environmental Health Sciences (NIEHS) under the National Institutes of Health (NIH), National Environmental Health Association (NEHA), and Centers for Disease Control and Prevention (CDC) have been leading the efforts of engaging community and supporting research. Leading journals such as Lancet also contributed in bridging disciplines and reaching out to stakeholders outside academia to mitigate the health effects of climate change (Costello et al., 2009).

Environmental data brings new insights into human health research

Environmental community is not only characterized by multi-disciplinary collaboration, but also by integrated and data-driven investigation approach. The increasing availability of environmental data - satellite observational data, in-situ measurements, model outputs, reanalysis data, biotic surveys, and social science data - has generated numerous new scientific discover in human health research by stimulating spatial thinking and providing resources to uncover biological and ecological interaction between human and environment.

Satellite remote sensing data provides long-term, large-scale, and spatial-temporally continuous observations of earth surface that allows for monitoring and prediction of disease geographical patterns. In an earlier study of Vibrio cholerare detection, (Lobitz et al., 2000) used satellite remote sensing data to monitor the outbreaks and transmission of cholera. It was found that both remote sensed sea surface temperature and sea surface height to be correlated to cholera outbreaks, which further suggested that cholera disease are climate-linked. Coupled with direct field measurements, Lobits et al leveraged the spatial-temporal continuous remote sensed data to uncover the geographical distribution of cholera by ocean current. This case demonstrated how multiple sources of environmental data can be integrated with epidemiological data to inform human health research, and how environmental science such as oceanography, ecology, microbiology, marine biology, and remote sensing can be brought together with epidemiology and medicine to produce new insights in global pandemics of diseases (Colwell, 1996).

Geospatial data such as meteorological variables derived from climate model can help reveal airborne or vector borne disease transmission pattern. By utilizing reanalysis meteorological data, (Shaman & Kohn, 2009) found that absolute humidity (AH) provide a single, coherent, more physically sound explanation for the observed variability of IVS (influenza virus survival), IVT (nfluenza virus transmission) and influenza seasonality in temperate regions. Based on this fingding, real-time Predicting seasonal influenza outbreak from 2003 to 2009 in New York was enabled using web-based estimates (Google flu trend) and US Centers for Disease Control and Prevention (CDC) records. More recently, (Bogoch et al., 2016) estimated the numbers of people living in geographies at risk for autochthonous Zika virus[2] transmission after the confirmed incidences of locally acquired in Brazil in

[2] Zika virus spreads to people primarily through the bite of an infected Aedes species mosquito (Ae. aegypti and Ae. albopictus). See: http://www.cdc.gov/zika/about/index.html

May, 2015. A global spread model was built by integrating integrates global ecological niche data for Aedes aegypti and albopictus and worldwide temperature profiles. Global flight itinerary data was also used to estimated risk magnitude and geographic areas that are conductive to zika transmission.

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