Background Description and Learning Experience

In December of 2010, the Indiana State Department of Health's Director of Environmental Public Health was accepted into ASTHO's 2011 *Environmental Public Health Tracking: State-to-State Fellowship Program.* The State of Wisconsin was chosen by the review committee to be Indiana's host state with a visit in March, 2011. Attendance at the National EPHTN Workshop in Brooklyn, NY in April, 2011 was also a valuable part of the fellowship.

Indiana's pilot project is related to the health effects of climate change. Since climate modeling indicates that the coming decades could bring a warmer planet earth causing extreme heat waves, it was chosen to develop a heat/health vulnerability map to identify those areas with people most susceptible to the health problems associated with this weather condition.

Host State Site Visit – March 7 – 9, 2011

Learning Experience:

A visit to the Wisconsin Department of Health Services (WI) was conducted on March 7 – 9, 2011. These particular dates were chosen because it coincided with a meeting of WI's EPHTN Technical Advisory Group (TAG), which was a very good addition to the overall benefits of the fellowship. The WI visit was highlighted with the following experiences:

Introductions and Bureau Overview – A synopsis of the Bureau of Environmental and Occupational Health programs and how tracking fits into the "big picture" of their operations.

WI EPHTN Program History – Understanding the efforts needed to convince the appropriate state officials of the benefits of developing an EPHTN.

Secure and Public Portal Demonstrations – This session focused on the current status of WI's EPHTN data portals. The program has produced a network for users to access and analyze data on asthma, heart attacks, cancer, air quality, drinking water quality, childhood lead poisoning, and reproductive outcomes.

Program Outreach, Marketing, and Training – Outreach, marketing, and training are not only important long-term matters, but also integral in the development phase of the network. The WI EPHTN shared their outreach plans for marketing and training, which has had four phases since its inception.

Program Evaluation – The information for this part of the site visit was provided by WI Program Evaluation Specialist Meredith Mueller. She explained the process the program went through to conduct usability testing, which is an important element of this process to evaluate usefulness, utility, and functionality. Assessing usability involves getting feedback from a select group of the target audience to garner any issues present and solicit suggestions for improvements to the network.

Data sharing and partnering with data stewards – One of the most difficult components of establishing the network. Since the concept of the EPHTN is to have a comprehensive system taking surveillance, exposure, and disease data and exploring relationships with environmental data, the data comes from various sources. Relationships have to be developed with the many data stewards, which are the data owners, to generate participation.

Technical Advisory Group (TAG) – As previously stated, the fellowship site visit was coordinated with WI to coincide with their semi-annual TAG meeting. As the committee's name implies, the TAG is to serve as the program's professional consulting, advice-giving, and counseling team to provide recommendations. The TAG includes advocacy group representatives, health and environmental data stewards, local health department staff, academic participants, and a communication specialist.

This was a particularly good TAG meeting to attend as they were conducting an evaluation of their experiences with the group and how it is structured. This was accomplished using a "focus group" approach with a moderator helping move the discussion.
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All-in-all, I cannot say enough about how valuable this site visit was. As outlined above, the variety of exposures to the different aspects of WI's program will be an exceptional experience for Indiana when the resources become available to create an EPHTN. The professionals working for WI are "top-notch" and their dedication and knowledge are proof of the quality of the program. When Indiana does develop a network, we will want the exact same caliber of staff to make it reality.

National Environmental Public Health Tracking Conference – April 2011

As an integral part the fellowship, the Environmental Public Health Tracking 2011 Workshop held in Brooklyn, New York City, NY on April 25 – 28 was attended. This annual meeting of the CDC's tracking state grantees was definitely a valuable component of the fellowship. Since the meeting was held near the Brooklyn Bridge, the workshop theme was appropriately titled, Bridging the Gap, which is where the tracking program is in some states that are trying to put all their pieces together to get networks up and running.

The meeting brings together state and academic staff to discuss and exchange successes and lessons learned; to learn about the latest technology and research in the field; and to coordinate network plans amongst the various sub- workgroups, which included break-out meetings for these sub-workgroups that cover content; standards and network development; geographic location mapping; and program marketing and outreach.

The workshop also included plenary sessions. One of these plenary session was presentations from the five academic partners that have had tracking projects recently funded to be included as part of the EPHTN. These academic partners will work to advance the science needed by improving the understanding of environmental risk factors related to human health. One of these university partners is the University of Illinois – Chicago, which is collaborating with Indiana, and other Midwestern states, for their tracking project concerning birth defects and its relationship to agriculturally caused water contamination from atrizine and nitrates.

Other interesting plenary sessions touched on: 1) the latest Geographic Information System software becoming available in the marketplace that will benefit tracking program's efforts to geo-code and map tracking activities. This is one area of the EPHTN world that continues to improve the available tools for environmental health practitioners; and 2) the evolving importance of Health Impact Assessments (HIA) was discussed by tracking academic partner Emory University. Emory's project involves the health impacts of ambient air pollution on the rates of emergency room department visits and hospitalizations for asthma and heart attacks. HIAs are becoming an important evaluation of the effect that human activities, such as urban development and industrial and agribusiness projects, has on human health. The EPHTN is becoming the tool of choice for HIAs since they fit right into the tracking mission "To provide information from a nationwide network of integrated health and environmental data that drives actions to improve the health of communities."

Another educational piece of the workshop was the portal demonstrations from various tracking states. This was exceptional helpful in that it not only demonstrated the particular states' tracking websites and associated features, but also the presenter discussed some of the successes and hurdles that took place to get the site up.

Attending this national workshop, and having attended the National EPHTN conference in 2009, has been a remarkable exposure to what goes into developing a network portal. Being amongst all the staffers that make these state portals into a national system, learning about what it has taken to get data and other resources, and seeing how the funded states work together to make all this happens really proves that the national EPHTN is more than just an electronic system bringing health information and records together with related environmental data, it also is a human resource network of professionals from federal and state governmental agencies, along with university academics, that are all engaged in it, that care about the network, and work very hard to make it a reality.

Pilot Project

Introduction

Extreme heat is the number one weather-related cause of mortality in the United States. These events are typically punctuated by brief 3 to 7 day periods of extreme temperature and humidity. Most climate projection models indicate a strong likelihood that extreme heat events are likely to increase in duration and intensity in the coming decades; with the Midwestern U.S. being especially susceptible. The thermal stress applied to individuals during these periods can quickly overcome the human body's ability to thermoregulate and lead to heat syncope and/or heat stroke. Further, the level of vulnerability to these events is highly disparate among different populations and their physical environment. Typically, older individuals living in highly urbanized areas are the most at-risk. However, undereducated, minority populations in varying levels of poverty within urbanized spaces are similarly vulnerable to the effects of extreme heat events. Further influencing the level of risk within these

urbanized areas is the effect that development has on the thermal environment of a city. This phenomenon is known as the urban heat island (UHI) and can cause temperature differences on the magnitude of 20 degrees Fahrenheit between the city and the contiguous rural area. Therefore, determining the areas where the UHI effect is coincident with vulnerable population groups leads to the development of models effectively illustrating the most vulnerable locations.

This project is in collaboration with the Indiana University Center for Urban Health and the Indiana University Center for Health Geographics (IU) under the direction of Daniel Johnson, Ph.D., Assistant Professor, with research assistance from his graduate assistants.

Methods and Strategy

The UHI effect is readily observable using satellite-based technologies. Using the current Moderate Resolution Imaging Spectroradiometer (MODIS) sensor available from the NASA Earth Observation System (EOS) it is possible to image the entire thermal surface of the United States daily. This is done at a sufficient enough spatial resolution to determine intra-county level variability in surface temperature. This project activity also utilized socioeconomic data from the U.S. Census Bureau at the census tract level. This census data along with a summer monthly composite of MODIS imagery for the state of Indiana was used in order to determine the overall level of vulnerability to extreme heat within the state.

This then provided indications to the numbers and locations of the most vulnerable areas within Indiana.

Data

Census Tract Level Data (2000): Caucasian, African American, Asian, Hispanic, age 5 and under, age 65 and older, median household income, total population below poverty, age 65 and older below poverty, age 5 and under below poverty, persons with less than a high school education, and age 65 and older living alone and those living in a nursing home.

MODIS Terra / MOD11A2: This product is an eight-day composite period. The dates of the image files represent a Land Surface Temperature (LST) of an eight- day average from the MODIS sensor.

Modeling

MODIS thermal imagery was downloaded from Glovis (USGS Global Visualization Viewer). The initial value recorded by thermal infrared sensors is a top of atmosphere radiance (TOA). The digital number recorded for each pixel value in the delivered product reflects the coefficients of the calibration which has to be converted by the end user to obtain a LST value. To do this IU used the raster calculator in ERDAS Imagine 9.2 to multiply each pixel value by a scaling factor of 0.02 which converts the pixel value to Kelvin.

For this study, IU calculated mean temperature at the Census Tract Level. This was accomplished using the Spatial Analysts tools in the geographic information system (GIS) software ArcInfo 10. IU then used Census Tract level data as the enumeration unit to calculate mean values. 2000 Census data were joined with 2000 Census Tract shapefiles and converted to a GIS point by having each point represents the center of their census tracts. After further post processing and analysis by IU, the resulting dataset was separated by standard deviation into levels of extreme heat vulnerability risks for each census tract.

Results

The resulting state-wide map visualizes the high-heat event vulnerability results across the state (Reference Section, Map 1). The map depicts not necessarily areas with vulnerability for high heat as in UHIs, but actually areas with residents that have heat-related health risk vulnerability.

Furthermore, the results are a statistical calculation of heat and socioeconomic variables, which prior research has demonstrated as being related to vulnerability during extreme heat events. Some of the variables include: age, education level and economics. It should be noted that at this time IU cannot definitively state how much more vulnerable an area might be (e.g., it cannot be said that red is two times as vulnerable as a blue). The equations used in the analysis are not that specific and the diverse environments and communities across the state would not support such a specific answer. The equations, however, do accurately demonstrate areas which are statistically more vulnerable or less vulnerable.

Also interesting, though unfortunate, is that Indiana experienced two “official” heat-related deaths this past summer. These deaths occurred on the edge of a Medium-High heat-health risk zone, and very close to a High risk zone within Indianapolis (Map 2), thus, in a sense, validating the concept of this

model.

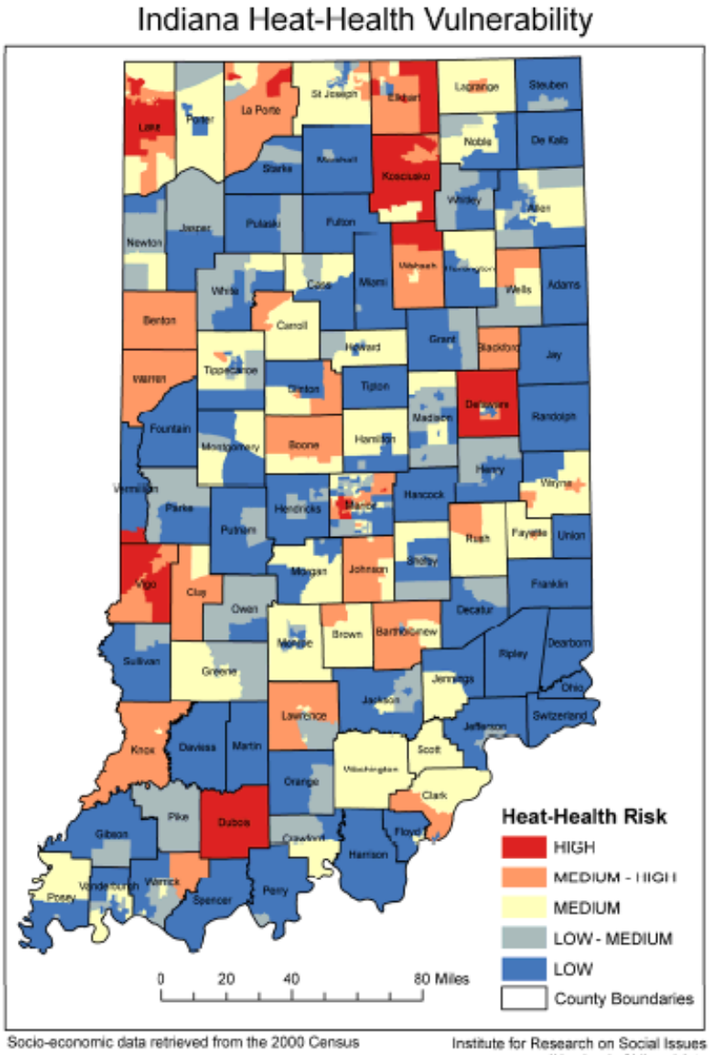
Conclusion and Next Steps

This heat vulnerability model, and the resulting maps, is a tool that can be used for more effective communication of heat as a cause of health concern and lead to effective delivery of relief efforts in the event of a major extreme heat episode in Indiana.

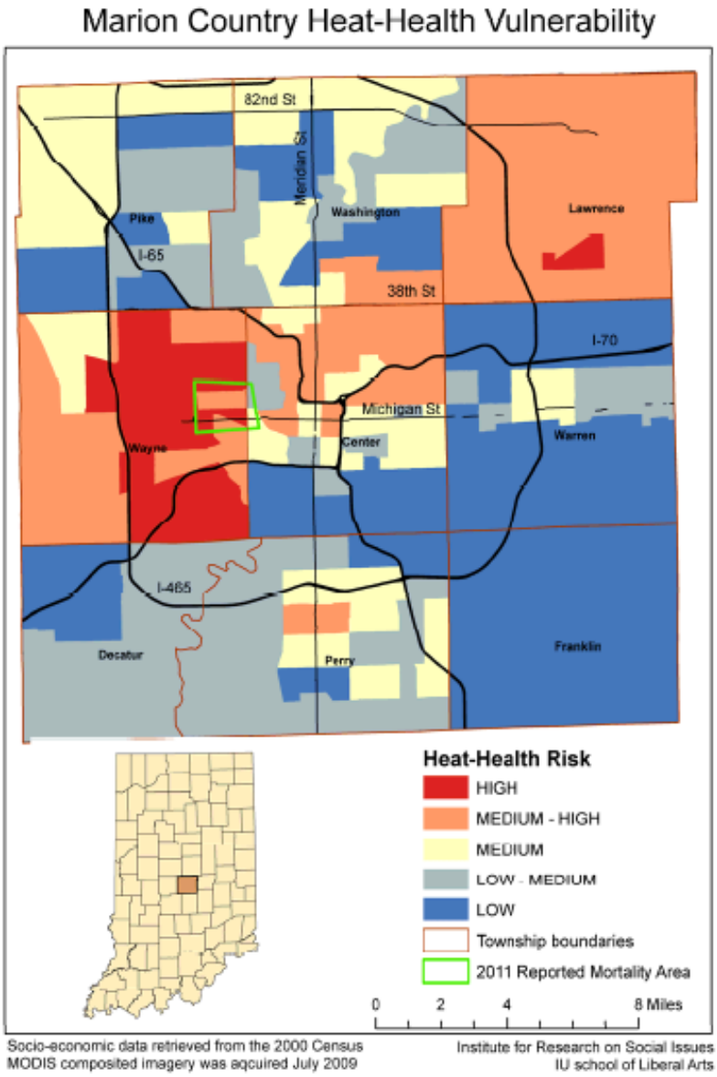
Also, the outputs from this project can be utilized to enhance public perception of the risk from extremes in temperature and to drive communication efforts. As has been shown in many recent natural disasters the knowledge of vulnerability prior to an event is of central importance in the protection of life and property.

Until a funding opportunity becomes available for unfunded states, Indiana plans to continue dialogue amongst stakeholders that would be involved in a TAG or be data stewards. The main purpose behind this is to keep potential EPHTN partners engaged in the network concept as they interact with their counterparts across the country that already are funded by the CDC.

Also, we currently are taking the next with the project. We are in the process of creating a webpage that will make variations of the maps included in this report, details regarding extreme heat, and other health effects of climate change information available to the public. At this time, the skeletal website should be up by early fall, 2011 as we are still ironing out some issues with the web server. Another goal for outreach is establishing a mechanism for interested parties to register for Twitter or text alerts. Regarding the dataset that the vulnerability model is based on, IU is also working with their informatics group on mining additional clinical data from the state-wide epidemiological surveillance system, which will further define and validate the results.



Map 1: State-wide Heat-Health Vulnerability Map



Map 2: Heat-Health Vulnerability Map for Indianapolis, Marion County, Indiana