National Institutes of Health (NIH) Grant Funds Study of Visualization in Health Education on Highway Pollution

Carolyn Wong, a researcher at the Institute for Asian American Studies (http://www.umb.edu/iaas), has received a $450,000 grant from the NIH's National Library of Medicine to lead a study of the role of computer visualization in promoting health literacy on the toxic effects of highway pollution in Boston Chinatown. The exploratory and developmental (R21) research grant will fund a two-year multi-university study. Researchers will develop map-based computer visualizations of particulate pollution dispersed across Chinatown. They will create animated depictions of actions people can take to reduce health risk associated with traffic pollution. The research team will develop and test an intergenerational co-learning process. Teenagers already familiar with computer technology will learn to use the visualization tool and in turn teach adult immigrants.

A multi-disciplinary team of principal investigators from three universities will direct the study. Wong, who holds a doctorate in political science, will coordinate the team. Wong brings her expertise on intergenerational communication, immigrant civic engagement, social policy, and participatory citizenship to bear on the research. Wong is joined on the team of PIs by members of the University of Massachusetts Lowell and Tufts University faculties. Georges Grinstein, professor of computer science at UMass Lowell and a founder of the open-source software Weave (http://oicweave.org/) will direct development of the visualization tool. Doug Brugge, professor of public health and community medicine at Tufts University, will guide the environmental health science components of the study. Brugge is a leader of the Community Assessment of Freeway Exposure and Health (CAFEH, http://sites.tufts.edu/cafeh/) a community participatory study which has created a large and unique store of scientific data on ultra-fine particulate pollution in the Chinatown, Somerville, and Dorchester neighborhoods of the Boston metro area. These visualizations will be derived from CAFEH's data. In addition, Susan Koch-Weser, assistant professor of public health and community medicine at Tufts, will contribute her expertise in health communication as a co-investigator. William Mass, associate professor of work environment at the University of Massachusetts Lowell, will direct student involvement at the University of Massachusetts Lowell in training teenagers to use the Weave software.

It is known that particulate matter in ambient air is a leading cause of mortality and morbidity worldwide. One type of pollution consists of ultra-fine particulate matter. Studies show that as levels of ultra-fine particulate matter rise and fall at central monitors in a city, bio markers of cardiovascular disease also rise and fall. The work of CAFEH has also shown that proximity to the highway is associated with risk of cardiovascular disease.

Unlike other types of pollution composed of larger particles, such as fumes and dust emitted from coal burning plants, the ultra-fine particles are so small that they are invisible to the naked eye. Wong explains the study's approach: "We want to make the invisible particles visible to

ordinary people in Chinatown." Menus on the computer visualizations will be bilingual in Chinese and English. Users of the visualization tool will be able to point on a computer screen to locations in Chinatown and an indicator will show levels of ultrafine particulate pollution for that location using styled depictions of greater or lesser density of pollution. Interactive animations will also show lowered pollution exposure when people close windows in homes, walk at times and locations with lowered exposure, or install filtration or air condition devices in homes. In addition, animated visualization will inform users about environmental health hazards and steps they can take to protect themselves.

Boston Chinatown has been selected as the study site because its residents face known obstacles to health literacy. In the core two census tracts of Chinatown, where most neighborhood residents of Asian descent reside, over a third of the population lives below the poverty line, one of the highest rates in the city according to estimates of the 2006–2010 American Community Survey. Nearly half of adults have less than a high school diploma. In addition, Chinatown residents are disadvantaged in gaining access to and comprehending health information by limited English proficiency.

The university researchers have formed a community partnership with the Boston Chinatown Neighborhood Center (BCNC, http://www.bcnc.net). In the first phase of developing the visualization software tool the academic researchers will seek advice from community-based experts on how to tailor visualizations and animations to cultural and linguistic characteristics of Chinatown. In the testing phase, researchers will train teenage participants in a youth leadership program of BCNC to use the tool. In turn, the youth will create educational presentations and information dissemination strategies aimed at informing adult learners in a BCNC English class. The research team will evaluate whether these methods facilitate comprehension of scientific information about highway pollution. In addition, they will test whether study participants gain confidence and a sense of self-efficacy in communicating what they learn.

One longer range goal of the study has been aptly described by founders of the Weave software platform who want to employ visualization technology to "democratize data" in society at large. A growing number of health data repositories are now available to the public but not everyone can access or use the information. Inequities are related to the "digital divide", which removes some segments of the populace from the benefits of the information revolution because of disadvantages of poverty, educational attainment, as well as social and cultural isolation. By making highway pollution visible and relevant health information comprehensible to members of an immigrant community, this study proposes one way to cross a significant information divide.