PRESIDENTIAL INVITED SPEAKER

Francesca Dominici, Ph.D

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A Particulate Solution: Data Science in the Fight to Stop Air Pollution and Climate Change

What if I told you I had evidence of a serious threat to American national security – a terrorist attack in which a jumbo jet will be hijacked and crashed every 12 days. Thousands will continue to die unless we act now. This is the question before us today – but the threat doesn't come from terrorists. The threat comes from climate change and air pollution.

We have developed an artificial neural network model that uses on-the-ground air-monitoring data and satellite-based measurements to estimate daily pollution levels across the continental U.S., breaking the country up into 1-square-kilometer zones. We have paired that information with health data contained in Medicare claims records from the last 12 years, and for 97% of the population ages 65 or older. We have developed statistical methods and computational efficient algorithms for the analysis over 460 million health records.

Our research shows that short and long term exposure to air pollution is killing thousands of senior citizens each year. This data science platform is telling us that federal limits on the nation's most widespread air pollutants are not stringent enough.

This type of data is the sign of a new era for the role of data science in public health, and also for the associated methodological challenges. For example, with enormous amounts of data, the threat of unmeasured confounding bias is amplified, and causality is even harder to assess with observational studies. These and other challenges will be discussed.

Biography

Francesca Dominici received her PhD in Statistics from the University of Padua, Italy, in 1997. From 1999 to 2009 she was a Professor at the Bloomberg School of Public Health at Johns Hopkins University. In 2009 she moved to the Harvard T.H. Chan School of Public Health as a tenured Professor of Biostatistics and was appointed Associate Dean of Information Technology in 2011. In Fall 2013, she was appointed Senior Associate Dean for Research and in February 2017, she was appointed as co-director of the Harvard Data Science Initiative.

Dr. Dominici's research has focused on the development of statistical methods for the analysis of large and complex data. She is a passionate data scientist; her expertise is in the development of statistical methods for the analysis of large, messy data and for combining information across heterogeneous data sources. She leads several interdisciplinary groups of scientists with the ultimate goal of addressing important questions in environmental health science, climate change, comparative effectiveness research in cancer, and health policy.

In her current role as co-director of the Data Science Initiative at Harvard University, Dr. Dominici is building on the collaborations that already exist across the University to foster a rich and cohesive data science community, bringing together scholars from across disciplines and schools. In her role as Senior Associate Dean for Research, she led advancements to optimize the health of the Harvard Chan School's research enterprise, and led the School's Office of Research Strategy and Development flagship faculty grant-writing short course. Dr. Dominici has personally contributed scientific leadership in the submission of myriad pioneering proposals designed to advance scientific innovation and the field of public health at large through data science. In addition to her research interests and administrative leadership roles, she has demonstrated a career-long commitment to promoting diversity in academia.

Dr. Dominici is an elected fellow of the American Statistical Association. She has received a number of prestigious awards and honors, including the 2016 Janet L. Norwood Award, 2015 Florence Nightingale David Award, 2009 Diversity Recognition Award from Johns Hopkins University, 2007 Gertrude Cox Award, and even a 1998 ENAR student award!