

## In Memoriam: Daniel Wartenberg (1952–2020)

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Dan Wartenberg, epidemiologist, teacher, researcher, and community advocate, passed away 21 August 2020 at the age of 68. Dan grew up on Long Island, New York. He earned his Ph.D. at the State University of New York at Stony Brook, combining statistics and ecology. Under biostatistician Robert Sokal, Dan became a pioneer of geospatial analysis. He combined community advocacy and a strong sense of social justice with rigorous mathematical methodology. He was both a creative mathematician and a creative epidemiologist.

During Dan's graduate days, eastern Long Island was grappling with well-water contamination by the carbamate pesticide aldicarb, which had been widely used on potato crops. Dan was critical of the U.S. Environmental Protection Agency (EPA) for initiating an investigation of aldicarb and then abandoning the problem, which left communities in the lurch. His involvement with local health departments set the stage for many other translational ventures with communities throughout his career. His Ph.D. in hand and aldicarb on his mind, Dan went to the Harvard School of Public Health for his postdoctoral training, combining science and public health with advocacy.

In the mid-1980s, Rutgers Medical School, under the leadership of Bernard Goldstein, formed the multidisciplinary Environmental and Occupational Health Sciences Institute. Fresh out of his postdoc, Dan brought expertise in environmental epidemiology to the Institute. He taught epidemiology and biostatistics to medical students and helped build an epidemiology and quantitative methods track in the newly created New Jersey Graduate Program in Public Health. He combined technical expertise and rigor with a creative approach toward methodological issues and a broad vision for how epidemiology contributes to areas as diverse as research ethics, air pollution, and cancer.

Dan's publications include a mix of highly technical geospatial and statistical methodology, population-based studies of causation, and exploration of the ethical challenges of epidemiology. Dan was a founding member, secretary-treasurer (2001–2006), and president (2010–2011) of the International Society for Environmental Epidemiology (ISEE), which he considered his primary professional affiliation. During his years of service at ISEE, Dan initiated and vitalized activities that increased the Society's worldwide influence and established its strong reputation in mentoring of young investigators in the field. He was an Elected Fellow of the American College of Epidemiology and was elected to the National Council on Radiation Protection and Measurement.

Although his academic accomplishments are impressive (Greenberg and Chess 2016), equally important to him was his work with communities translating technical data and negotiating with governmental agencies on their behalf. State health departments frequently receive public requests for investigation



Daniel Wartenberg, 1952–2020. Here, Dan was examining flasks of mercury at a New Jersey strategic materials stockpile in summer 2001. Image: Michael Gochfeld.

of putative cancer clusters. With Rutgers colleague Michael Greenberg, Dan brought a formal statistical approach to the study of cancer clusters and how they can be identified and defined in time and space. They studied media coverage of clusters and wrote about how state health departments responded to reports of disease clusters (Wartenberg and Greenberg 1992). Indeed, 18 of his nearly 100 peer-reviewed papers were on clusters, almost all before 2001.

Community members often did not trust governmental agencies, which they felt dismissed their concerns about clusters, but they usually trusted Dan. Sometimes he offered reassurance that an apparent cluster was actually a coincidence, and at other times he ascertained that a cluster was real and required investigation. His work raised fundamental questions about the importance of statistical power in assessing the likelihood that apparent clusters were real, as well as in examining multiple sources and pathways of exposure.

He was patient when explaining methods to audiences unfamiliar with terms like “kriging” and “splines,” and he argued passionately for using evidence to protect communities. But his advocacy was firmly science based. He often discussed the challenges of cancer causation. He was critical of scientists who reported seemingly positive associations based on post hoc cut point bias or who drew negative conclusions based on underpowered studies.

His interest in supporting health departments' access to and use of data resulted in his final project, a collaboration with several states to assess the feasibility of the U.S. Centers for Disease Control and Prevention developing a national tracking network. Today, the National Environmental Public Health Tracking Program combines health and environmental data with analytic tools for rapid evaluation of specific national or regional environmental health concerns.

In collaboration with Douglas Thompson of the University of Southern Maine, Dan explored issues about access to individual-level data, which was becoming increasingly restricted due to concerns about confidentiality under the Health Insurance Portability and Accountability Act (HIPAA) privacy rule. They pointed out that HIPAA privacy safeguards had the unintended consequence of significantly limiting public health research. They urged the public health community to advocate for changes “that establish a more appropriate balance between privacy concerns and protection of public health” (Wartenberg and Thompson 2010).

Some of Dan's other research included linking air pollution and birth outcomes, evaluating data on electromagnetic field exposure, and studying unexplained illnesses among Gulf War Veterans, health effects of World Trade Center dust on first responders, and symptom patterns and psychiatric illness in troops. He even helped

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develop creative ways of analyzing spatial distribution of birds nesting in breeding colonies from Cape May to Montauk. He was an active member of the Rutgers Graduate Program in Ecology and Evolution and a valuable resource for students.

In addition to his pioneering work on clusters, his analysis of the literature on trichloroethylene (TCE) showed that the chemical was carcinogenic. Dan championed the concept of meta-analysis while it was still controversial. His meta-analysis of TCE showed excess kidney and liver cancer and non-Hodgkin lymphoma in cohorts exposed to solvents (Radican et al. 2008). He was careful to point out that exposure to TCE in isolation was rare. His work was cited by the EPA in classifying TCE as a human carcinogen.

In New Jersey, Dan contributed to his own community by serving as a volunteer fireman for two decades, including a turn as assistant chief. He joined local politicians in lobbying the Department of Defense (DOD) to remove thousands of tons of stockpiled mercury from the rapidly growing township of Hillsborough, emphasizing the risk it posed. The community eventually prevailed, and the DOD moved the mercury to a remote Nevada location. Some years later, the now-empty mercury warehouse caught fire, realizing one of Dan's convincing disaster scenarios.

Dan was diagnosed with early onset Alzheimer's disease at age 61. His doctor told him that to slow the progression he must swear off all the stresses of teaching and research. He abruptly ended those aspects of his life as he embarked on a new life of Alzheimer's advocate and teacher, continuing as long as he was able. Like everything else he did, he passionately embraced his condition, working with the Alzheimer's Association and speaking widely on life with the disease. Despite his illness, he trained rigorously for, and completed, the 2.5-mile swim from Peaks Island to Portland, Maine. This was no small feat for one with Alzheimer's, and he was quite proud of it.

Dan touched many through his collaborations and activism. He was brilliant and visionary, a gifted and accomplished scholar.

Former Ph.D. student Larry Radican remembers Dan as "incredibly modest, thoughtful, caring, compassionate, and empathetic. He constantly built people up and made us students believe we could achieve and even surpass our goals." Dan was naturally a mentor for students, but he was also a mentor for colleagues whose work intersected with environmental epidemiology. He inspired confidence with his science and enthusiasm with his activism. He could also be impatient with those who misused statistics or misrepresented data.

For the last few years, Dan lived in Maine with his devoted wife, Caron Chess. They lived in what Caron describes as a "dementia-friendly" community. They spent time paddling through Greenland, touring Iceland, and discovering islands off the coast of Britain. They request that any memorial contributions be given to the Cure Alzheimer's Fund (<https://curealz.org/>) or to Beyond Pesticides (<https://beyondpesticides.org/>), a national advocacy organization where he served on the board for many years.

We appreciate the many people who helped with this memorial, particularly C. Chess, L. Radican, M. Greenberg, J. Graber, B. Goldstein, S. Booker, and F. Laden.

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