



## Commentary

# The George W. Comstock Center for Public Health Research and Prevention: A Century of Collaboration, Innovation, and Translation

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The Johns Hopkins Bloomberg School of Public Health has been engaged in public health research and practice in Washington County, Maryland, nearly since its inception a century ago. In 2005, the center housing this work was renamed the George W. Comstock Center for Public Health Research and Prevention to honor its pioneering leader. Principles that guided innovation and translation well in the past included: research synergies and opportunities for translation realized through longstanding connection with the community; integration of training with public health research; lifelong learning, mentorship, and teamwork; and efficiency through economies of scale. These principles are useful to consider as we face the challenges of improving the health of the population over the next 100 years.

collaborative research; community partnerships; epidemiology; prevention; training

Abbreviations: ACHIEVE, Aging, Cognition, and Hearing Evaluation in Elders; ARIC, Atherosclerosis Risk in Communities; STURDY, Study to Understand Fall Reduction and Vitamin D in You.

Nearly since its inception in 1916, the Johns Hopkins Bloomberg School of Public Health has been engaged in public health research and practice in Washington County, Maryland (1). The nature of this engagement has evolved with public health needs over the past century, but it has always been vibrant and forward-looking, with its leaders drawing on past lessons learned to inform future activities. As we celebrate the 100th anniversary of the School, we reflect on which guiding principles and infrastructure may be useful in Washington County to further enable efforts in the conduct of groundbreaking epidemiologic research, translation of research findings into public health practice, and training of the next generation of public health research and practice leaders, while anticipating, adapting, and responding to new macro-level trends influencing the field (2).

### HISTORY OF RESEARCH, PRACTICE, AND TRAINING IN WASHINGTON COUNTY, MARYLAND

Different names have been used for the research and public health activities in Washington County over the past century

(1). In 2005, the Center was renamed the George W. Comstock Center for Public Health Research and Prevention to honor Dr. George Comstock's contributions as Director of the Johns Hopkins Training Center for Public Health Research from 1962 to 2003. George Wills Comstock, a public health physician, epidemiologist, and faculty member at the School for more than 50 years, led and promoted community-based research studies on cancer and heart disease, among other conditions, at the Center. Prior to the founding of the Johns Hopkins Training Center for Public Health Research, the National Cancer Institute established the Environmental Cancer Field Research Project in Washington County in 1957. This field research project built on a number of studies and innovations that trace back to the fortuitous 1911 establishment of the Hagerstown Civic League by the leading women of the community "to labor for the civic betterment of Hagerstown and its vicinity" (1, p. 676). The league raised funds in collaboration with other organizations to support a tuberculosis nurse; at the time, tuberculosis was an important but stigmatized public health problem. To circumvent the stigma of tuberculosis, the initiative was expanded to include general

public health. This broad focus on public health nursing likely attracted the School's attention to Washington County as a site for students to gain practical exposure to public health problems and acquire experience in their control in a rural setting (a separate urban focus was started in Baltimore). In 1921, the Johns Hopkins University's Washington County Health Demonstration began, contemporaneous with the third graduating class of the School. One of the first studies conducted was the series of Hagerstown Morbidity Surveys, the first truly representative community health surveys and forerunners of the National Health Interview Survey. Other pioneering research included studies on child growth and dental caries in the 1930s.

### ANTICIPATING, ADAPTING, AND RESPONDING TO PUBLIC HEALTH NEEDS OF THE FUTURE

The past guiding principles and infrastructure of the Comstock Center and the epidemiologic studies conducted at the Center remain very instructive as the Center's faculty, staff, and trainees reflect on how to anticipate, adapt, and respond to future public health needs. A thoughtful 2015 article by Brownson et al. (2) used interviews with 15 experienced epidemiologists to identify macro-level trends in public health influencing the future of epidemiology and thus training needs, including big data, health-care system reform, translational sciences, team and transdisciplinary science, and the funding environment. Here, we focus on 4 guiding principles that Dr. Comstock imbued in the Comstock Center and its infrastructure—1) connection with the community; 2) integration of training with research; 3) lifelong learning, mentorship, and teamwork; and 4) efficiency of research through economies of scale—that have facilitated past and current successes in research, practice, and training, and that we argue will be assets for the future and will help epidemiologists adapt well to some of these macro-level trends (2) in public health.

#### Research synergies and opportunities for translation realized by longstanding connection with the community

Dr. Comstock personified a connection with the community best by living in Hagerstown in Washington County, being active in local civic and health organizations, and having offices at both the Washington County Health Department, the original home of the Center, and the School. Despite the 70-mile separation, every week he worked at both locations, forming a meaningful connection based on a deep knowledge of and respect for both local health issues and the global state of the art in epidemiology. His legacy is still apparent as the Center continues productive collaborations and efforts with Washington County institutions and organizations, such as the Washington County Health Department and the Meritus Medical Center and Health System. While it is nearly impossible to recruit someone with Dr. Comstock's aplomb, the current leadership believes his guiding principle that a deep knowledge of, connection with, and respect for local institutions is critical to the success of collaborative and translational public health research, practice, and training. In 2008, coauthor Dr. Josef Coresh was appointed the

Director of the Center. He united the large Washington County community-based cohort studies—CLUE I and II, with over 25,000 participants each recruited in 1975 and 1989 (<http://epi.grants.cancer.gov/Consortia/members/clue.html>)—with the Washington County sites of several large multicenter cohort studies—the Atherosclerosis Risk in Communities (ARIC) Study (<https://www2.cscce.unc.edu/aric/desc>) and the Cardiovascular Health Study (<https://chs-nhlbi.org/>)—in a single research facility for staff, and he updated the biospecimen banking facility for these cohorts (3).

While it is no longer possible for the Center to be physically located in the Washington County Health Department, its home for more than 4 decades, Dr. Coresh and the County Health Officer hold regular meetings to keep informed about each other's research and public health activities and efforts. The realities of the current financial situation for the Washington County Health Department, like that for all local health departments around the United States, have necessitated a focus on the provision of essential services, such as vaccination, maternal and child health services, and addiction treatment, and attention to immediate public health concerns. In chronic disease prevention and management, the Health Department often relies on partners such as the health system, with the Comstock Center collaborating on study design and data principles to inform efforts.

Comstock Center collaborations with the Meritus Medical Center and Health System have increased as US health-care system reform has progressed to include an expectation of hospital responsibility for community health. In particular, a strong incentive for administrators of this health system to think in terms of community health rather than a fee-for-service model is the total payment reimbursement model, wherein the Meritus Medical Center, the only hospital in Washington County, is paid a flat fee by the Centers for Medicare and Medicaid Services for all Medicare hospitalizations taking place during the year (4).

While technology has made data collection, management, and analysis easier, partly fueling the current focus on use of "big data" for research, the systematic linkage of large-scale quantitative data from various sources to obtain answers to important new questions is longstanding at the Center. Dr. Comstock practiced and promoted efficient data collection and shepherded the careful use and repurposing of data over time throughout his entire career. He recognized the power of private censuses of the population to provide a sampling frame, to conduct large, truly community-based and thus representative cohort studies, and to enhance data collected in other studies through linkage with private censuses. His 1963 and 1975 censuses each enumerated over 90,000 Washington County residents with little help from computers. Mortality follow-up of these residents is still ongoing, as is their linkage to the Maryland Cancer Registry and the CLUE studies. Likewise, linkage of different studies in this same community can yield longer follow-up times and novel observations that are not possible in the individual studies. For example, linkage of blood pressures measured in the CLUE I Study in 1974 to serum creatinine concentrations measured in the ARIC Study during 1986–1989 established that blood pressure elevation, even below the hypertensive range, may induce early kidney damage (5). A similar linkage of the CLUE I data with

the US Renal Data System identified early risk factors for kidney failure (6). Linkage of 13,146 persons whose weights and heights were measured between the ages of 5 and 18 years in Hagerstown during the period 1933–1945 to mortality among residents in the 1963 and 1975 private censuses showed a link between childhood weight and adult mortality (7).

The size and depth of “big data” continue to grow, but the principles of repurposing, data retention for future research and practice needs, and hypothesis-driven analysis of data collected without that purpose in mind, as well as the creation of value through novel linkages, has a long and productive history at the Center. Given this experience, the Center is currently pursuing a partnership with the Meritus Health System to use deidentified electronic medical record data for both research and translation to improve the quality of care in Washington County and beyond.

### Integration of training with public health research

Dr. Comstock always felt that appropriate inclusion of students and training in research is one of the best ways to make sure assumptions are questioned, innovation is fostered, and the productive energy of youth is harnessed. The Comstock Center connects the large number of students, postdoctoral fellows, and other trainees of the Johns Hopkins schools of public health and medicine with the Center’s experienced staff and collaborating community organizations and institutions. Trainees are the lead authors of the majority of the Center’s published papers. Trainee-driven research is often facilitated by a distributed-data model, where studies like ARIC make all of the data available in a deidentified manner on a network drive to all participating investigators and trainees, once they have obtained required approvals (institutional review boards, the Health Insurance Portability and Accountability Act (HIPAA), and the ARIC manuscript proposal committee) for their proposed research. The current leadership, as did Dr. Comstock, values rigorous research and peer-reviewed publication but views the ultimate goal as improving public health and affecting policy. The leadership encourages trainees to focus on this ultimate goal.

National Institutes of Health training grants are wonderful vehicles for funding the work of students and postdoctoral fellows, but they underfund faculty efforts and provide no funds for the trainees’ research. Therefore, trainees being supported by training grants must be incorporated into large, funded research projects that support the faculty and the collection of data and samples. Through the richness of data and grant funding of studies housed at the Comstock Center, over many decades, the Center has extensively integrated training grant-supported students and fellows in epidemiology (cancer, cardiovascular, aging), biostatistics, mental health, medicine (general, cardiology, endocrinology, nephrology), surgery, otolaryngology, and radiology into the conduct of Center research. Historically, the School’s preventive medicine residents have also visited the Washington County Health Department and engaged in applied projects. Many of the trainees and junior faculty who used the Center’s data have gone on to be leaders in their respective public health, medicine, and surgical disciplines, including the

current authors and Drs. Michael Klag, Kathy Helzlsouer, Ann Hsing, Thomas Perneger, Moyses Szklo, and Javier Nieto.

### Lifelong learning, mentorship, and teamwork

Taking the long-range perspective is incredibly important in epidemiology and other public health research, particularly when studying chronic disease. Dr. Comstock used to remind colleagues that participants in observational studies tended to live longer than nonparticipants, that staff in a small town with longstanding experience produce outstanding data, and that the secret to his longevity (he reached his 92nd birthday) was setting up cohort studies with long follow-up periods. While some of his reminders were made with tongue in cheek, his comments conveyed a lot of wisdom: Nurturing longstanding relationships and viewing mentorship and learning as a lifelong process generate value.

Doctoral students need mentorship and guidance in choosing their dissertation topics, applying the epidemiologic concepts and methods they learned in the classroom to be able to conduct their dissertation research, and being acculturated in collaborative research. In our rapidly evolving public health world, all of us—postdoctoral fellows, junior faculty, even senior faculty—need advice and can gain wisdom from trusted colleagues and mentors. At all stages, it may be of benefit to view the learning process as bidirectional; both those who are senior and those who are junior can learn from the interaction. One example at the Center now includes Dr. Josef Coresh, Director of the Comstock Center, benefiting from the enormous wisdom and technical expertise of senior Center members such as Drs. Moyses Szklo and Richey Sharrett. Buy-in of the Chair of the Department of Epidemiology, Dr. David Celentano, and the Dean of the School, Dr. Michael Klag (both of whom were mentored by Dr. Comstock), into Comstock’s guiding principle of “lifelong learning, mentorship, and teamwork” led to the development of the Comstock Chair, whose endowment income in turn supports trainee pilot studies. Clinically active faculty members of the Center provide a complementary perspective to that of the full-time researchers. Likewise, Center staff with decades of experience help guide and support faculty at all stages in study conduct and optimization of participant interactions.

Dr. Comstock recognized and promoted the perspective that we can accomplish far more, with the highest quality and translational import, as teams than as individual investigators. Today, our Center extensively uses the team and transdisciplinary science approach, with teams routinely including epidemiologists and clinicians from a variety of disciplines. Such a model for research is welcoming to the participation of experts from other disciplines and in the formation of consortia. The Center has participated in several highly impactful consortium studies, including genome-wide association studies of dozens of conditions. For example, Dr. Georg Ehret used ARIC and CLUE data in leading a study on the genetics of hypertension and a Mendelian randomization analysis addressing its causal consequences (8). Kottgen et al. (9) identified polymorphisms associated with gout in a genome-wide association study that included ARIC data and then collaborated with basic scientists to discover that the *ABCG2* gene

[ATP-binding cassette, subfamily G (WHITE), member 2 (junior blood group)] transports uric acid in the kidney proximal tubule—a finding that has implications for new drugs to treat gout (10).

### Efficiency of research through economies of scale

In the current funding environment of effectively flat National Institutes of Health budgets and consequent financial constraint, efficiency in research is more important than ever. As Dr. Comstock promoted, the Center's experience is that economies of scale can extend the scope of epidemiologic research and enhance its quality. Cohort studies are very expensive to conduct (for some, millions of dollars a year for decades) but once a cohort has been established, ancillary studies conducted within such cohorts are far less costly than starting new studies from scratch. The Center's new venture into epidemiologic research on cancer risk and outcomes in ARIC, ARIC Cancer—led by Drs. Elizabeth Platz and Corinne Joshi and funded by the National Cancer Institute—was set up as an ancillary study so that more than 20 years of follow-up data could be available right away and to capitalize on established procedures for follow-up and the good rapport with participants. With enhanced infrastructure at marginal additional cost, staffing, and facilities, the ARIC cohort is becoming a full-fledged, mature cancer epidemiology cohort that brings novel features to cancer research, such as repeated clinically measured anthropometric characteristics, repeated determinations of cancer-relevant biomarkers already measured for cardiovascular, kidney, and diabetes studies, a genome-wide scan, and linkage to Medicare data on procedures and prescriptions. In contrast, most cancer cohort studies have only self-reported anthropometric data and a single blood specimen, and their biomarker data and genetic variants are measured in only subsets of participants (e.g., in nested case-control sets).

Cancer epidemiology investigators have been able to rapidly leverage the clinically measured anthropometric factors and biomarkers measured in virtually all ARIC participants to address associations between weight change from early to later adulthood (7) and biomarkers, such as C-reactive protein (11) and glycated hemoglobin (12), and cancer risk. Beyond the ascertainment of newly diagnosed cancers among the ARIC participants, the team is building on the infrastructure that is already in place to contact participants and, with their approval, ascertain information on cancer recurrences and progression to metastases and death. Junior faculty member Dr. Corinne Joshi also leveraged the Center's established relationship with the Meritus Medical Center to set up a parallel study of cancer tissue to efficiently store tissue blocks that would otherwise be routinely discarded after a mandatory period of storage. These latter components of ARIC Cancer—the ascertainment of recurrence and progression events and the storage of cancer tissue—are especially needed resources for the Center's faculty and trainees and the cancer research community more broadly, to address modern cancer epidemiologic questions about secondary and tertiary prevention, prognosis, and the etiologic heterogeneity of cancer.

Housing the Center in a 10,000-square-foot research facility and having approximately 30 highly trained and experienced

staff has also made starting new studies for students, junior faculty, and senior investigators more efficient. The law of large numbers, whereby averages are more stable with larger sample sizes, also applies to well-managed research organizations. The highs and lows of each study and studies needing “fractions” of a staff member are managed much better when several studies share trained staff. Two examples of such studies launched at the Center are 2 clinical trials: the Aging, Cognition, and Hearing Evaluation in Elders (ACHIEVE) Study (13; <http://www.linresearch.org/clinical-studies.html>) and the Study to Understand Fall Reduction and Vitamin D in You (STURDY) (14; <http://www.sturdystudy.org/>).

ACHIEVE used Center facilities to rapidly expand the research capacity of a junior faculty member in otolaryngology at the Johns Hopkins School of Medicine, so that within a year of starting, a pilot study confirming the high prevalence of hearing loss at older ages and its association with cognitive decline was completed and rapidly published (13). The study benefitted from ARIC's infrastructure and already-collected data, which allowed for the linking of hearing-loss data with both cognitive function test scores and magnetic resonance imaging data. The findings of this study, along with the Center's track record, resulted in the receipt of a grant from the National Institute of Aging to plan a randomized trial testing hearing rehabilitation interventions to delay cognitive decline. This planned trial will recruit most of its participants from the National Heart, Lung, and Blood Institute-funded ARIC Neurocognitive Study.

STURDY is a single-university, 2-site clinical trial of the use of vitamin D to prevent falls in high-risk elderly persons (14). Participants are being recruited from semirural Washington County through the Center to complement the recruitment of urban Baltimore residents through the Johns Hopkins ProHealth Clinical Research Unit, allowing a single university to achieve adequate recruitment power as well as racial and geographic diversity, while still using a single laboratory and specimen bank within driving distance of both centers. Center leadership is very hopeful regarding both the results of the trials and the trials' potential to generate ancillary studies and vehicles for training.

While Center leadership hasn't yet figured out the right center-level granting mechanisms that value these synergies, the efficiency itself generates some extra capacity through the conservation of core resources for the conduct of pilot studies to support future larger-scale projects and to set up infrastructure in advance of the start of major studies.

### Future directions

Future studies will be enhanced by Dr. Comstock's guiding principles, as outlined above. Specifically, long-term follow-up to characterize the full lifelong outcomes of participants is planned. Longitudinal follow-up from middle age well into advanced age in studies like ARIC is a top priority to ascertain both anticipated and unanticipated health-care needs and required interventions in the aging local and US population. Integration of tried-and-true high-validity data collection by trained staff with home-based and mobile technology (e.g., cell phones, accelerometers, electrocardiographic monitors, blood pressure measurements) and passive data collection



from electronic medical records, enhanced by natural language processing, will provide powerful platforms. Finally, the Center will continue to promote the conduct of research that is translationally focused, and with its community partners will develop, implement, and evaluate interventions in the community and health system.

### Summary

Many of the research and practice challenges of the future have analogies in the past. Centers like the George W. Comstock Center for Research and Prevention can benefit from the experience and wisdom of the past in collaborating, innovating, and translating research findings to meet anticipated and unanticipated public health challenges.

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