Matthew Samore, MD

Research

The mission of our VA and University health services research program is to advance scientific discovery, implement novel interventions, promote collaboration, increase research capacity, and engage operational partners to improve healthcare delivery. In our research process, high priority problems are characterized through scientific inquiry (figure below). We use methods drawn from socio-technical systems theory to examine the gaps and needs of decision-makers. Using tools such as ethnographic observation, cognitive task analysis, psychometrics, and social network analysis, we examine interactions between technology and human behavior in complex systems of care.

As depicted in the figure, population analytics provides another set of tools to convert experience and observations, as represented in healthcare data, into knowledge and evidence. Analysis of “Big Data” requires integration of expertise in informatics and epidemiology. Natural language processing methods are needed because much of the clinical data in electronic health records are in text form. Discerning treatment effects from observed associations entails an understanding of methods of causal inference. Predictive modeling involves the construction of statistical algorithms to forecast future events or to classify current status.

Our research on clinical practice and decision-making lays the groundwork for development of innovative solutions. We design theory-driven systems for decision-support, which have high potential for translation and generalizability. In cooperation with our operational partners, new interventions are fit to clinical workflow to ensure adoption and enhance impact. The clinical environment is transformed, producing a new set of needs in an iterative cycle.

Our work in the area of antibiotic resistance and antibiotic stewardship illustrates these processes. Through epidemiological investigation, we characterized mechanisms by which antibiotic use contributes to spread of antibiotic resistant pathogens and identified sources of variation in management of acute infection. Analyses of secular trends demonstrated increased use of broad spectrum antibiotics which was usually not justified by results of microbiological tests. We also observed an alarming rise in prescribing of antibiotics of last resort, such as polymyxin, reflecting a high local prevalence of multi-drug resistant Gram negative rods in selected facilities. Thus, overuse of antibiotics constitutes a major target for practice improvement.

We devised novel decision support tools to address these problems. One of our recent studies was centered on the concept of an antibiotic time-out. The purpose of the time-out was to give clinicians an opportunity to reevaluate the need for continued antibiotics after 72 hours of therapy. Dual process theory provided a conceptual framework to guide the design of the intervention. A dashboard was developed for antibiotic stewards. Clinical cognition was guided through construction of a note template that was embedded within the electronic health record. Multi-institutional studies to test additional decision support tools for antibiotic stewardship are currently underway.

Research Service Project: Develop Capacity for Simulation and Modeling at the University of Utah.

We use models and simulations as mechanisms to inform decision-making, to improve interpretation of empirical data, and to provide insights about biological and clinical care processes. Much of our methodological work on statistical models has focused on the development of better ways to estimate parameters from epidemiological data in the field of infectious diseases. Limitations of off-the-shelf statistical models are particularly glaring in this realm, because of the failure of conventional methods to account for transmission. Dynamic models complement and extend traditional epidemiological techniques.
Computer simulation is a strategy to mirror real situations for the purpose of explanation, prediction, or practice. Empirical research informs the development of simulations and, in turn, simulation boosts learning from experience. Simulation enhances interpretation of results of experimental and observational studies, serving as a probe to examine consequences of assumptions and to characterize emergent phenomena. What-if experimentation using simulation makes it possible to generalize evidence derived from intervention trials into untested situations.

The goal of our Benning Research Service Project is to increase capacity for modeling and simulation at the University of Utah. We will foster connections among faculty members with diverse types of methodological expertise. Strengthening collaborations across the Health Sciences Center and main campus of the University of Utah will be an emphasis. A key requirement will be to secure funding that supports a mix of methodologically-oriented and applied research. Policy-makers and decision-makers will be engaged in the study design process to ensure that high priority-problems are addressed. Models and simulations will target both health and economic outcomes.

Our approach will be to build on our successes to date. For instance, we have actively collaborated with the CDC to tackle problems of healthcare-associated infection, antibiotic resistance, and acute respiratory infection. We also have a strong link with the VA National Infectious Disease Service and the Multi-Drug Resistant Organism Prevention Initiative. The Center for Quantitative Biology and the Scientific Computing and Imaging Institute will serve as key local partners.

This Research Service Project will lead to the establishment of new products and resources that will be widely shared. Synthetic data generated from simulations will be made available to other investigators. Collaboration will be promoted through distribution of new software modules to fit models to data.

**Biographical Summary**

_Education and Professional Experience:_ Undergraduate in Biology at Macalester College (1975-1979); MD at University of Wisconsin-Madison (1980-1984); Internal Medicine Residency at Washington University; Fellowship in Infectious Diseases at Brigham & Women’s Hospital and Beth Israel Hospital (1987-1990); Faculty Member at Harvard Medical School (1990-1998); Faculty Member at University of Utah Department of Internal Medicine (1998-present)

_Current Professional Service:_ Chief, Division of Epidemiology; Director, Informatics, Decision Enhancement and Analytic Sciences (IDEAS) Center; Co-Chair Search Committee for Chair of Population Health Sciences

_Honors and Awards:_ National Merit Scholar; Phi Beta Kappa; Alpha Omega Alpha; Cora M. & Edward Van Liere Award for Highest Academic Achievement; Elbert and Marie Christensen Research Professorship

**References**