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Authors
Califf, Robert M
Robb, Melissa A
Bindman, Andrew B
et al.

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Transforming Evidence Generation to Support Health and Health Care Decisions

Robert M. Califf, M.D., Melissa A. Robb, M.S.(Reg.Sci.), B.S.N., Andrew B. Bindman, M.D., Josephine P. Briggs, M.D., Francis S. Collins, M.D., Ph.D., Patrick H. Conway, M.D., Trinka S. Coster, M.D., Francesca E. Cunningham, Pharm.D., Nancy De Lew, M.A., Karen B. DeSalvo, M.D., M.P.H., Christine Dymek, Ed.D., Victor J. Dzau, M.D., Rachael L. Fleurence, Ph.D., Richard G. Frank, Ph.D., J. Michael Gaziano, M.D., M.P.H., Petra Kaufmann, M.D., Michael Lauer, M.D., Peter W. Marks, M.D., Ph.D., J. Michael McGinnis, M.D., M.P.P., Chesley Richards, M.D., M.P.H., Joe V. Selby, M.D., M.P.H., David J. Shulkin, M.D., Jeffrey Shuren, M.D., J.D., Andrew M. Slavitt, M.B.A., Scott R. Smith, Ph.D., B. Vindell Washington, M.D., M.H.C.M., P. Jon White, M.D., Janet Woodcock, M.D., Jonathan Woodson, M.D., and Rachel E. Sherman, M.D., M.P.H.

Making better choices about health and health care requires the best possible evidence. Unfortunately, many of the decisions made today in our health care system are not supported by high-quality evidence[1-4] derived from randomized, controlled trials or well-designed observational studies. But as rich, diverse sources of digital data become widely available for research and as analytical tools continue to grow in power and sophistication, the research and health care communities now have the opportunity to quickly and efficiently generate the scientific evidence needed to support improved decision making about health and health care.

The pursuit of high-quality, data-driven evidence in no way detracts from the importance of expert opinion and qualitative information as a complementary source of knowledge to inform policy decisions or population and individual choices; in fact, it enhances it. However, we believe there is an opportunity to use qualitative methods to supplement high-quality quantitative data with a more focused approach.

Prompted by President Barack Obama's Precision Medicine Initiative[5] and Vice President Joe Biden's Cancer Moonshot,[6] the leaders of the federal health agencies are seeking unprecedented collaborations among agencies involved in biomedical research and health care delivery with regard to data sharing, research infrastructure, and computational capabilities. Such collaborations require combining expertise and resources and will entail substantial changes to the culture of clinical research, interactions between providers and patients, and the ways in which health systems, clinicians, and patients work together with the clinical research community to create a new environment for generating and using evidence in practice. In this article, we propose a set of core principles for data collaboration and system organizational design that we believe will further enable research efforts by both the private sector and government agencies (see box). Although these principles represent high-level articulations of concepts that are not new, their distillation will help to focus collaboration across federal agencies and with the private sector, thereby achieving synergies that will enable the more rapid development of an effective system.

Activities for Building a Strong Foundation for the Implementation of a Learning Health System.

1. We will address the strategic, organizational, and technical aspects that must be considered through an assessment of the current landscape of data available to clinicians and patients for use in clinical decision making and the opportunities for enhancing the available body of clinical evidence.
2. We will work to better identify and describe the landscape of ongoing activities contributing to narrowing the current evidence gap through approaches that leverage and extend the use of the volumes of relevant digital health and health care data to facilitate efficient, streamlined randomized trials and high-quality observational studies.
3. We will initiate demonstration projects focused on collaborations seeking to leverage resources created by ongoing projects that use digital data from government sources and private organizations (e.g., health care organizations, payers, providers, and patients).

CLOSING THE EVIDENCE GAP

Historically, the tasks of implementing quality-of-care improvements and generating high-quality medical evidence have been expensive and cumbersome. Furthermore, the medical research enterprise and the health care delivery system are often viewed, and indeed operate, as separate spheres of activity. These factors contribute to an evidence gap that slows the development and uptake of beneficial advances[7] and that can result in ineffective or sometimes even harmful interventions remaining in clinical use.[8]

However, over the past several decades, a vision has coalesced — one in which decisions about health and health care are supported by continuously updated, high-quality evidence and in which integrated health care and research data systems accelerate investigations into the spectrum of prevention, diagnostic approaches, therapeutic regimens, population health, and delivery systems.[9] After years of technological and methodologic development, and despite lingering challenges, that goal is within reach.[10] Not only can data be generated efficiently by means of streamlined research activities across multiple interoperative systems, but newly available digital data drawn from multiple sources can be repurposed for research applications to create generalizable knowledge with appropriate consent and privacy protections.

When these capabilities are combined with rapidly expanding patient-centered approaches to generating needed evidence, it will be more feasible to determine what works and what does not — not just in the lab or in research environments that can draw on dedicated resources and infrastructure but in daily medical practice and public health activities. Just as importantly, we will be better able to offer the right therapy for the right patient and the right intervention to the right population, thus improving the quality and effectiveness of patient care, public health interventions, and health care operations.

Taking full advantage of these new capabilities will require the development of an approach to the generation of evidence that contributes to a learning health system[11] in which health-related data are continually generated, updated, and stored in an accessible format and linked in ways that facilitate research and collaboration while also protecting patient and consumer well-being, security, confidentiality, privacy, and autonomy. Importantly, such a system would be useful for a wide variety of research designs, from observational studies to randomized, controlled trials and cluster-randomization designs, and will be able to generate evidence that ultimately leads to improved health outcomes and a more efficient health care system without compromising the relationship between provider and patient. Of note, the inclusion of patients, consumers, and clinicians in the development and operation of the learning health system will increase the likelihood that the evidence generated will be adopted into practice to improve health practice quickly. This evidence can also feed into the organizational and incentive changes that the government and the private sector have prioritized, incorporating process and outcome improvements into Medicare and other payment systems, thereby helping to improve the quality and affordability of health care.

A CALL TO ACTION

In accordance with the congressional mandate that requires "the coordination of relevant Federal health programs to build data capacity for comparative clinical effectiveness research . . . in order to develop and maintain a comprehensive, interoperable data network to collect, link, and analyze data on outcomes and effectiveness from multiple sources, including electronic health records,"[12,13] governmental agencies and partners in the private sector, including those that fund research, are now collaborating on the focused development of infrastructure for the generation of evidence that can support a learning health system. Table 1 describes five key principles that must be adopted for the evidence-generation system to become a reality, including commitments to meaningful stakeholder engagement, the creation of robust systems that ensure the privacy and autonomy of research participants, the building of secure, efficient, and interoperable research data networks that are capable of producing high-quality data fit for multiple purposes, the development and piloting of new research designs that can answer meaningful research questions, and the creation and implementation of more efficient approaches to study conduct that harmonize and streamline processes while ensuring study quality and protections for patients.

Table 1. Key Principles and Foundational Elements for an Evidence-Generation System to Support a Learning Health System.*

Core Principle	Foundational Elements	Examples
Organize operational systems that create effective research networks embedded in practice and bring them together	Broad stakeholder participation in prospective, randomized, controlled trials and observational studies Regulatory approaches that facilitate practice-based systems for surveillance and research Support for adequate time commitment for clinicians to engage with patients to ensure mutual understanding and appropriate informed consent Efficient systems to handle contracting and liability A new paradigm for evidence generation in which clinical care and research are closely aligned	AHRQ Primary Care Practice-Based Research Networks[14] include groups of primary care clinicians and practices that are focused on community-based health care research and translation of research findings into practice The National Patient-Centered Clinical Research Network (PCORnet)[15] combines Clinical Data Research Networks that are based in health care systems with Patient-Powered Research Networks run by patients, advocacy organizations, and research partners interested in sharing health data and participating in effectiveness research
Establish robust frameworks for autonomy, privacy, confidentiality, and security	A system in which patients and consumers are valued, integral participants in the development of evidence to inform care Robust procedures that ensure data security and protect confidentiality Efficient systems to keep patients and potential study participants informed about research opportunities and ensure appropriate informed consent Balance of individual autonomy with public health needs	The All of Us Research Program[16] is a data-driven enterprise supporting cutting-edge research that prioritizes responsible data sharing to ensure privacy and foster participant engagement The Million Veteran Program[17] is a partnership in which volunteering veterans receiving care in the VA system participate in studies about how genes affect health through the creation of a database comprising genetic data and information, stored and shared with authorized researchers under strict procedures designed to ensure privacy and confidentiality, to enable research on health conditions, including those related to military service
Adopt common approaches to configuring, storing, and reusing digital health care data with appropriate informed consent and privacy protections	Interoperability among systems that capture, store, and exchange health care data Development of common standards and terminology for prospective data collection Continuous effort to curate data to produce high-quality data sets for analysis with the use of common data models Streamlined randomized, controlled trials and high-quality observational studies that leverage existing digital health and health care data to create efficiencies	The ONC Shared Nationwide Interoperability Roadmap[18] is a stakeholder-driven effort to coordinate policy and technical efforts to achieve the interoperability of health information technology for a national research and health care data system The CMS Virtual Research Data Center[19] provides timely access to Medicare and Medicaid program data and facilitates analysis within the CMS secure environment
Develop and test new methods to reliably answer research questions	Dissemination of information from pilot programs that provide proof of concept for efficient, scalable, randomized, controlled trials, cluster-randomized trials, and observational studies Improvements in statistical and epidemiologic methods to better leverage increasing amounts of existing health care data Continued development of approaches to observational comparisons of treatments and empirical analysis of which methods are best for which types of research questions Approaches that promote further integration of clinical care and research	The FDA Sentinel System[20] expands the FDA postmarketing surveillance capabilities by aggregating claims data on >100 million U.S. residents to actively gather information about the safety of regulated medical products once they reach the market The National Academy of Medicine Clinical Effectiveness Research Innovation Collaborative[21] facilitates information exchange and knowledge sharing among researchers and health system leaders
Ensure development of new approaches that facilitate efficient study design and conduct	Streamlined and harmonized processes that eliminate barriers to efficient research while ensuring needed safeguards Systems for high-quality and efficient ethics review (institutional review boards) and contracting Development of approaches to assure the quality of research results that make better use of analytic approaches to increase efficiency	NIH HCS Research Collaboratory[22] brings together multiple large, integrated health systems to use existing data in pragmatic clinical trials to build infrastructure, methods, knowledge, and capacity for pragmatic research at the health care system level NCATS Clinical and Translational Science Awards Program[23] is a national consortium of >60 large academic health centers that seeks to foster and enhance the efficiency, quality, and effect of clinical and translational research

* AHRQ denotes Agency for Healthcare Research and Quality, CMS Centers for Medicare and Medicaid Services, FDA Food and Drug Administration, HCS Health Care Systems, NCATS National Center for Advancing Translational Sciences, NIH National Institutes of Health, ONC Office of the National Coordinator for Health Information Technology, and VA Department of Veterans Affairs.

Projects such as the National Patient-Centered Clinical Research Network (PCORnet, created by the Patient-Centered Outcomes Research Institute),[15] the Food and Drug Administration Sentinel Initiative,[20] the evolving multiple-stakeholder National Evaluation System for Health Technology,[24,25] the Health Care Systems Research Collaboratory (sponsored by the National Institutes of Health),[22] and the Million Veteran Program (sponsored by the Department of Veterans Affairs[17]) are already using digital data from clinical settings to generate the meaningful evidence that is needed to support informed decisions about health and health care. As these systems develop, we are working to connect them in ways that create a more powerful engine for evidence generation, and we encourage others to join us in this endeavor.

ENGAGING ACROSS MULTIPLE STAKEHOLDERS AND SYSTEMS

Because the projects noted above span multiple broad objectives, from improving quality of care to providing safety surveillance and enabling large pragmatic trials, there are practical limits on the degree of integration that is possible across all of them. However, each project is establishing the feasibility of programs that are designed to generate evidence while embedded in ongoing clinical care, as well as building capacity for the generation of evidence to support a learning health system. In addition, the underlying data, approaches to operational systems, and many of the basic analytical tools and methodologic approaches are similar and are openly available. As leaders in federal agencies and organizations, we are highly motivated to leverage these investments across an interoperative national research environment — itself a necessary prerequisite for a learning health system that provides value for all stakeholders. President Obama's Precision Medicine Initiative (which includes both the All of Us Research Program [formerly the Precision Medicine Initiative Cohort Program][16] and the Million Veteran Program[17]) and delivery-system reform efforts provide a critical venue for the effective integration of these disparate elements. At the heart of the Precision Medicine Initiative is a major effort to harness large volumes of digital data to inform the creation of a sustainable evidence generation system.

We recognize that such an effort entails substantial technical, organizational, and cultural challenges. Success will require new approaches to collaboration, a willingness to reexamine our current systems critically for generating evidence, and a commitment to testing innovative methods and ensuring their appropriate use when they are shown to work. For example, considerable efforts will be needed both to continue the drive toward convergence on common data standards and terminology[18] and to curate data for high-quality, analyzable data sets. These efforts in turn will require substantial personnel support and the development of revamped educational programs that are capable of building a workforce that is adequately prepared to meet the challenges of a rapidly evolving research environment. Another difficult area will be the development of methods and incentives that enable a higher level of engagement on the part of practitioners — and the systems in which they work — in prospective studies that require direct interactions with patients (including, often, the obtaining of informed consent). A particularly important aspect of this will be finding ways to ensure that an emphasis on evidence generation does not disrupt clinical workflow and the efficient provision of patient care.

As leaders of agencies charged with advancing the health of the public, we want to join forces with external stakeholders, including large health care systems, public- and private-sector insurers, employers, academic institutions, and medical-product manufacturers to engage proactively in using increasing amounts of available digital data to produce evidence for making health care decisions throughout clinical trials and observational studies. But most critically, we seek to engage with patients, consumers, research participants, advocacy groups, and clinicians to realize the vision of a national learning health system supported by high-quality evidence — one that builds on existing efforts such as those articulated in the Shared Nationwide Interoperability Roadmap[18] and that can accommodate the integration of disparate parts into a functional whole while retaining the flexibility to evolve over time as our experience grows.[26]

TRANSFORMATIONAL CHANGES AND HISTORIC OPPORTUNITIES

Over the past several decades, we have developed and refined the capacity to receive, manage, analyze, transfer, and store vast amounts of data related to health, health care, and environmental factors. Amid this growing complexity, we are exploring how to apply these data to answer questions by means of observational studies as well as individual and cluster-randomized clinical trials. Furthermore, as we have come to recognize the essential role that the perspectives of patients and consumers play in shaping the methods, goals, and outcomes of medical research and interventions, we have an imperative to ensure that all participants in our health system have the opportunity to engage in research and have access to the evidence they need to make informed decisions.

We know that when people make choices about health and health care without adequate evidence to inform them, those choices can be ineffective at best and at worst can cause actual harm. But when patients and clinicians have ready access to high-quality evidence, they are better equipped to make decisions that maximize benefits while minimizing risks, ultimately leading to improved health not just at the level of the individual but across entire communities. All of us — patients, consumers, families, clinicians, and society as a whole — will benefit from a learning health system that takes full advantage of digital data to help us make informed choices. Americans deserve no less.

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