ITdotHealth II

The Meeting at Harvard on a Health Information Technology Platform

SEPTEMBER 10-11, 2012

COUNTWAY LIBRARY OF MEDICINE

MINOT ROOM, 5TH FLOOR

10 SHATTUCK ST.

BOSTON, MA 02115

SPONSORS:

Agenda

Monday, September 10, 2012		
11:00am	Lunch, Networking	Ballard/Lahey Rooms
1:00pm	Introduction **Kenneth Mandl** Director, Intelligent Health Lab, Boston Children's Hospital Informatics Program; Associate Professor, Harvard Medical School	Minot Room
1:15pm	Making EHR Apps Substitutable: Theory & Experience **Joshua Mandel** Lead Architect, SMART Platforms; Research Faculty, Boston Children's Hospital Informatics Program; Instructor, Harvard Medical School	Minot Room
1:45pm	Apps & APIs: Innovating With and Around Vendor and Homegrown EHRs **Moderator: Brian Athey** Chair, University of Michigan Medical School, Department of Computational Medicine and Bioinformatics; Professor, UM Medical School **Howard Goldberg** Senior Corporate Manager, Partners Health Care; Lecturer, Harvard Medical School **John Halamka** Chief Information Officer, Beth Israel Deaconess Medical Center; Co-Chair, National Health IT Standards Committee; Professor, Harvard Medical School **John Hutton** Director of Biomedical Informatics, Cincinnati Children's Hospital; Professor, University of Cincinnati College of Medicine **John Mattison** Chief Medical Information Officer, Kaiser Permanente	Minot Room
3:00pm	Keynote Address: "Data, Predictions, and Decisions: On Computational Futures for Evidence-Based Healthcare" **Eric Horvitz** Distinguished Scientist & Deputy Managing Director, Microsoft Research	Minot room
4:00pm	Break	Ballard/Lahey Rooms
4:30pm	Apps & APIs: Meeting Customer Demand for Physician and Patient Users **Moderator: Isaac Kohane** Henderson Professor, Harvard Medical School; Director, Boston Children's Hospital Informatics Program; Co-Director, HMS Center for Biomedical Informatics **Stanley Crane** Chief Innovation Officer, Allscripts **Sean Nolan** Chief Architect and General Manager, Microsoft Health Solutions Group **Marc Overhage** Chief Medical Informatics Officer, Siemens Healthcare	Minot Room
5:45pm	Email Break	
6:00pm	**Dinner, Music**	Lower Level 1

Tuesday, September 11, 2012		
7:30am	Breakfast, Networking	Ballard/Lahey Rooms
8:00am	Observations from Day 1 **Kenneth Mandl**	Minot Room
8:30am	Keynote Address **Clayton Christensen** Kim B. Clark Professor of Business Administration, Harvard Business School	Minot Room
9:30am	Discussion	Minot Room
10:00am	Break	Ballard/Lahey Rooms
10:30pm	SMART-Enabled Platforms **Moderator: David Kreda** Business Translation Consultant, smartplatforms.org **Joseph Dal Molin** President, E-Cology Corporation; Chairman, WorldVistA **Travers Franckle** Research Software Engineer, Indivo, Boston Children's Hospital Informatics Program **Carl Kesselman** Professor, University of Southern California **Daniel Nigrin** Senior VP for Information Services & CIO, Boston Children's Hospital; Assistant Professor, Harvard Medical School **Sims Preston** CEO, Polyglot Systems **Nich Wattanasin** Team Leader & Project Manager, i2b2, Partners Healthcare	Minot Room
12:15pm	Lunch	Ballard/Lahey Rooms
1:15pm	Apps, Meaningful Use, and Accountable Care **Moderator: Kenneth Mandl** **Ken Majkowski** Vice President of Strategy and Innovation, Surescripts **Joshua Mandel** **Shawn Murphy** Medical Director of Research Computing and Informatics, Partners HealthCare Research Computing; Associate Professor, Harvard Medical School; Associate Neurologist Massachusetts General Hospital **Jonathan Perlin** President, Clinical and Physician Services and Chief Medical Officer, Hospital Corporation of America **Claudia Williams** Senior Advisor, Health IT at White House Office of Science and Technology Policy	Minot Room
2:30pm	Sparking the Ecosystem	Minot Room
3:00pm	Adjourn	

Table of Contents

This conference is being videotaped and photographed

September 10, 2012

Dear Participants,

Welcome to the Harvard Medical's School Center for Biomedical Informatics and Children's Hospital Informatics Program invitation-only meeting on developing a national *Health Information Technology Platform* supporting *Substitutable Apps* (loosely, an "App Store for Health").

You are joining key stakeholders from industry, government, academia and the public sector to follow up the work begun three years ago at www.ITdotHealth.org. **Eric Horvitz** of Microsoft Research opens the first day with a keynote and **Clayton Christensen** of Harvard Business School will keynote on the second day.

We have powerful senior representation from the EMR industry, government, pharma, pharmacy, care management, academia, and for-profit, not-for profit health care, military, and public health care. At this signal moment for HIT, we engage together in a conversation. Our goal is to develop a mutual understanding, set of principles, and agreement on next steps to guide key aspects of the formation of a national system for safe, accountable and cost-effective health care.

Underpinning our discussions is the notion of an information technology platform which we presented in a paper in the *New England Journal of Medicine*, called "No Small Change for the Health Information Economy," suggesting that EMRs should look a lot more like an iPhone than they currently do. The platform approach to software design can be used to create and support an extensible ecosystem of applications and to stimulate a market for competition on value and price. An infrastructure based on "substitutable" components is a highly promising way to drive down healthcare technology costs, allow flexibility, support standards evolution, accommodate differences in care workflow, foster competition in the market, and accelerate innovation. We have developed a model for such a system—the SMART Platform (Substitutable Medical Applications Reusable Technologies, funded by the National Coordinator of Health Information Technology under the SHARP Program) from which we have learned important lessons about the technical, regulatory, and business implications of this transformative and rapidly evolving trend. Several EMR vendors have signaled movement toward a platform model.

Unlike exploratory meetings, pure business conferences and conventional academic colloquia, the 2012 ITdotHealth meeting is intended to forge interdisciplinary partnerships, combining 18 years of federally funded research at Harvard with the know-how of industry leaders, governments, NGOs, and leading academics.

There are no "canned" talks. There are no breakouts. We will all work together. There will be very few slides. In addition to the keynote sessions, four moderated discussions—each initiated with brief presentations by panels of experts--focus on:

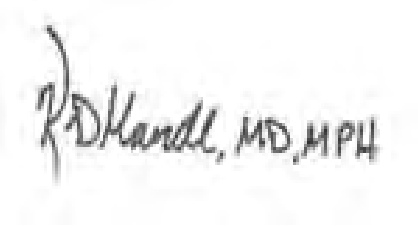
- Innovating with and around the base transactional EHRs from both the customer and vendor perspectives
- Experiences of platforms and apps that have experimented with implementing the SMART API
- The role of apps in meaningful use, research, and accountable care

Tweeting is encouraged, but so that people can speak freely, we discourage direct attribution. A hashtag will be announced at the beginning of the meeting.

Sessions are all recorded and video will be made available on the smartplatforms.org website.

Thank you for participating!

Kenneth D. Mandl, MD, MPH



Kenneth_Mandl@Harvard.edu

Isaac S. Kohane, MD, PhD

Isaac_Kohane@Harvard.edu

Keynote Speakers

Eric Horvitz

Microsoft Research | Distinguished Scientist & Deputy Managing Director

Eric Horvitz is Distinguished Scientist and Deputy Managing Director at Microsoft Research. He has pursued research on machine learning, inference, and decision making, with contributions spanning theory and practice. His efforts have contributed to the fielding of applications and services in healthcare, information retrieval, human-computer interaction, and e-commerce. He has been elected Fellow of the American Academy of Arts and Sciences, the Association for the Advancement of Artificial Intelligence (AAAI), and the American Association for the Advancement of Science (AAAS). He has served as President of AAAI and is incoming chair of the AAAS Section on Information, Computing, and Communication. He has also served on the NSF CISE Directorate advisory board, council of Computing Community Consortium (CCC), Naval Research Advisory Committee (NRAC), and the DARPA ISAT Study Group. He received his PhD and MD degrees at Stanford University. More information can be found at http://research.microsoft.com/~horvitz. A list of technical publications is available at http://research.microsoft.com/~horvitz/abstracts.htm.

Clayton Christensen

Harvard Business School | Kim B. Clark Professor of Business Administration

Professor Christensen holds a B.A. from Brigham Young University and an M.Phil. in applied econometrics from Oxford University where he studied as a Rhodes Scholar. He received an MBA and a DBA from the Harvard Business School, where he is currently the Kim B. Clark Professor of Business Administration. He is regarded as one of the world's top experts on innovation and growth.

Christensen founded a number of successful companies and organizations which use and apply this theories in various ways: Innosight, a consulting firm helping companies create new growth businesses; Rose Park Advisors, a firm that identifies and invests in disruptive companies; and Innosight Institute, a non-profit think tank whose mission is to apply his theories to vexing societal problems such as healthcare and education.

Professor Christensen is the best-selling author of eight books and more than a hundred articles, including the New York Times best-selling, *How Will You Measure Your Life?* He received the Global Business Book Award for *The Innovator's Dilemma* and *The Economist* named it as one of the six most important books about business ever written. In 2011 in a poll of thousands of executives, consultants and business school professors, Christensen was named as the most influential business thinker in the world.

Professor Christensen was born in Salt Lake City, Utah. He worked as a missionary for the Church of Jesus Christ of Latter-day Saints in the Republic of Korea from 1971 to 1973 and continues to serve in his church in as many ways as he can. He and his wife Christine live in Belmont, MA. They are the parents of five children and grandparents to five grandchildren.

Meeting Co-Chairs

Kenneth Mandl

Harvard Medical School |Associate Professor
Intelligent Health Lab, Boston Children's Hospital Informatics Program | Director

Kenneth D. Mandl, MD, MPH is an Associate Professor at Harvard Medical School (HMS) and the Louis Diamond Investigator at Children's Hospital Boston, where he directs the Intelligent Health Laboratory within "CHIP", the Children's Hospital Informatics Program.

Mandl has pioneered and published extensively in the areas of personal health records and biosurveillance. Under a major a HHS initiative, he co-leads the SMART Platforms project, which seeks to create an "app store" for health. He co-directs a CDC Center of Excellence in Public Health Informatics working to define the role of online social networks in healthcare and public health. Recognized for his teaching and research, he has received the Barger Award for Excellence in Mentoring at Harvard Medical School and the Presidential Early Career Award for Scientists and Engineers, the highest honor bestowed by the United States government to outstanding scientists and engineers. He has been an advisor to two Directors of the CDC and now chairs the Board of Scientific Counselors of the NIH's National Library of Medicine.

Dr. Mandl has published over 130 papers in the medical literature and has been elected to multiple honor societies including the American Society for Clinical Investigation, the Society for Pediatric Research, the American College of Medical Informatics and the American Pediatric Society. He leads two postdoctoral training programs in clinical and informatics research and directs the Population Health Track of the new Masters Degree in Biomedical Informatics at HMS. Mandl is a faculty member in the HMS Center for Biomedical Informatics and in the Division of Health Sciences and Technology at Harvard and MIT.

Isaac Kohane

Harvard Medical School |Henderson Professor
Boston Children's Hospital Informatics Program |Director
HMS Center for Biomedical Informatics | Co-Director
HMS Countway Library of Medicine | Director

Isaac (Zak) Kohane is the director of the Children's Hospital Informatics Program and is the Henderson Professor of Pediatrics and Health Sciences and Technology at Harvard Medical School (HMS). He is also the co-Director of the HMS Center for Biomedical Informatics and Director of the HMS Countway Library of Medicine. Dr. Kohane leads multiple collaborations at Harvard Medical School and its hospital affiliates in the use of genomics and computer science to study diseases (particularly cancer and autism) through the perspective of biological development. He also has developed several computer systems to allow multiple hospital systems to be used as "living laboratories" to study the genetic basis of disease while preserving patient privacy. Among these, the i2b2 (Informatics for Integrating Biology and the Bedside) National Computing Center has been deployed at over 52 academic health centers internationally. Dr. Kohane has published over 180 papers in the medical literature and authored a widely used book on Microarrays for an Integrative Genomics. He has been elected to multiple honor societies including the American Society for Clinical Investigation, the American College of Medical Informatics, and the Institute of Medicine. He leads a doctoral program in genomics and bioinformatics at the Division of Health Sciences and Technology at Harvard and MIT. He is also a practicing pediatric endocrinologist and father of three energetic children.

September 10 Panelists & Presenters

Making EHR Apps Substitutable: Theory and Experience

Joshua Mandel, MD

SMART Platforms | Lead Architect
Boston Children's Hospital Informatics Program | Research Faculty
Harvard Medical School | Instructor

Josh is a physician and software engineer interested in improving clinical care through information technology. After earning an S.B. in computer science and electrical engineering from the Massachusetts Institute of Technology and an M.D. from the Tufts University School of Medicine, he joined the faculty of the Boston Children's Hospital Informatics Program and Harvard Medical School, where he serves as lead architect of the SMART Project (http://smartplatforms.org). Josh has a special interest in tools and interfaces that support software developers who are new to the health domain.

Apps & APIs: Innovating Around Vendor & Homegrown EHRs

MODERATOR

Brian Athey, PhD

University of Michigan Medical School | Professor
UM Medical School, Department of Computational Medicine and Bioinformatics | Chair

Brian Athey, Ph.D. is Collegiate Professor and Inaugural Chair of the Department of Computational Medicine and Bioinformatics at the University of Michigan Medical School. He is also a Professor of Psychiatry and of Internal Medicine. He is the founding Principal Investigator of the NIH National Center for Integrative Biomedical Informatics (NCIBI), one of eight NIH National Biomedical Computing Centers. He also serves as US Academic lead and Co-PI of tranSMART, an emerging US and EU consortium to create and support an open data and analytic software "Apps Store" to accelerate clinical and translational research. Brian also serves as the Biomedical Informatics Core Director of Michigan's Clinical and Translational Science Award (CTSA), and is Associate Director of the Michigan Institute for Clinical and Health Research (MICHR). Brian has served as Director of Academic Informatics for the Medical School. Brian is an active teacher and mentor, being the Principal Investigator of the U-M NIH/NIGMS Bioinformatics Training Grant; he has trained more than 15 Ph.D. students and Post-Doctoral Fellows.

Brian led the National Library of Medicine (NLM) Next-Generation Internet (NGI) Visible Human Project and the DARPA Virtual Soldier Project. He has over 100 peer-reviewed scientific publications and proceedings, ranging from bioinformatics, metabolomics, computational biology, optical imaging, and grid computing. Brian is a highly sought after speaker and has been honored with several awards for his work. He has served as a special advisor to the CIO of the NIH and to the DARPA Defense Science Office (DSO). Brian is the Chairmen of the Technical Advisory Board Chairman of the 1Mind4Research, an emerging neuroscience Public Private Partnership. He is also a founding member and former Board Chairman of the non-profit Scientists & Engineers of America (SEA), based in Washington, D.C. He received his Ph.D. in Cellular and Molecular Biology (Biophysics concentration) from the University of Michigan, where he and collaborators were the first to propose the double helical 'crossed-linker' for chromatin structure. His is still a very active researcher in this field.

September 10 Panelists & Presenters

Apps & APIs: Innovating Around Vendor & Homegrown EHRs (cont.)

Howard Goldberg, MD

Partners Health Care | Senior Corporate Manager
Harvard Medical School | Lecturer

Howard S. Goldberg, MD, Corporate Manager for Enterprise Clinical Informatics and Infrastructure Services (ECIIS) and Lecturer in Medicine, HMS, is a well-known medical informatician with over twenty years experience in Healthcare IT with numerous peer-reviewed publications. Goldberg, a board-certified general internist, received his MD degree from Albert Einstein College of Medicine, completed residency training in Internal Medicine at Boston University Medical Center, and completed a fellowship in Medical Informatics/Clinical Decision-Making at New England Medical Center. Goldberg participated on the team at Johns Hopkins Hospital in the early 1980's that built the first networked clinical information system centered around a relational database. Prior to joining Partners Healthcare in 2005, Goldberg served as the Associate Director for the Clinical Informatics Unit at the Deaconess Hospital, on the faculty at the Center for Clinical Computing at Beth Israel Deaconess Medical Center, and as Director for R&D / Vice President of Product Development at Clinician Support Technology, a pioneering start-up in patient-facing portals. Since 2009, Goldberg has also served as a US representative to the Clinical Content Committee of IHTSDO, the international organization responsible for the maintenance of SNOMED-CT.

Since joining Partners Healthcare and Clinical Informatics R&D in 2005, Goldberg has been leading a team of informaticians and IT professionals in the development of a centralized infrastructure for informatics services. The Partners' informatics infrastructure provides a broad array of terminology services, standards-based interoperability services to create and deconstruct CDA-based documents, and a centralized enterprise decision support system for the next generation of clinical decision support, leveraging the use of commercial business rules management systems. As Services Team Lead for the Clinical Decision Support Consortium and as PI in other ongoing investigations, Goldberg and his team are demonstrating the feasibility of providing remote, service-based decision support on a regional and national level. By establishing a single set of standards for the multiple institutions comprising Partners, Goldberg and his team hope to improve the quality of information captured at the point of care, simplify semantic interoperability between diverse systems, and lay the groundwork for enhanced decision support and data mining capabilities.

John Halamka, MD, MS

Harvard Medical School | Professor
Beth Israel Deaconess Medical Center | Chief Information Officer
National Health IT Standards Committee |Co-Chair

John D. Halamka, MD, MS, is a Professor of Medicine at Harvard Medical School, Chief Information Officer of Beth Israel Deaconess Medical Center, Chairman of the New England Healthcare Exchange Network (NEHEN), co-Chair of the national HIT Standards Committee, co-Chair of the Massachusetts HIT Advisory Committee and a practicing Emergency Physician.

As Chief Information Officer of Beth Israel Deaconess Medical Center, he is responsible for all clinical, financial, administrative and academic information technology serving 3000 doc-

September 10 Panelists & Presenters

Apps & APIs: Innovating Around Vendor & Homegrown EHRs (cont.)

tors, 14000 employees and two million patients. As Chairman of NEHEN he oversees clinical and administrative data exchange in Eastern Massachusetts. As co-Chair of the HIT Standards Committee he facilitates the process of electronic standards harmonization among stakeholders nationwide. As co-Chair of the Massachusetts HIT Advisory Committee, he engages the stakeholders of the Commonwealth to guide the development of a statewide health information exchange.

John Hutton, MD

Cincinnati Children's Hospital |Director of Biomedical Informatics
University of Cincinnati College of Medicine | Professor

John J. Hutton MD is Director of Biomedical Informatics at Cincinnati Children's Hospital Medical Center and Professor of Pediatrics at the University of Cincinnati College of Medicine. He also serves as Director of the Biomedical Informatics Core of the UC CTSA. His group is responsible for the research data center, high performance computing, data warehousing and mining, software development, and IT security. Dr. Hutton has served as Principal Investigator of an IAIMS award from NIH/National Library of Medicine to support innovative research in and development of information management systems and is presently the Principal Investigator of an award from AHRQ to build modular chronic disease registries to support quality improvement and comparative effectiveness research in pediatrics. From 1987 until 2002, he was Dean of the UC College of Medicine and Chair of the Board of UC Physicians, the faculty practice organization. While Dean, he served two four year terms as a member of the Administrative Board of the Council of Deans of the Association of American Medical Colleges, a seven year term on the Executive Council of the Association of American Medical Colleges, and a 3 year term as a member of the Liaison Committee on Medical Education, the accrediting body for US and Canadian medical schools. He was a member of national task forces on primary care, clinical research, and graduate education. In recognition of his services to medical education, Dr. Hutton was elected a Distinguished Service Member of the Association of American Medical Colleges. He is the author of numerous research papers in mammalian molecular biology and genomics. He has received awards for distinguished service from the American Society of Clinical Investigation and the American Society of Hematology.

John Mattison, MD

Kaiser Permanente | Chief Medical Information Officer

John began his medical career at UC San Diego and Scripps Clinic, where he practiced in many clinical settings including primary care, critical care, preventive medicine, hyperbaric medicine, trauma and helicopter medicine, and held several directorships while at Scripps Clinic, including Quality, Utilization, and Critical Care. He joined Kaiser Permanente in 1989, and was appointed as Assistant Medical Director and Chief Medical Information Officer in 1992.

He has designed, built, and/or implemented seven different Electronic Health Record systems, most recently KP HealthConnect, which has resulted in numerous national recognitions for quality, including HIMSS Level 7 awards for all KP hospitals in SCAL, and 6 of those hospitals were recognized among the top 24 hospitals nationwide as "Most Connected Hospitals in the US" by US News and World Report earlier this year. His team received the prestigious Davies Award at HIMSS 2012.

September 10 Panelists & Presenters

Apps & APIs: Innovating Around Vendor & Homegrown EHRs (cont.)

Currently, John actively oversees all information systems for the SCAL region of Kaiser Permanente and is an active member of local, state, and federal governing bodies that oversee Health Information Exchange. He is the founding chair of the HL7 XML committee that has produced the Clinical Document Architecture (CDA) and Continuity of Care Document (CCD), and was the first clinician member of the SNOMED International board where he served for six years. He is an active supporter of the Open mHealth initiative for an open source mobile app architecture.
He is actively involved in health policy at both state and federal levels, and is currently a member of the California State Privacy Steering Committee and subcommittee on Secondary Use. He is also a charter member of the NwHIN coordinating committee, and the 2012 FACA on Federal Governance of HIE. He has given formal testimony on policy issues associated with Health IT at the PCAST hearings and NCVHS. He is an active participant in AMIA's annual Policy Conference.
He has published numerous papers in the field of medical informatics, has hosted dozens of delegations from around the world interested in the work done by his teams, and gives keynote addresses at numerous conferences nationally and internationally on both Health IT and Consumer Health issues and perspectives, in addition to international consultation in health IT.

Apps & APIs: Meeting customer Demand for Physician and Patient Users

MODERATOR

Isaac Kohane

Stanley Crane

Allscripts | Chief Innovation Officer

At Allscripts, Stanley's development teams created the beginnings of Allscripts Open Platform – a set of API's that would enable internal and external developers to create companion products. Internally those API's have most recently been used to create Allscripts Wand for iPad.
Allscripts platform API's are used today by twenty clients and third products, with over 100 applications in development.
Prior to spending more than a decade in healthcare software, Stanley was involved in Silicon Valley where he held positions with many well-known software companies. As the General Manager of Lotus cc:Mail, he created the first remote mail products. He was also the Vice President of Engineering at WordStar International, Director of Applications at Ashton-Tate, managing their Macintosh products as well as dBase IV.
Stanley holds a BA in mathematics from Fort Lewis College in Durango, Colorado and an MA also in mathematics from the University of Wyoming in Laramie, Wyoming.
Stanley also served on the CCHIT Foundation Workgroup in 2007.

September 10 Panelists & Presenters

APPS & APIS: INNOVATING AROUND VENDOR & HOMEGROWN EHRS (CONT.)

Sean Nolan

Microsoft Health Solutions Group | Chief Architect and General Manager

As Distinguished Engineer for the Health Solutions Group at Microsoft Corp., Sean Nolan directs all aspects of product development and operations for the division's consumer and enterprise health platforms.

Before rejoining Microsoft in 2006, Nolan served as founder and president of Software Poetry Inc., a software and management consultancy. While at Software Poetry, Nolan worked with venture capital firms to deliver technical diligence on early-stage investments, and provided product definition, strategy and execution services to startup ventures, focusing on the online advertising and e-commerce sectors.

Before Software Poetry, Nolan was chief technical officer for drugstore.com Inc., where he led the design and implementation of its award-winning e-commerce systems. While there, he was honored as one of the nation's Premier 100 IT Leaders for 2001 by Computerworld magazine.

Nolan has co-founded a number of other technology ventures, including Cognisoft Corp., where he architected one of the first Web-based knowledge management systems. Cognisoft was ultimately acquired by Verity, where Nolan served as vice president of Technology for Information Applications.

A graduate of Dartmouth College, Nolan began his software career at Microsoft, where he was the development manager for the original Microsoft Network (MSN®) client tools and their conversion to Internet technologies.

Marc Overhage

Siemens Healthcare | Chief Medical Informatics Officer

Dr. Overhage is the Chief Medical Informatics Officer for Siemens Healthcare. Prior to joining Siemens he was the founding Chief Executive Officer of the Indiana Health Information Exchange and was Director of Medical Informatics at the Regenstrief Institute, Inc., and a Sam Regenstrief Professor of Medical Informatics at the Indiana University School of Medicine.

He has spent over 25 years developing and implementing scientific and clinical systems and evaluating their value. With his colleagues from the Regenstrief Institute, he created a community wide electronic medical record (called the Indiana Network for Patient Care) containing data from many sources including laboratories, pharmacies and hospitals in central Indiana. The system currently connects a majority of acute care hospitals in Indiana and includes inpatient and outpatient encounter data, laboratory results, immunization data and other selected data for 12 million patients. In order to create a sustainable financial model, he helped create the Indiana Health Information Exchange, a not-for-profit corporation. In addition Dr. Overhage has developed and evaluated clinical decision support including inpatient and outpatient computerized physician order entry and the underlying knowledge bases to support them. He practiced general internal medicine for over 20 years including the ambulatory, inpatient and emergency care settings.

Over the last decade, Dr Overhage has played a significant regional and national leadership role in advancing the policy, standards, financing and implementation of health information exchange. He serves on the Health Information Technology Standards Committee as well as serving on the Board of Directors of the National Quality Form and being engaged in a number of national healthcare initiatives.

September 11 Panelists & Presenters

SMART-Enabled Platforms

MODERATOR

David Kreda

SMARTplatforms.org | Business Translation Consultant

David is an independent business and informatics consultant. He currently serves as the Translation advisor for the SHARP-III grant. Prior to his current work, he co-founded GivingCapital Inc., a software-as-a-services platform enabling financial advisors to sell and deliver asset-based charitable products. His earlier career was focused on financial modeling and trading systems at Reuters and SunGard, and analytical work at McKinsey & Co.

Joseph Dal Molin

e-cology corporation | President
WorldVistA | Chairman

Joseph is an internationally recognized expert in health IT, open innovation strategy, open source development and implementation, with over 25 years private/public sector experience which includes manager Digital Equipment Corp. (DEC) Canadian healthcare business, VP Stentor Innovation Centre, a joint venture, e-health business incubator of Canada's major telecom companies, and co-founder of WorldVistA. Joseph is a co-recipient of the 2007 Wired Magazine Rave Award Medicine recognizing the WorldVistA team's community building and contribution to the worldwide adoption of VistA.

Joseph's pioneering work in open source began in 1998, establishing the business plan and strategy for McMaster University's Dept. of Family Medicine very successful OSCAR primary care EHR and the European Commission funded SPIRIT collaborative. In 1999 He founded E-cology Corp., focusing on open innovation and open source strategy, clients include the OECD, Canada Health Infoway, US Centers for Medicaid, Industry Canada, and UCLA and Harvard Medical Schools and Hewlett Packard.

His accomplishments include leading the development and certification of WorldVistA EHR, advising on and facilitating open source adoption in health systems internationally in the UK Thailand, Iraq, Ireland, Malaysia and China. Joseph served as chief adviser to Jordan's Royal Hashemite Court and Electronic Health Solutions (EHS) nonprofit, helping design, incubate and implement Hakeem, Jordan's national open source, integrated e-health infrastructure programme. E-cology is currently under contract to Harvard to SMART-enable the US VA's highly acclaimed VistA EHR.

Travers Franckle

Boston Children's Hospital Informatics Program | Research Software Engineer

Travers Franckle is a Research Software Engineer at Boston Children's Hospital, and the Lead Architect of the Indivo X project. He has been developing software professionally for the past 7 years, and earned a B.S. in Neuroscience and Behavioral Biology and an M.S. in Computer Science from Emory University.

September 11 Panelists & Presenters

SMART-Enabled Platforms

Daniel Nigrin, MD, MS

Boston Children's Hospital | Senior VP for Information Services & CIO
Harvard Medical School | Assistant Professor

Daniel J. Nigrin, MD, MS, is the Senior Vice President for Information Services and Chief Information Officer at Children's Hospital Boston, Assistant Professor of Pediatrics at Harvard Medical School, a senior staff member of the Children's Hospital Informatics Program (CHIP), and an active and practicing member of the Division of Pediatric Endocrinology at Children's Hospital Boston.

Dr. Nigrin received his undergraduate and medical degrees from Johns Hopkins University in 1987 and 1991, respectively, and then pursued his pediatric residency training at Johns Hopkins Hospital, which he completed in 1994. He then did simultaneous fellowships in Pediatric Endocrinology at Children's Hospital Boston and in Medical Informatics through the Harvard-MIT Division of Health Sciences and Technology, receiving a Master's degree in Medical Informatics from the Massachusetts Institute of Technology in 1999. Dr. Nigrin joined the faculty of Harvard Medical School in 1995, and he is board-certified in Pediatrics and Pediatric Endocrinology.

Dr. Nigrin's research interests developed at CHIP include large-scale clinical data mining and electronic patient-physician communication systems. In 1998, he was awarded First Prize in the student paper competition at the American Medical Informatics Association (AMIA) Symposium, and in 2000, he was a finalist for Best Overall Paper at the AMIA Symposium. In 2005, Computerworld Magazine chose Dr. Nigrin as one of its 100 Premier IT Leaders. In 2010, HIMSS Analytics awarded Children's Hospital Boston a Stage 7 designation on its EMR Adoption Score.

Sims Preston

Polyglot Systems | CEO

Sims Preston is the CEO of Polyglot Systems, Inc., whose technology improves the quality and efficiency of healthcare by improving patient understanding. Prior to joining Polyglot, Sims spent fourteen years as a lawyer, both in private practice and as in-house counsel for some of the world's most dynamic and innovative companies. Sims was Associate General Counsel at Quintiles Transnational Corp., a leading provider of research services to the pharmaceutical industry, and was Senior Legal Counsel at Nuance Communications, Inc., a leading provider of voice recognition, text to speech, optical character recognition and other cutting edge technologies. Mr. Preston earned a BA from Columbia University and is a cum laude graduate of Duke University School of Law.

September 11 Panelists & Presenters

SMART-Enabled Platforms (cont.)

Nich Wattanasin

Partners Healthcare | Team Leader & Project Manager, Research Computing

Nich Wattanasin is currently involved in health and medical informatics research and technical operations at Partners HealthCare in Boston. As a team leader and project manager, he participates in the R&D of various health informatics initiatives such as Informatics for Integrating Biology and the Bedside (i2b2) an NIH National Center for Biomedical Computing, the Shared Health Research Informatics Network (SHRINE) consisting of a federated query tool connecting multiple i2b2 instances across the country, and the Substitutable Medical Apps Reusable Technologies (SMART) project as part of the ONC's Strategic Health IT Advanced Research Projects (SHARP) program. With a background in Computer Science, Biology, and IT Management, Nich is also an adjunct instructor at Brandeis University as part of its Health and Medical Informatics Master's degree program.

Carl Kesselman

University of Southern California | Professor

Apps, Meaningful Use and Accountable Care

MODERATOR

Kenneth Mandl

Ken Majkowski, Pharm.D

Surescripts | Vice President of Strategy and Innovation

Ken Majkowski Pharm.D, Vice President, Strategy and Innovation, Surescripts, LLC, has over 30 years of healthcare experience. Ken received his Bachelors in Pharmacy from Purdue University and his Doctor of Pharmacy from the University of Minnesota. He has experience in E-Health, Managed Care, Transplant Services, Pharmacy Mail Services, Medical Devices and Drug Delivery Systems, Home Infusion Therapy and Hospital and Retail Pharmacy.

At SureScripts-RxHub, Ken has served as Director of Product Management and Director of Account Management and Vice President of Business Development and Vice President of Clinical Affairs and Product Strategy prior to moving into his present role as Vice President of Strategy and Innovation.

Prior to joining RxHub, Ken was Director of Trade Relations and Director of Data Services for HealthNexis, the exchange funded by McKesson, Cardinal Health Systems, AmeriSourceBergen, and Fisher Scientific. Prior to HealthNexis, he was Vice President for Supplier Relations at Embion, an e-procurement service. Ken was also the Vice President for Medical Affairs at United Resource Networks, the Transplant Center of Excellence Division of United Health Group. He served as Director of Transplant Pharmacy Services at Chronimed, a nation wide specialty pharmacy and Director of Clinical Development at Pharmacia Deltec, a medical device company. Ken has 14 years of clinical pharmacy experience in retail, hospital and home care pharmacy.

September 11 Panelists & Presenters

Apps, Meaningful Use and Accountable Care (Cont.)

Joshua Mandel, MD

SMART Platforms | Lead Architect
Boston Children's Hospital Informatics Program | Research Faculty
Harvard Medical School | Instructor

Shawn Murphy, MD, PhD

Partners HealthCare Research Computing |Medical Director of Research Computing and Informatics
Harvard Medical School | Associate Professor
Massachusetts General Hospital |Associate Neurologist

Dr. Murphy is the Medical Director of Research Computing and Informatics at Partners HealthCare and is Associate Professor of Neurology at Harvard Medical School. He holds a Ph.D. in Pharmacology and Physiology from the University of Chicago. He completed his medical school training at the University of Chicago in 1991, and his residency in Neurology at the Massachusetts General Hospital in 1995. He completed a fellowship in Medical Informatics at the Massachusetts General Hospital Laboratory of Computer Science, where he serves as the Associate Director.

Dr. Murphy developed and currently directs the Research Patient Data Registry (RPDR) for Partners HealthCare. The RPDR is a large data warehouse with 5 million patients and 1.4 billion rows of clinical data, serving as a central clinical data registry for inpatient and outpatient encounters in order to support clinical research. The RPDR brings clinical information to the fingertips of over 2600 active researchers. Dr. Murphy is also the chief architect and software development manager for the NIH Sponsored Informatics for Integrating Biology and the Bedside (i2b2), an open source project that integrates data from the hospital medical record and the bioinformatics community into a common software platform, with over 60 operating installations worldwide. Dr. Murphy operates the pharmacovigilance platform at Partners HealthCare where the above tools are integrated into a shared resource for finding medication-based adverse events.

Jonathan Perlin, MD, PhD, MSHA, FACP, FACMI

Hospital Corporation of America | President, Clinical and Physician Services; Chief Medical Officer

Dr. Jonathan B. Perlin is President, Clinical and Physician Services and Chief Medical Officer of Nashville,
Tennessee-based HCA (Hospital Corporation of America). He provides leadership for clinical services and improving performance at HCA's 166 hospitals and more than 800 outpatient centers and physician practices. Current activities include implementing electronic health records throughout HCA, improving clinical "core measures" to benchmark levels, and leading patient safety programs to eliminate preventable complications and healthcare-associated infections.

Before joining HCA in 2006, "the Honorable Jonathan B. Perlin" was Under Secretary for Health in the U.S.

Apps, Meaningful Use and Accountable Care (Cont.)

Department of Veterans Affairs. Nominated by the President and confirmed by the Senate, as the senior-most physician in the Federal Government and Chief Executive Officer of the Veterans Health Administration (VHA), Dr. Perlin led the nation's largest integrated health system.

At VHA, Dr. Perlin directed care to over 5.4 million patients annually by more than 200,000 healthcare professionals at 1,400 sites, including hospitals, clinics, nursing homes, counseling centers and other facilities, with an operating and capital budget of over $34 billion. A champion for implementation of electronic health records, Dr. Perlin led VHA quality performance to international recognition as reported in academic literature and lay press and as evaluated by RAND, Institute of Medicine, and others.

Dr. Perlin has served previously on numerous Boards and Commissions including the National Quality Forum and the Joint Commission, and currently on the Boards of the American Hospital Association, National Patient Safety Foundation and Meharry Medical College. He chairs the U.S. HHS Health IT Standards Committee. Broadly published in healthcare quality and transformation, he is a Fellow of the American College of Physicians and the American College of Medical Informatics. Dr. Perlin has a Master's of Science in Health Administration and received his Ph.D. in pharmacology (molecular neurobiology) with his M.D. as part of the Physician Scientist Training Program at the Medical College of Virginia of Virginia Commonwealth University (VCU).

Recognized perennially as one of the most influential physician executives in the United States by *Modern Healthcare*, Dr. Perlin has received numerous awards including Distinguished Alumnus in Medicine and Health Administration from his *alma mater*, Chairman's Medal from the National Patient Safety Foundation, the Founders Medal from the Association of Military Surgeons of the United States, and is one of a dozen honorary members of the Special Forces Association and Green Berets.

Dr. Perlin has faculty appointments at Vanderbilt University as Adjunct Professor of Medicine and Biomedical Informatics and at VCU as Adjunct Professor of Health Administration. He resides in Nashville, Tennessee, with his wife, Donna, an Emergency Pediatrics Physician, and children, Ben and Sarah.

Claudia Williams

White House Office of Science and Technology Policy| Senior Advisor, Health IT

Claudia Williams is Director of the State Health Information Exchange Program in HHS's Office of the National Coordinator for Health IT where she leads ONC's efforts to enable health information exchange to support provider achievement of meaningful use and sustainable improvements in health and health care efficiency. In addition to her role at ONC, Claudia currently serves as the Health IT lead for the White House Chief Technology Officer. She came to ONC from the Markle Foundation where she was Director of Health Policy and Public Affairs and helped direct Markle Connecting for Health, a coalition of health care leaders from across the spectrum of perspectives including technology innovators, leading provider groups and consumer organizations who advance recommendations for using health IT to make rapid improvements in health care system performance. Prior to joining Markle, she directed the Synthesis Project for the Robert Wood Johnson Foundation, an initiative to inform key coverage, health market, public health and care delivery policy decisions with strong research evidence. She has also held senior positions at the Lewin Group and in the Office of the Assistant Secretary of Planning and Evaluation at HHS. Ms. Williams holds an MS in Health Policy from the Harvard School of Public Health and a BA from Duke University.

Attendees

Jonathan Baran

Madeline Barber Dal Molin

Brian Barnes

David Bates

Douglas Berman

Elmer Bernstam

Michael Brown

Narath Carlile

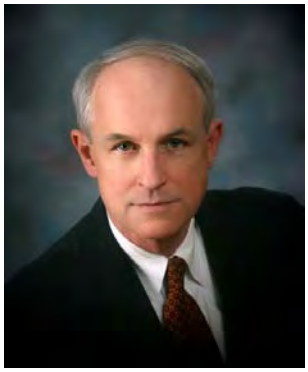
Simon Carr

Michael Coene

Mark Davenport

Marc Dumontier

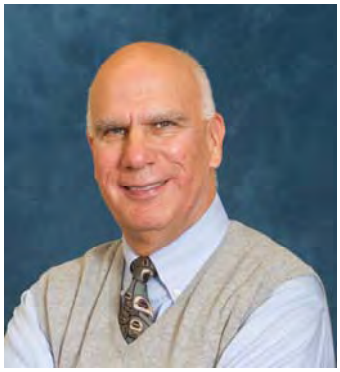
Ian Duncan



Frederic Ehrler

Lynn Etheredge

Charles Friedman

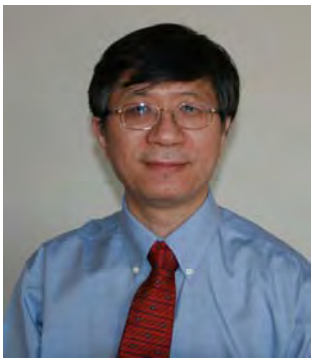


Attendees

Mark Frisse

Vincent Fusaro

Yaorong Ge



Douglas Gentile

Adrian Gropper

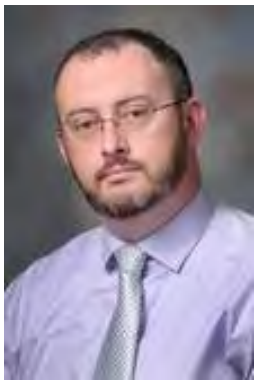
Claudia Grossmann

Barbara Grosz

Linda Hamill

Jim Hansen

Jorge Herskovic



Matthew Holt

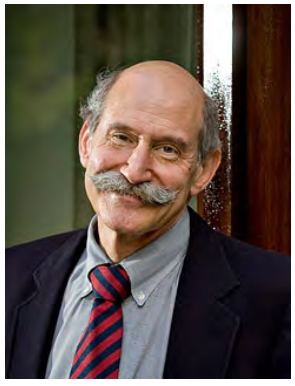
Sachin Jain

Eric Jamoom

Gerry King

Rob Kolodner

Ross Koppel



Attendees

Steve Krein

Thomas Krohn

Shannon Manzi

James Murray

Andy Oram

Christine Park

Jyotishman Pathak

Plamen Petrov

Pascal Pfiffner

Velumani Pillai

Doug Porter

Eric Prud'hommeaux

Edmond Ramly

Del Richmond

Douglas Rosendale

Will Ross

Attendees

Anubha Sant

Arjun Sanyal

Nikolai Schwertner

Avinash Shanbhag

Ed Shultz

Ali Sunyaev

Peter Szolovits

Manu Tandon

Patrick Taylor

Troy Trygstad

Joris Van Dam

Erick Von Schweber

Linda Von Schweber

Ann Waldo

Keeley Wray

Alan Yen

Attendee Profiles

Jonathan Baran

HealthFinch
Co-Founder & CEO
Jonathan@healthfinch.com 608-561-1844

Jonathan is the co-founder and CEO of healthfinch a Madison, WI based startup focused on building physician productivity apps for the electronic medical record. Jonathan has led healthfinch in the successful launch of the companies first product, Refill-Wizard as well as the raising of the companies first round of financing. Jonathan graduated with both his B.S. and M.S. from the University of Wisconsin—Madison's Biomedical Engineering Department.

Madeline Barber Dal Molin

e-cology
Consultant
WorldVistA
Secretary
madeline.joi@gmail.com 647-864-9393

As a volunteer executive with WorldVistA, Madeline has been involved in promoting the adoption of open source in healthcare for nearly ten years helping plan and implement numerous VistA community meetings across the US and currently serves as WorldVistA's Secretary. At E-cology, Madeline has assisted in business development, project administration and management on several initiatives including E-cology's efforts to SMART-enable VistA the Veterans Administration's open source EHR as part of the Harvard led SMART program. She also contributed to Jordan's successful adoption of WorldVistA EHR as the foundation for its national health system by helping adapt the VA's VistA EHR policy and procedures to the Jordanian context. Madeline has a strong interest in open source personally controlled health records and primary care EHRs and is currently providing consulting and program management services in these areas. Madeline is a graduate of the University of Waterloo's Honours Arts and Business co-op program.

Brian E. Barnes, MD

Vanguard Health Systems
VP of Growth & Innovation
brianedwardbarnes@gmail.com 615-870-8256

Brian is honored to work for Vanguard Health Systems (VHS), a nationwide health system with business operations in 6 states. VHS is a $4.9 Billion publicly traded organization with 28 hospitals and over 6 thousand beds. As VP, Growth & Innovation, Brian is responsible for the technology strategy and implementation of the growth platform. The platform is being created to help patients find facilities easier, access services more easily, and improve their overall health. Two primary drivers are behind the design: 1) increase patient engagement, and 2) increase physician alignment. Patient engagement is measured on several dimensions: ranging from growth in net new patients through targeted marketing, to insights derived from clinical analytics about risks, to improved health through closing gaps in care. Physician alignment is also measured on several dimensions: ranging from increased physician referrals to engagement with clinical decision support tools to drive evidence-based decisions. The key technology components of the platform include data integration, health information analytics, web and mobile services, and search engine optimization (SEO) components. The growth platform will serve both traditional inpatient services, outpatient services, as well as facilitate Accountable Care Organizations (ACOs) and population health services. On a personal note, Brian is an independent developer of mobile coaching apps for the iOS platform (iPhone and iPad). He also holds a 2nd degree Black Belt in Tae Kwon Do and is cross-trained in Brazilian Jiu Jitsu and Chi-Gong. He teaches self-defense on the weekends. His enduring love is his family.

Christopher Barwick

Marshfield Clinic
Senior Solutions Architect
barwick.christopher@marshfieldclinic.org
715-207-5297

Christopher Barwick is a Senior Solutions Architect at Marshfield Clinic in Marshfield, WI. He has spent most of his career in various roles as Software Engineer, Architect, Technical Lead and Project Lead building out large-scale data and analytics platforms in a variety of fields, including banking, financial services data, asset management, retail product data management, commercial real estate, brand strategy/integrated marketing, insurance, telecom and large manufacturing.
"It's about the patient." is the mantra that is the fo-

cus of the organization and the main reason for Mr. Barwick's move to Central Wisconsin. His focus is on many aspects of the Software Architecture including Real-Time Analytics, Data Warehousing, Data Platform, Data Instrumentation, Service Layers, iPad/ iPhone integration and various other activities. His personal goal is to continually improve information presentation, giving the provider the means to make more informed decisions throughout the Care Delivery Process.

David W. Bates, MD, MSc

Brigham and Women's Hospital
Chief Quality Officer & Senior VP
Partners Healthcare
Medical Director of Clinical and Quality Analysis
dbates@partners.org 617-732-5650

Dr. Bates is an internationally renowned expert in patient safety, using information technology to improve care, quality-of-care, cost-effectiveness, and outcomes assessment in medical practice. He is a Professor of Medicine at Harvard Medical School, and a Professor of Health Policy and Management at the Harvard School of Public Health, where he co-directs the Program in Clinical Effectiveness. He directs the Center for Patient Safety Research and Practice at Brigham and Women's Hospital, and serves as external program lead for research in the World Health Organization's Global Alliance for Patient Safety. He is the president-elect of the International Society for Quality in Healthcare (ISQua). He is also the Associate Editor of the Journal of Patient Safety. He has been elected to the Institute of Medicine, the American Society for Clinical Investigation, the Association of American Physicians and the American College of Medical Informatics, and was chairman of the Board of the American Medical Informatics Association. He has over 600 peer-reviewed publications.

Douglas Berman

UC San Francisco
Douglas.Berman@ucsf.edu 415-502-0184

Douglas Berman is the Deputy Director for Academic Research Systems at The University of California San Francisco. Academic Research Systems provides research environments , tools and access to clinical data supporting researchers campus-wide.
Doug has held a variety of healthcare information technology positions for over 20 years with a focus on Electronic Health Records, data warehousing, analytics and reporting. He has a Bachelor's degree from the State University of NY at Binghamton and Master's degree from MIT's Operations Research Center.

Elmer V. Bernstam, MD

University of Texas Health Science Center, Houston
Professor of Biomedical Informatics & Internal Medicine
elmer.v.bernstam@uth.tmc.edu 713-500-3900

Elmer Bernstam is Professor of Biomedical Informatics and Internal Medicine at the University of Texas Health Science Center at Houston. Dr. Bernstam heads the clinical informatics focus at the School of Biomedical Informatics (SBMI) at Houston and the Biomedical Informatics component of the Center for Clinical and Translational Sciences (UT-Houston CTSA program). His research has been funded by the National Institutes of Health, Robert Wood Johnson Foundation (Health-e-Technologies Initiative), the Medical Letter, the University of Texas System (Patient Safety research program) and other agencies. Current research projects focus on translational biomedical informatics, consumer informatics and information retrieval. In addition to his MD, Dr. Bernstam holds Master's degrees in computer engineering and biomedical informatics. He completed a National Library of Medicine post-doctoral fellowship in informatics at Stanford Medical Informatics. Dr. Bernstam maintains an active clinical practice as a hospitalist.

Michael Brown, MD, MPH

Harvard University Health Services
Chief Information Officer
mbrown@uhs.harvard.edu 617-495-2890

Michael is the Chief Information Officer at Harvard University Health Services (HUHS) where he oversees the university health service information system department. HUHS has completed a transition of its ambulatory medical record to an electronic medical record system, and he is working within his organization to take full advantage of the new technologies. The EMR system that was originally developed at HUHS is now at use in over 150 other universities.
Michael is an instructor at the Harvard School of Public Health where he teaches an IS course to senior physician executives and advises students in their management practicum projects.
Michael graduated with B.S. in Natural Sciences from the Johns Hopkins University. He has a M.S. (Cell Biol-

Attendee Profiles

ogy) and an M.D. degree from New York University. He completed his internship in Internal Medicine at Scripps Clinic in San Diego, and performed a two year research fellowship at the Scripps Research Institute. In June '07, he completed a Masters in Health Care Management from the Harvard School of Public Health.

Narath Carlile, MD

Brigham and Women's Hospital
Senior Resident, Internal Medicine, Global Health and Social Equity
narathc@gmail.com 617-510-4446

Narath is currently a senior resident in Internal Medicine, Global Health and Social Equity at Brigham and Women's Hospital, and an MPH candidate at Harvard's School of Public Health. Having grown up in Kwazulu-Natal, South Africa, Narath is interested in medical systems that extend services to people in need and quality improvement in healthcare, both through education and through the use of appropriate technologies. Prior to medical school, Narath trained as a software engineer, and co-founded and acted as Chief Technical Officer of an educational software company specializing in science education, where he developed a patented evaluation-based learning software engine as well as applications for various clients including the Government of Canada. In 2008 Narath was the first James Strickler Clinical Fellow at Muhimbili National Hospital (MNH) in Dar Es Salaam, Tanzania, sponsored by the Dickey Center Global Health Initiative. During his work at Muhimbili, he identified a need and devised systems for hand hygiene and a cell phone-based paging system (Open Cell Pager), both of which have since been implemented at the hospital. Narath was a student advisory board member for the IHI Open School, is a Schweitzer fellow, a member of the Gold Humanism in Medicine Honor society, and has received an AMA Excellence in Medicine award. Narath's goal is to help improve quality in healthcare using cost-effective, agile technology solutions, and is passionate about the possibilities for personalized health records and health apps to radically improve healthcare. His current master's work is focused on understanding and describing the diffusion of innovation in health care, and in global health settings in particular.

Simon Carr

University Hospitals of Leicester
Enterprise Applications Manager
simon.carr@uhl-tr.nhs.uk +44 790-519-2692

Enterprise Applications Manager for the University Hospitals of Leicester (UK), which is large acute NHS Trust. I am responsible for Clinical Applications Management, Application Development, Database Administration, Data Integration, elearning, Data Warehousing and Business Intelligence. We work very closely with the University of Leicester Biomedical Research Unit (BRU) in developing the www.brisskit.le.ac.uk suite of open source, integrated applications. The Leicester Cardiovascular BRU is specifically aimed at improving the diagnosis, prognosis and treatment of coronary heart disease and hypertension (high blood pressure). It provides an infrastructure – people, space and equipment – which allows researchers to complete challenging or complex projects in these conditions. In addition, the BRU hosts a dedicated research database using BRISSK IT components, the first of its kind in the UK, which is linked to a collection of blood samples from patient volunteers who have made their medical records available to researchers.

Michael Coene

US Food and Drug Administration
Chief Technology Officer
michael.coene@fda.hhs.gov 301-796-3005

Michael Coene is currently the Chief Technology Officer at the U.S. Food and Drug Administration. In this role, Michael is responsible for FDA's Workforce Mobility and Virtualization capabilities and evaluating new technologies and innovative approaches to enhance FDA's mission.

Michael has been at FDA since 1989 in many different roles. In December of 2011, he retired from the U.S. Public Health Service as a Captain and returned to FDA as a civil servant. He spent nearly two years as Deputy Chief Information Officer responsible for the overall operations of IT at FDA. He led the Application Development Division for six months, overseeing the development of over 200 applications. He was Deputy of Infrastructure for over one year responsible for keeping the 280+ locations all over the world online and modernizing the FDA infrastructure by implementing a private cloud. His first 18 years at FDA, he worked in the Center for Devices and Radiological Health in various roles managing and developing soft-

ware applications to support premarket, compliance, and post market programs.
He has led a team developing an iOS application to perform retail tobacco inspection; the application was developed in three months and has performed 50,000 inspections to-date. He has also developed applications for doing egg farm inspections using mobile technology that has improved efficiency by 50%.
During his career in the PHS, he was deployed several times for national emergencies. During Hurricane Katrina, he was responsible for providing logistical support for all the PHS missions in the state of Louisiana. During Hurricane Ike, he was stationed at College Station, Texas were he was responsible for providing logistical and IT support for running a 250 bed federal medical shelter and deploying a mobile EMR system for the first time during a emergency.
Michael has a M.S. in Computer Science from Johns Hopkins University and holds a B.S. in Electrical and Computer Engineering from Marquette University.
Michael's personal interests include being a husband and dad, playing competitive soccer, sailing, photography, and watching his children grow up and play sports.

Elaine Collier

NIH, National Center for Advancing Translational Sciences
ec5x@nih.gov 301-435-0794

Mark Davenport

Cerner Corporation
mark.davenport@cerner.com 785-969-4899

Mark joined Cerner Corporation as a Software Engineer with the Innovations group after acquiring his BS in Computer Science from University of Kansas. During the first year of employment he worked on developing new concepts around mobile and web based platforms called "MPages" for supporting better user interface, easier workflow and clinical decision support. Most of his work helped Cerner advance physician usability in ED and Inpatient Venues. In his new role Mark, leads an agile development team focusing on Medication Clinical Decision Support and MPages around Inpatient, ICU and ED venues.
He continues to work for the Innovations Development team within Cerner to contribute to the systemic improvement of health care delivery and the health of the community by pushing the boundaries of MPages.

Marc Dumontier, MD

McMaster University
marc@mdumontier.com 519-584-5601

Marc Dumontier has worked in the health informatics field for 11 years. Trained in Computer Science, he immediately went to work in the bioinformatics space, and worked on genomic and proteomic databases, focusing on developing solutions using large scale cluster based parallel computing. He went on to focus his efforts on developing the BIND molecular interaction database at Mt. Sinai Hospital in Toronto.
In 2005, Marc moved on to working on developing solutions in the health integration space with the CAISI group in Toronto under the guidance of Dr. Tomislav Svoboda; extending the OSCAR EMR. Since 2009, Marc has been working primarily on the OSCAR EMR, focusing his efforts on specialist customizations, and integrations.

Ian Duncan

Walgreens Company
VP, Clinical Outcomes & Analytics
University of California Santa Barbara
Professor
ian.duncan@walgreens.com 860-471-1081

Mr. Duncan is Vice President, Clinical Outcomes & Analytics at the Walgreens Company, responsible for Walgreens outcomes, research and publications, and custom analytics. He is an Adjunct Professor Actuarial Statistics at the University of California Santa Barbara, and an Adjunct Research Professor in the Dept. of Healthcare Administration at Georgetown University. He founded Solucia Consulting, a provider of analytical and consulting services to the healthcare financing industry in 1998 and retired in 2010. He has over 30 years of experience in healthcare and insurance product design, management, financing, pricing, and delivery.
Mr. Duncan holds a post-graduate degree in economics from Balliol College, Oxford, and is a fellow of the Society of Actuaries, the Institute of Actuaries (London) and the Canadian Institute of Actuaries. He is active in public policy and healthcare reform, and serves on the board of directors of the Commonwealth of Massachusetts Health Insurance Connector Authority, and the Advisory Board of Bryan University, Tempe AZ. He is the author of numerous peer-reviewed papers, and several books and book chapters. His latest book

Attendee Profiles

"Healthcare Risk Adjustment and Predictive Modeling" (Actex Publications) was published in May 2011.

Rachel Eastwood

SMART
Communications Manager
Rachel_eastwood@hms.harvard.edu 781-244-7288

Frederic Ehrler, PhD

Geneva University Hospitals
R&D Developer, Division of Medical Information Sciences
frederic.ehrler@hcuge.ch +41 223-728-697

Frederic Ehrler is an experienced health care IT professional specializing in system integration projects. He holds a PhD in computer science from the University of Geneva, Switzerland. His thesis focused on text mining on biomedical data. Since 2010, Frederic has been working as R&D developer in the Division of Medical Information Sciences of the Geneva University Hospitals (HUG). Research projects cover innovations related to the hospital's Clinical Information System. Prior to that Frederic held research assistant positions at the University of Geneva and at the HUG. He is currently looking for innovative ways to facilitate the access to patient information on mobile devices in order to improve patient care. For this purpose, he is also studying medical data representation and user interfaces.

Lynn M. Etheredge

George Washington University
Rapid Learning Project
lyneth1@mac.com 301-654-4185

Lynn Etheredge is an independent consultant on health care and social policy issues and heads the Rapid Learning Project at George Washington University. His career started at the White House Office of Management and Budget (OMB), where he was OMB's principal analyst for Medicare and Medicaid and led its staff work on national health insurance proposals. Lynn headed OMB's professional health staff in the Carter and Reagan administrations. Later, he was a co-author of the Jackson Hole Group's proposals for healthcare reform. In 2007, he proposed the concept of the "rapid-learning health system" and is collaborating widely in developing this approach. Lynn's recent publications include "Creating A High-Performance System for Comparative Effectiveness Research", and "Medicare's Future: Cancer Care". He serves on the editorial board of Health Affairs. He is author of more than 85 publications and is a graduate of Swarthmore College.

Charles Friedman

University of Michigan
Director, Health Informatics Program
cpfried@umich.edu 734-764-8058

Charles Friedman joined the University of Michigan last year as Professor of Information and Public Health, and Director of Michigan's new health informatics program. For the previous eight years, Dr. Friedman held several positions in the federal government, prior to which he served for 26 years as a university faculty member and administrator. Most recently, Dr. Friedman held executive positions at the Office of the National Coordinator for Health IT (ONC) in the U.S. Department of Health and Human Services. From 2007 to 2009 he was Deputy National Coordinator and from 2009 to 2011 he was ONC's Chief Scientific Officer. While at ONC, Friedman oversaw a diverse portfolio of nationwide activities that included development of a "learning health system"; health IT research and workforce development programs; clinical decision support; evaluation of ONC's programs; and international cooperation for eHealth. He was the lead author of the first national health IT strategic plan which was released in June of 2008 and the architect of an EU-US Memorandum of Understanding for cooperation in health IT.

From 2003 to 2006 he was a senior scholar at the National Library of Medicine and from 2006 to 2007, he served as an Associate Director of the National Heart, Lung and Blood Institute. He was part of the NIH team that created the program of National Centers for Biomedical Computing.

Prior to his work in the government, Dr. Friedman was Professor, Associate Vice Chancellor for Biomedical Informatics, and Founding Director of the Center for Biomedical Informatics at the University of Pittsburgh. He also served for many years in a range of faculty and administrative roles at the University of North Carolina at Chapel Hill. He directed UNC's Office of Educational Development and served as Assistant Dean for Medical Education and Medical Informatics.

Mark Frisse, MD, MSc, MBA

Vanderbilt University
Accenture Professor of Biomedical Informatics

Professor of Management
mark.frisse@vanderbilt.edu 615-720-7761
Mark Frisse is the Accenture Professor of Biomedical Informatics at the Vanderbilt University School of Medicine and Professor of Management at the Vanderbilt Owen Graduate School of Management. His work focuses on the intersection between health care informatics, economics, policy, and health care transformation. His service includes responsibilities coordinating informatics activities among regional hospitals and fostering effective health information exchange. His research is directed toward the potential contribution to economic sustainable health care through more effective use of health care information technology and formal methods for representing and enforcing privacy polices and patient preferences. His teaching focuses on graduate-level strategic consulting projects and the development of clinical informatics training programs.
In Tennessee, Dr. Frisse led the development and oversight of a six-year federal- and state-sponsored effort to create and operate a health information exchange for the greater Memphis area. Among other current responsibilities, he is the Director of the Project Management Office for a $19m CMS Innovation Award focused on care coordination.
Previously, Dr. Frisse has held leadership positions at Washington University, Express Scripts, and the First Consulting Group. At Express Scripts, he was Chief Medical Office and was responsible for their Practice Patterns Science division and the DrugDigest.org consumer Web site. In this capacity he helped found RxHub. At First Consulting, he led engagements in vendor selection, quality governance, physician IT leadership development, and clinician governance.
Dr. Frisse is a board certified internist trained in hematology-oncology. He was trained at the University of Notre Dame (BS), Washington University (MD, MBA), and Stanford University (MSc, Medical Information Science).

Vincent Fusaro, PhD

Harvard Medical School Laboratory for Personalized Medicine
NLM Fellow
vfusaro@hms.harvard.edu 617-519-1502
Dr. Vincent A. Fusaro is a senior member of the Laboratory for Personalized Medicine at Harvard Medical School (HMS) and was recently awarded the highly prestigious "Pathways to Independence" K99/R00 grant to investigate drug repurposing using healthcare data. Most recently, Dr. Fusaro was a National Library of Medicine Fellow during his postdoctoral training at HMS. He has become an expert in biomedical cloud computing and frequently uses the cloud to accelerate translational research from whole genome sequencing to pharmacogenomics and clinical reporting. Previously, Dr. Fusaro performed his graduate research at the Broad Institute of MIT and Harvard working in both the Proteomics and Computational Biology Platforms. While there his research focused on novel computational methods to improve candidate protein biomarker validation using targeted mass spectrometry methods. He is well versed in machine learning, pattern recognition, and statistical analysis. Prior to graduate school, Dr. Fusaro worked at the National Cancer Institute with Drs. Lance Liotta and Emanuel Petricoin to develop computational algorithms to predict ovarian cancer using mass spectrometry-derived blood-based protein patterns. Dr. Fusaro has a successful track record of (co)writing 19 papers, has presented numerous posters at national conferences, and has given invited presentations across the United States and Japan.

Yaorong Ge, PhD

University of North Carolina at Charlotte
Associate Professor
yge@uncc.edu 704-687-1951
Yaorong Ge, PhD., is an Associate Professor in the Department of Software and Information Systems at University of North Carolina at Charlotte. He received his Ph.D. in Computer Science with a focus on medical imaging and imaging informatics from Vanderbilt University. He was a part of the imaging research group at Wake Forest University Health Sciences that initiated, advanced, and commercialized virtual colonoscopy, a minimally invasive technology for colorectal cancer screening. Dr. Ge also has strong experience in the healthcare IT industry. He co-founded a medical IT startup to commercialize virtual colonoscopy and radiology structured reporting technologies and grew it to more than 30 employees. After the startup was acquired by IDX Corporation/GE Healthcare, he directed three software development teams in the radiology information system division and gained first-hand experience inside a leading HIT vendor. Since returning to academia, Dr. Ge has been focusing on health informatics research with a special interest in

Attendee Profiles

integrating, standardizing, and sharing clinical data within and across enterprises for enhancing clinical research and health care. In a recent project, he lead the development of a patient-controlled platform for sharing imaging data across unaffiliated healthcare providers that respects both patient privacy and physician workflow.

Douglas Gentile, MD

Allscripts
Chief Medical Officer
Douglas.gentile@allscripts.com 802-238-1806

Dr. Gentile is Chief Medical Officer at Allscripts. In that capacity, he is responsible for driving clinical product strategy, working with both clients and internal development teams to deliver market leading solutions. Dr. Gentile did his undergraduate training at Duke University and received his MD from the Medical College of Wisconsin. Following residency training at the University of Rochester, he joined the faculty at Vanderbilt University in Emergency Medicine. In 1991, he was awarded a Hartford Foundation Fellowship to study health policy, and received a master's degree in business administration from the Stanford University Graduate School of Business. After business school, Dr. Gentile joined the Decision Support Group, where he led strategic and business planning. In 1996, he and several partners founded The Crucible Group, a venture capital group focused on early stage healthcare companies, where he developed the business plans for Sharepoint and IPC, the Hospitalist Company, Inc. (Nasdaq: IPCM) . After moving to Burlington, Vermont, Dr. Gentile joined IDX Systems Corporation as part of ChannelHealth, which was later acquired by Allscripts. Dr. Gentile is on the Steering Committee for the Markle Foundation, the HIT Policy Committee Governance Workgroup, the Bipartisan Policy Center Collaborative on Health IT and Delivery System Reform, and the iHealth Alliance PatientConnect Advisory Committee. He continues to practice Emergency Medicine part time at Fletcher Allen, the main teaching hospital of the University of Vermont College of Medicine.

Adrian Gropper, MD

HealthURL.com
Principal
agropper@healthurl.com 617-500-3396

Dr. Gropper is a pioneer in web-based health records. He holds an engineering degree from MIT and an MD form Harvard Medical School. He began work on telemedicine and picture archiving and communications systems (PACS) with Massachusetts General Hospital in the early 90's later founding AMICAS as the first Web-based PACS and the first to provide direct links to diagnostic imaging in electronic health records. In 2004, he founded MedCommons for image-enabled patient controlled health records supporting all of a patient's caregivers.

Dr. Gropper consults on medical devices and is an active advocate for patient-centered and patient controlled health IT. Historical, standards participation includes IHE, HITSP, Liberty Alliance, CCR and the ONC Direct project and the Markle Foundation where he was responsible for the open authorization best practice in Blue Button.

Current affiliations include state and national activity. Dr. Gropper contributed patient-access provision to the recently enacted MA payment reform law, serves on the MA HIE and the MA Medical Society HIT Committee. National participation includes Direct Project and S&I RHEx standards, Collaborative Health Consortium, The Society for Participatory Medicine and Patient Privacy Rights.

Claudia Grossmann, PhD

Institute of Medicine
Senior Program Officer, Roundtable on Value and Science-Driven Health Care
cgrossmann@nas.edu 202-334-3867

Claudia Grossmann is a Senior Program Officer with the Institute of Medicine's Roundtable on Value and Science-Driven Health Care. Since coming to the Roundtable in 2009, Dr. Grossmann has supported the Roundtable's work in the areas of Clinical Effectiveness Research and Health Information Technology. Previously she served as Program Evaluator at the California Breast Cancer Research Program, where she directed evaluation and strategic planning efforts. Dr. Grossmann holds a PhD in Biomedical Sciences from the University of California, San Francisco and B.A. in Biology with concentrations in Molecular Biology and Microbiology from Washington University in St. Louis.

Barbara J. Grosz

Harvard University
Higgins Professor of Natural Sciences, School of Engineering and Applied Sciences
grosz@eecs.harvard.edu 617-495-3673

Barbara J. Grosz is Higgins Professor of Natural Sciences in the School of Engineering and Applied Sciences at Harvard University. From 2007-2011, she served as interim dean and then dean of Harvard's Radcliffe Institute for Advanced Study, and from 2001-2007 she was the Institute's first dean of science, designing and building its science program. Grosz is known for her seminal contributions to the fields of natural-language processing and multi-agent systems. She developed some of the earliest computer dialogue systems and established the research field of computational modeling of discourse. Her work on models of collaboration helped establish that field and provides the framework for several collaborative multi-agent and human-computer interface systems. Grosz is also known for her leadership in the field of artificial intelligence and her role in the establishment and leadership of interdisciplinary institutions, and she is widely respected for her contributions to the advancement of women in science.

Grosz is a member of the National Academy of Engineering, the American Philosophical Society, and the American Academy of Arts and Sciences and a fellow of the Association for the Advancement of Artificial Intelligence (AAAI), the Association for Computing Machinery, and the American Association for the Advancement of Science. In 2009, she received the ACM/AAAI Allen Newell Award for "fundamental contributions to research in natural language processing and in multi-agent systems, for her leadership in the field of artificial intelligence, and for her role in the establishment and leadership of interdisciplinary institutions."

Linda Hamill

CMS Center for Clinical Standards & Quality
Technical Advisor
linda.hamill@cms.hhs.gov 410-786-0070

Ms. Linda Hamill is a technical advisor for the Center of Clinical Standards and Quality (CCSQ) at the Centers for Medicare & Medicaid Services (CMS). CCSQ is responsible for all quality measures for CMS, value-based purchasing programs and quality improvement programs in all 50 states. Her focus is to align technology with business goals and provide improvements to service delivery, standardization, security and systems performance. Ms. Hamill provides guidance and expertise for new software development initiatives and infrastructure modernization efforts.

Ms. Hamill began her Federal career with the National Security Agency (NSA) in 1979 and supported various IT initiatives in communications, Internet technology and cryptology. Before leaving NSA, Ms. Hamill led several new technology initiatives funded by the Advance Research Program.

Ms. Hamill has a Bachelor of Science in Computer Science from University of Maryland and maintains active membership as a Certified Information Systems Security Professional (CISSP).

Jim Hansen, MBA

Dossia Consortium
Vice President & Executive Director
Jim.Hansen@DossiaConsortium.org
617-528-8280

Jim Hansen serves as Vice President and Executive Director of the Dossia Consortium, a not-for-profit association that brings together major employers - including AT&T, Intel, Walmart and Vanguard Health Systems - representing over five million employees, dependents and retirees to promote the effective use of health information technology to improve the safety, quality and efficiency of health and health care.

Mr. Hansen possesses 30 years of information technology, strategic planning, product development, marketing, operations and finance experience including 20 years within the health care industry. Prior to joining the Dossia Consortium, he was founding President and CEO of CareEntrust, an award-winning not-for-profit employer-sponsored health information exchange delivering secure regional health record services for use by both consumer/patients and health care providers. Prior to CareEntrust, he successfully launched the global IDC Health Industry Insights research and analysis business unit. As a member of the First Consulting Group (now CSC) Emerging Practices team, Mr. Hansen created and published thought leadership points of view on next generation health delivery and health plan models, roadmaps and associated IT infrastructure. In the field, he led and actively participated in a wide variety process redesign and automation, system development, system selection, EHR implementation, product design and eHealth strategy initiatives.

Mr. Hansen is actively involved in a number of national health and health care transformation supporting organizations including the Institute of Medicine (multiple groups, co-authored recent paper), Bipartisan Policy Center's Task Force on Health Delivery Transformation, HIT Standards Committee Patient Engagement Power

Attendee Profiles

Team, Center for Health Value Innovation, Patient-Centered Primary Care Collaborative, ONC S&I Framework Transitions of Care workgroup, Markle Foundation, eHealth Initiative, National eHealth Collaborative and most recently DirectTrust. He was previously a long time working member of the Healthcare Information Technology Standards Panel (HITSP). Mr. Hansen holds BS Business Administration (Information Management emphasis) and MBA degrees from the University of Colorado.

Eric Hanson

Veteran's Health Administration
Eric.hanson3@va.gov 703-627-1958

Jorge Herskovic, PhD

MD Anderson Cancer Center
Pan-Sharp Lead
jrherskovic@mdanderson.org 832-380-5976

Dr. Herskovic holds a PhD in Health informatics from The University of Texas Health Science Center at Houston and is a researcher specializing in clinical information extraction and data mining of clinical records. Dr. Herskovic's current work is in research information extraction and analysis at The University of Texas MD Anderson Cancer Center along with providing expertise to the SHARPC visualization team. As part of his SMART and SHARPC efforts, Dr. Herskovic leads the Pan-SHARP project.

Matthew Holt

Health 2.0
Co-Chairman
The Health Care Blog
Author
matthew@health2con.com 650-218-4002

Matthew Holt has spent around 20 years in health care as a researcher, generalist forecaster, and strategist. He learned from some of the best in forecasting, policy and survey organizations, like Institute for the Future and Harris Interactive. But these days he's best known as the author of The Health Care Blog and as Co-Chairman of Health 2.0. For that he's been mostly self-taught!

Sachin Jain, MD, MBA

Merck and Company
Harvard Medical School
Boston VA Medical Center
sachin.jain@merck.com 617-901-7000

Sachin H. Jain is Vice President and Chief Medical Information and Innovation Officer at Merck and a Lecturer in Health Care Policy at Harvard Medical School. He also serves as an attending hospitalist physician at the Boston VA-Boston Medical Center.

Previously, Jain was senior advisor to Donald M. Berwick, Administrator of the Centers for Medicare and Medicaid Services (CMS), where he helped lead the launch of the Center for Medicare and Medicaid Innovation that was chartered by Section 3021 of the Patient Protection and Affordable Care Act, briefly serving as its first Acting Deputy Director for Policy and Programs. As a senior advisor to Berwick, Jain had advocated for speedier translation of health care delivery research into practice and an expanded use of clinical registries.

Jain also served as Special Assistant to the National Coordinator for Health Information Technology at the Office of the National Coordinator for Health Information Technology (ONC). At the ONC, Jain worked with David Blumenthal to implement the HITECH Provisions of the Recovery Act and to achieve broader alignment between health plans and federal meaningful use policies and enhance electronic health record usability. He also led private sector engagement efforts on behalf of ONC.

Jain received his undergraduate degree magna cum laude in government from Harvard College; his medical degree from Harvard Medical School; and his master's degree in business administration from the Harvard Business School. He was a recipient of the Paul and Daisy Soros Fellowship and the Dean's Award. He completed his residency in internal medicine at Brigham and Women's Hospital, where he was honored with the Resident Mentor Award.

Jain is a founder of several non-profit health care ventures including the Homeless Health Clinic at UniLu; the Harvard Bone Marrow Initiative; and Improve-HealthCare.org. He worked with DaVita-Bridge of Life to bring charity dialysis care to rural Rajasthan, India and Medical Missions for Children to bring cleft lip and palate surgery to the region.

He previously maintained a faculty member at Harvard Business School's Institute for Strategy and Competitiveness and worked with strategy professor Michael Porter on his global health agenda and on a new case literature on health care delivery innovation. He presently serves as an honorary Senior Institute Associate at the Institute.

Jain has worked previously at WellPoint, McKinsey & Co, and the Institute for Healthcare Improvement. He has also served as an expert consultant to the World Health Organization.
Jain has authored over 50 publications on health care delivery innovation and health care reform in journals such as the New England Journal of Medicine, JAMA, and Health Affairs. His work has been cited in the New York Times, CNN, the Wall Street Journal, and other media outlets. The book he co-edited with Susan Pories and Gordon Harper, "The Soul of a Doctor" has been translated into Chinese.
A native of Bergen County, New Jersey, he now resides in Boston, Massachusetts.

Eric Jamoom, PhD

National Center for Health Statistics
Senior Service Fellow
ejamoom@cdc.gov 301-458-4798

Dr. Eric Jamoom is a senior service fellow with the Centers for Disease Control and Prevention's National Centers for Health Statistics within the Division of Health Care Statistics. Since 2010, Dr. Jamoom is the lead scientist on the physician workflow survey, a 3 year longitudinal survey to investigate the barriers, impacts, and experiences physicians are having with EHR adoption.
Dr. Jamoom has presented at national conferences and refereed journals on the topics of disability, mental health and chronic disease, EHR adoption, physician behavior, and other areas of health services research.
Dr. Jamoom received a masters in medical genetics from the University of Minnesota and received his Ph.D. in health services research as well as his MPH in Management and Policy from the University of Florida.

Gerry King

SURVEYOR Health Corporation
VP of Business Development
gking@surveyorhealth.com 877-797-8783 x106

Gerry King joined SURVEYOR Health in October of 2011 as VP Business Development. He brings a wealth of expertise selling disruptive technologies and is focusing on direct sales and channel development for the professional version of MedRiskMaps and their use in Medication Therapy Management.
A dynamic, results-driven Leader with comprehensive expertise building and managing high performance sales and services teams in growing and emerging markets, Gerry has also demonstrated success in all aspects of: client engagement; revenue generation; contract negotiations; services delivery and business operations. He has international experience representing a range of technology, information services and analytics to life science, healthcare, financial services and telecommunications industries. Known for the ability to attract, retain and lead high quality talent, empowering teams to execute strategy and deliver results he is a respected change agent with exceptional leadership, communications and influence skills.
Most recently, from 2005 to 2011 he was at IMS Health as the General Manager, West Region & US Leadership Council Member. He managed $100+M budget and 50 staff delivering thought leadership and innovative solutions to the global BioPharma/Life Sciences industry through timely market insights, consulting, analytics and services.

Robert M. Kolodner, MD, FACMI

Open Health Tools, Inc.
Executive VP & Chief Health Informatics Officer
rob@openhealthtools.org 443-864-2004

Robert M. Kolodner, MD is co-founder and President of Collaborative Transformations, LLC, and also serves as the Executive Vice President and Chief Health Informatics Officer for Open Health Tools, Inc. (OHT), a multinational, non-profit organization dedicated to improving the health of people through the transformation of health information technologies (IT) for personal health, health care delivery, and population health. In these two roles, Dr. Kolodner is continuing his work to improve the health and wellbeing of individuals and communities worldwide by facilitating the widespread use and rapid, collaborative evolution of health IT tools and solutions.
Dr. Kolodner's 31 years of Federal service and leadership include serving as the National Coordinator for Health IT, the President's designated lead for the United States eHealth initiatives, and as the key clinical champion in the U.S. Department of Veterans Affairs (VA) providing vision, direction, and effective leadership for VA's award-winning suite of health IT solutions, including My HealtheVet, a Personal Health Record for veterans, and VistA – the world's first successful large-scale Electronic Health Record implementation. His VA activities also included research and teaching, with clinical faculty appointments at Emory University, the University of Texas Southwestern Medical Center, and the University of Maryland.

Attendee Profiles

Dr. Kolodner received his A.B. from Harvard, M.D. from Yale, and completed his medical internship at New England Deaconess Hospital (now Beth Israel Deaconess Medical Center) and his psychiatric residency at Washington University in St. Louis. Dr. Kolodner is board certified in psychiatry and is a Fellow in the American College of Medical Informatics.

Ross Koppel, PhD

University of Pennsylvania
Professor
rkoppel@sas.upenn.edu 215-576-8221

Ross Koppel, Ph.D. is a leading scholar of healthcare IT, of the interactions of people, computers and workplaces, with a special interest in workarounds. His articles in JAMA, JAMIA, Health Affairs, NEJM, etc. are considered seminal works in the field. Professor Koppel is on the faculty of the Sociology Department, University of Pennsylvania and on the faculty of the Medical School at UPenn, where he is the Principal Investigator of the Study of Hospital Workplace Culture and Medication Error. Dr. Koppel is also the Internal Evaluator of Harvard Medical School's project to create a new HIT architecture. Ross Koppel is co-investigator of the National Science Foundation Project on Safe Cyber Communication and Smart Alerts in Hospitals. He is also Chair of the Evaluation Working Group and a member of the Usability Task Force of the American Medical Informatics Association.

Professor Koppel focuses on the use of computer system in situ. His work combines ethnographic research, extensive statistical analysis, surveys, and usability studies. Recently he coauthored the AHRQ Guide to reducing unintended consequences of HIT, www.ucguide.org. His newest book, First Do Less Harm: Confronting the Inconvenient Problems of Patient Safety (Cornell Univ. Press, 2012) was published this May.

Steven Krein, JD

StartUp Health
CEO
steve@startuphealth.com 917-903-4288

Steven Krein is the Co-founder and CEO of StartUp Health, an Academy to inspire, educate, and provide resources for entrepreneurs to build sustainable health and wellness companies. Steven is on a mission to accelerate technology innovations in health and wellness that help lower the costs and improve the quality of health care in our country. The firm was founded on the belief that successful health and wellness companies are the result of passionate entrepreneurs, an early focus on customer validation and great coaching and guidance. Steven is also co-founder and CEO of OrganizedWisdom, a Digital Doctor's Office and Patient Portal that helps doctors save time, grow their practice, and improve their online presence.

Steven was previously co-founder, Chairman, and CEO of Webstakes and Promotions.com, a global online advertising, direct marketing, and technology company. He took the company public on the Nasdaq prior to being acquired by iVillage. In under four years, the company built a membership base exceeding 20 million consumers, raised nearly $100 million, and achieved a $500 million market capitalization. Steven began his online career with Law Journal Extra!, now known as Law.com, the first online legal news and information website, which was acquired by American Lawyer Media.

Steven received his J.D. degree from Widener University School of Law, and B.A. degree from the University of Maryland-College Park. Steven is a member of YPO (Young Presidents' Organization) Metro New York Chapter and lives in New York City with his wife and three daughters.

Thomas Krohn, MBA

Eli Lilly and Company
Director, Clinical Open Innovation
krohnta@lilly.com 317-651-8923

Tom Krohn is the Director of Clinical Open Innovation, a transformation initiative in the Lilly Research Labs R&D department. Tom is responsible for leading a high-performance team in bringing open innovation methods into the development phase of drug development. More information is available at www.lillycoi.com. Prior to assuming his current role, Tom was the business lead for a large, co-development program for transforming the clinical planning and trial design process through the use of computer-aided-design and predictive analytics. Tom has also held leadership positions in the IT organization of Lilly including architecture, portfolio and strategy roles with leadership roles in programs for data management, statistics, and global clinical portfolio management.

Prior to Lilly, Tom has served in pharmacy roles in both hospital and retail settings. The bulk of Tom's pre-Lilly experience is in the developing world where he lived

and worked 10 years in Madagascar in sustainable healthcare delivery system development. His time in Africa, both Madagascar and consulting to other organizations throughout Sub-Saharan Africa, was instrumental in shaping his views on the power of community, engaged colleagues and innovation. Working in the local language and culture of Madagascar, Tom helped grow a small faith-based organization, SALFA, to become the largest healthcare provider in the country, during which time he served as pharmaceutical production lead, information system lead, CFO and ultimately General Manager.
Tom's education is a pharmacy degree from North Dakota State University and an MBA from the University of Texas at Austin. Tom remains active in consultation roles for international healthcare development including serving as a board member of the Serving Others Abroad (SOA) organization.

Shannon Manzi, PharmD

Boston Children's Hospital
Director, Clinical Pharmacogenomics
shannon.manzi@childrens.harvard.edu 617-355-2837

Shannon is currently the Director of the Clinical Pharmacogenomics Service at Children's Hospital Boston. She is also the team leader for Emergency and Combined Services in the Department of Pharmacy. She graduated from the University of Rhode Island's PharmD program in 1996. She has practiced pediatric pharmacy for over 16 years, and pediatric emergency pharmacy for 11 years. Shannon formerly chaired the Adverse Drug Events Committee for the hospital for ten years and assisted with the implementation and refinement of the hospital EMR system. She has served as a pediatric expert for the review of Strategic National Stockpile content and actively participates in the Massachusetts SNS working group. She served as a consultant for the CDC National Advisory Committee on Children and Terrorism and as a consultant for the Health Alert Network (HHAN), MADPH. She is actively working with EMS-C and the Artemis Project to improve pediatric safety in EMS and the Emergency Department, and recently participated in a several national NDMS and ASPR meetings focused on children in disasters.

Shannon is also the Chief Pharmacist for the MA –1 Disaster Medical Assistance Team and has deployed multiple times, including responses to Biloxi MS and New Orleans LA during Hurricane Katrina LA, Hurricane Gustav LA, Hurricane Ike TX Red River Floods ND and the earthquake in Haiti. She holds clinical adjunct faculty positions at Northeastern University, Massachusetts College of Pharmacy and Allied Health Sciences, and the University of Connecticut. She has published several articles on pediatric emergency medicine topics and co-authored two reviews of pediatric disaster medicine post-Hurricane Katrina. Shannon has contributed to several textbooks and served as co-editor for Pediatric Signs and Symptoms (Lippincott 2005). She has presented several national and local workshops and lectures on pediatric and disaster related topics. She has supported several grant awardees including and AHRQ R01 (Porter 2004 -6), AHRQ R01 (Reis 2010-11), and Strategic Health IT Advanced Research Projects (SHARP) Program (Mandl/Kohane 2010-14).

Keith Marsolo

Cincinnati Children's Medical Center
keith.marsolo@cchmc.org 513-390-8955

Michael McCoy

University of Southern California
mike.mccoy@usc.edu 310-422-2582

James Murray

CVS CareMark/ Minute Clinic
CIO & VP, Information Technology
JMurray@cvs.com 401-770-6501

James Murray is Vice President, Information Technology for MinuteClinic at CVS/Caremark. He is responsible for the all systems and solutions to support over 600 walk in medical clinics. Mr. Murray works to support a medical practice of over 1900 providers by enabling the efficient use of technology in the clinical setting. MinuteClinic maintains a strong focus on collaboration with medical systems in the communities we serve. The integration of medical records with their affiliate institutions across the country helps to improve continuity of care and enable communication around all aspects of a patient's care.
Mr. Murray has nearly 20 years experience in Healthcare Information Technology beginning his career as an application developer for the Department of Surgery at Brigham and Women's Hospital in Boston, MA. Mr. Murray moved on to technical management at Brigham and Women's Physicians Organization prior to accepting a role of Corporate Manager

Attendee Profiles

of Support and Technology Innovation at Massachusetts General Hospital and the Massachusetts General Physicians Organization. While working at MGH, he led teams supporting patient scheduling and billing systems as well as the development and deployment of a variety of software including mobile solutions for physicians and ambulatory patient tracking. Mr. Murray moved on to work for Partners Healthcare corporate Information Systems as a Technology Architect. Mr. Murray is a member of the Board of Directors for eHealth Initiative in Washington, D.C. He holds a degree in economics from the University of Nebraska and is a 2009 graduate of the Society of Information Management Regional Leadership Forum.

Marc Natter, MD

Boston Children's Hospital Informatics Program
marc.natter@childrens.harvard.edu
857-218-3531

Andy Oram

O'Reilly Media
Editor
andyo@oreilly.com 617-499-7479

Andy Oram is an editor at O'Reilly Media, a highly respected book publisher and technology information provider. An employee of the company since 1992, Andy currently specializes in open source, software engineering, and health IT, but his editorial output has ranged from a legal guide covering intellectual property to a graphic novel about teenage hackers. His work for O'Reilly includes the influential 2001 title Peer-to-Peer, the 2005 ground-breaking book Running Linux, and the 2007 best-seller Beautiful Code. Andy also writes often for O'Reilly's Radar site (http://radar.oreilly.com/) and other publications on policy issues related to the Internet and on trends affecting technical innovation and its effects on society. Print publications where his work has appeared include The Economist, Communications of the ACM, Copyright World, the Journal of Information Technology & Politics, Vanguardia Dossier, and Internet Law and Business. Conferences where he has presented talks include O'Reilly's Open Source Convention, FISL (Brazil), FOSDEM, and DebConf. His web site is http://www.praxagora.com/andyo/

Christine Park

Mirth Corporation
Project Manager
christinep@mirthcorp.com 949-255-6434

After 5 years working as a project manager in web and software development firms, Christine joined Mirth Corporation as a project manager. She currently oversees the SMART platform project.

Jyotishman Pathak, PhD

Mayo Clinic
Associate Professor of Biomedical Informatics
pathak.jyotishman@mayo.edu 507-538-8384

Dr. Pathak is an Associate Professor in Medical Informatics at the Mayo Clinic College of Medicine. He joined Mayo in 2007 with several years of experience in biomedical ontologies, semantic data integration and information extraction, and has played important leadership roles in two large-scale initiatives—the Electronic Medical Records and Genomics (eMERGE) and Strategic Health IT Research Project (SHARP) projects—which have pioneered techniques for high-throughput phenotyping from electronic health records (EHRs). His current research focuses on secondary uses of EHR data for clinical and healthcare delivery research, integration of genomic data within EHRs, and clinical decision support systems for personalized therapeutics. Dr. Pathak received his Ph.D. in Computer Science from Iowa State University (2007) and a B. Eng. in Computer Science and Engineering from National Institute of Technology, Jamshedpur, India (2002). He is the recipient of Iowa State University Graduate Research Excellence Award and Mayo Clinic Early Career Development Award in 2007 and 2010, respectively.

Plamen Petrov

Blue Cross Blue Shield Association
Executive Director, Architecture & Chief Enterprise Architect
plamen.petrov@bcbsa.com 312-297-5688

Plamen Petrov serves as Executive Director of Architecture & Chief Enterprise Architect for the Blue Cross Blue Shield Association (BCBSA), a national federation of 38 independent, locally operated Blue Cross and Blue Shield companies. At the enterprise architecture level Plamen's responsibilities include the overall architectural leadership, governance, standards and processes across BCBSA. At the technical architecture level Plamen's responsibilities include conceptualizing, defining, specifying and overseeing the architectures of ma-

jor transactional, informational and analytical systems and platforms. Additionally, Plamen's responsibilities include technology innovation, new technology assessment, selection and introduction.
In his current role Plamen collaborates closely with peer architects at the 38 Blue Cross and Blue Shield companies to ensure system-wide interoperability and integrity. Plamen chairs the Architecture Advisory Group (AAG) where architects from the Blue Cross and Blue Shield companies ensure that technology and information assets are architected properly to support the business needs across the system of Blue Plans.
Outside of his corporate responsibilities at BCBSA Plamen teaches part-time graduate-level Computer Science courses in Software Architecture, Service Oriented Architecture, Software Testing, and Enterprise Architecture at both Loyola University Chicago and DePaul University. Throughout his career Plamen has held both senior technical and management positions in a variety of industries and at diverse companies such as Convergys, Motorola, Sun Microsystems, and United Airlines.
He holds a Master of Engineering Management degree from Northwestern University, a Master of Science degree in Computer Science from Loyola University Chicago and a Bachelor's degree in Computer Engineering and Computer Science from Technical University of Sofia. He has completed executive professional development work at Kellogg Graduate School of Management at Northwestern University and at Carnegie Mellon University.

Pascal Pfiffner, MD, PhD

Boston Children's Hospital Informatics Program
Postdoctoral Research Fellow
pascal.pfiffner@childrens.harvard.edu
617-396-7274

Pascal Pfiffner is a postdoctoral research fellow at Children's Hospital Informatics Program. After completing an MD-PhD in immunology and bioinformatics in Bern, Switzerland, he joined the Indivo and SMART groups at CHIP. Focusing on mobile aspects of these web-based services he is currently working on native iOS frameworks, both to build native mobile apps for evaluation in a clinical setting and to enable external developers to build apps native against SMART and Indivo.

Velumani Pillai

Pfizer, Inc.
Senior Director, Pfizer Integrated Health
velumani.pillai@pfizer.com 908-901-6303

Velumani (Lou) Pillai is the Head of Technology & Product Engineering for Integrated Health business at Pfizer, focused on innovative healthcare platforms.
In this role he drives technology strategy, product technology innovation, and sourcing for timely development and operation of tools, services, solutions within rapidly evolving health ecosystems.
His interests and expertise include all aspects of applying technology to solve real problems, and is passionate about improving healthcare.
Lou holds an M.S. (Technology) in Instrumentation with 25 years of experience in the Pharma and Consumer Product Industries.
Lou is an active member international standards related to mobile Health, health data interoperability, manufacturing science, product serialization and product data.
He has published two books and several papers. In his spare time, he coaches robotics teams, mentors startups and hikes national parks.
Pharmaceutical Manufacturing honored Lou's team with 2006 Team of the Year, Catalyst Award for advancing the science technology in Pharmaceutical Manufacturing.

Doug Porter

Blue Cross and Blue Shield Association
Senior VP &CIO
doug.porter@bcbsa.com 312-297-5671

Doug Porter serves as Senior Vice President of Operations & Chief Information Officer for the Blue Cross Blue Shield Association (BCBSA), a national federation of 38 independent, locally operated Blue Cross and Blue Shield companies.
Doug's responsibilities include leadership of all facets of operations, information technology, and analytics within the Blue Cross Blue Shield Association, enabling system wide interoperability, the Association National Programs, Federal Employee benefit processing, and the support of the Blue Health Intelligence analytics company. In his current role, Porter leads the CIO Cooperative where technology is positioned in support of the business across the system of Blue plans. He is a recognized thought leader in the practical application of technology in solving business needs.
Doug has served in various capacities advancing the high-tech sector and State level economic development

Attendee Profiles

with his work as an Officer of Corporate Boards, Public/ Private Sector collaboration committees, advisory role for two venture funds, and University Advisory Councils.
Doug has held both technical and business positions in his career including service in the banking, finance, travel, insurance, healthcare, and computing industries. He holds a Master of Science in International Business from Johns Hopkins University, a Bachelor's degree in Management Information Systems from Jacksonville University, has completed executive professional development work at Harvard, Northwestern and is currently pursuing a fellowship at Wharton.

Eric Prud'hommeaux

MIT World Wide Web Consortium (W3C)
Sanitation Engineer
eric@w3.org 617-599-3509

Eric Prud'hommeaux is a sanitation engineer employed by the World Wide Web Consortium (W3C) at MIT. While at W3C, he has actively edited and participated in the development of many specifications, extending open source tools like libwww, Apache, Mozilla, MySQL and SWObjects to implement and test new protocols. His past standards work includes HTTP 1.1, PEP, SOAP, SAWSDL, RDF, SPARQL and SQL Direct Mapping. The latter work aims to connect existing relational data via the Semantic Web without performance penalty.
The Semantic Web and relational database work formed the backbone of several projects in W3C's Semantic Web in Health Care and Life Sciences Interest Group. This group has established a large corpus of biological and chemical data to connect to clinical data for research and health care support. In addition to his role in W3C groups, Eric is participating in the HL7 FHIR initiative, modeling the RIM in OWL in order to provide Semantic Web views of clinical data.

Edmond Ramly, MS

University of Wisconsin- Madison
Doctoral Student
ramly@engr.wisc.edu 608-698-4656

Edmond Ramly, M.S. is a member of the evaluation team based at the University of Wisconsin-Madison that was commissioned by the SMArt team to evaluate the SMArt initiative.
A health systems engineering doctoral student advised by Patricia Brennan, R.N., Ph.D. at the University of Wisconsin-Madison, Ramly is developing a methodology to characterize Health IT innovation projects and guide the selection of evaluation approaches that do not obscure innovation and unanticipated outcomes. He is currently a research assistant at the Center for Health Systems Research and Analysis, guiding the Wisconsin Department of Health Services in the development and evaluation of an IT-enabled statewide public-private collaboration to support and benchmark internal quality improvement in assisted living facilities. Ramly has worked as a process improvement and technology assessment engineer at the University of Wisconsin Hospital, and as a medical logistics research associate at the RAND corporation. In 2010, he co-authored the AHRQ/NSF federal report on the critical areas of research at the intersection of industrial and systems engineering and health care, with emphasis on the supportive role of health information technology (healthit.ahrq.gov/engineeringhealthfinalreport)

Rachel Ramoni

Harvard Medical School
Rachel_ramoni@hms.harvard.edu 617-823-1034

Del Richmond

AT&T
Regional Health Care Sales Director
del.richmond@att.com 857-205-6923

Mr. Richmond has an extensive breadth of experience as a senior marketing and business development executive with a successful track record of improving sales performance for leading companies in the healthcare information technology sector.
As Regional Healthcare Sales Director for AT&T, Mr. Richmond directs the company northeast sales efforts for its ForHealth solution portfolio, including healthcare information exchange, telehealth, mhealth and imaging offerings.
Prior to AT&T, Mr. Richmond served as Director of Business Development for Healthcare Information Exchange at NaviNet, Director of Marketing for Hospitals at MedPlus and served in significant healthcare and life sciences marketing roles at IBM. Mr. Richmond launched the GartnerGroup Healthcare community healthcare information networks consulting practice. He began his career as Marketing Manager, Healthcare for Data General Corporation where he collaborated with a number of leading healthcare application providers.

Mr. Richmond holds a Bachelor of Arts degree from the University of New Hampshire and an MBA in Marketing from Boston University.

Douglas E. Rosendale, D.O., F.A.C.O.S.

Veteran's Health Administration
Senior Physician Advisor, Office of Health Information
douglas.rosendale@va.gov 202-368-3708

Dr. Rosendale is currently the Senior Physician Advisor for the Veterans Health Administration Office of Health Information. He is a board certified general surgeon and trained in clinical informatics at Harvard Brigham and Women Hospital. He was affiliate faculty for the Harvard Decision Systems Group Informatics program and is now affiliate faculty at the University of California San Diego Medical Informatics program. He also co-chairs the HITIDE sub group for health IT innovation, overseen by the White House Office of Science and Technology and Policy (OSTP) and administrated by the Networking IT R&D (NITRD) program under the National Coordination Office and the National Science Foundation. He provided clinical informatics guidance to establishing the VA/DoD Interagency Program Office as well as establishing the Clinical Informatics Division focused on the interagency EHR and the Virtual Lifetime Electronic Record (VLER). Dr. Rosendale was the Chair of the Surgery Discipline and on the Board of Governors for the American College of Osteopathic Surgeons. He was the Chief of Surgery for the Grand Junction VA Medical Center and while in private practice he was a Chief of Staff and Vice President of an Independent Physician Organization. Dr. Rosendale's health IT background spans many aspects of "Quality and Performance" initiatives with the American College of Surgeons as a member of the Surgical Quality Alliance, Ambulatory Quality Alliance (AQA, Secretary of Health and Human Services "Value Exchanges," and the VA National Surgical Quality Improvement Program (NSQIP). He is currently on the Technical Expert Panel for Clinical Decision Support, overseeing the AHRQ pilots at Harvard and Yale Universities. Dr. Rosendale is the recipient of the 2006 American College of Osteopathic Surgeons "Presidential Recognition Award" for his contributions on the Surgical Quality Alliance. He has been widely published in national journals and presented on clinical informatics topics at numerous national venues.

Will Ross

Redwood MedNet
Project Manager
wross@redwoodmednet.org 707-462-6369 x512

Will Ross is the founding Project Manager for Redwood MedNet, a nonprofit community based health information service provider (HISP). Incorporated on the rural north coast of California in August 2005, Redwood MedNet began electronic delivery of laboratory results to safety net providers in Sonoma County in April 2008. The service has since expanded to additional health care facilities, additional counties, and additional data types. Facilities currently participating in the service include hospitals, community clinics, private practices, long term care, public health agencies, laboratories and imaging centers. Prior to Redwood MedNet, Mr. Ross was CTO at Alliance for Rural Community Health in Ukiah, California, a consortium of rural safety net community clinics. Prior to his work at the Alliance, Mr. Ross worked in information technology assignments in the manufacturing and retail sectors. Mr. Ross is a member of the American Medical Informatics Association (AMIA), the Healthcare Information Management Systems Society (HIMSS), and the International Society for Disease Surveillance (ISDS).

Anubha Sant

McMaster University
Product Manager
santa@mcmaster.ca 416-970-8926

As the Product Manager, Anubha is responsible for business development and interacting with stakeholders and consumers, to determine specifications for MyOSCAR. MyOSCAR is a tethered Personal Health Record, founded at the Department of Medicine at McMaster University, which is undergoing numerous developments. MyOSCAR has a near future vision of enabling health applications or "apps", to provide users with a custom PHR. She is currently involved in creating a PHR adoption strategy for MyOSCAR. Additionally, Anubha is a Master of Science in eHealth Candidate ('13) at McMaster University's DeGroote School of Business, interested in: user perceptions of Personal Health Records, health technology adoption models, the Pan-Canadian eHealth strategy, and clinic workflow process re-engineering. She previously holds a Bachelor of Science in the Life Sciences from McMaster University and a Post-Graduate certificate in Bioinformatics from Seneca College.

Attendee Profiles

Arjun Sanyal

Boston Children's Hospital Informatics Program
arjun.sanyal@childrens.harvard.edu 3 47-247-6978

Arjun Sanyal is a software engineer with a special interest in building health applications with high-quality user experiences. He is the apps and user experience lead for the SMART Platforms team.

Nikolai Schwertner, MS

Boston Children's Hospital Informatics Program
Developer
nikolai.schwertner@childrens.harvard.edu
781-964-8964

Nikolai joined the SMART developers team in 2011 and has been working on developing apps and implementing new reference container features. He has a masters degree in computer science and is working on completing a second masters in engineering management.

Avinash Shanbhag, MS

HHS, Office of the National Coordinator
Program Officer
Avinash.Shanbhag@hhs.gov 202-691-2116

Avinash Shanbhag, MS serves as Division Director for Nationwide Health Information Network Division, in the Office of National Coordinator (ONC) at the Office of Health and Human Services (HHS) . He is responsible for the development of standards and services that form the foundation of nationwide health information network. He also supports the NHIN Exchange program and works closely with Standards and Interoperability framework initiatives on technical specifications and implementation testing needed for national health information exchange. He is the project officer for the SMART program.

Jeff Shaw

Michigan Health Information Network
Senior Integration and Technical Architect
shaw@mihin.org 517-803-3082

Jeff Shaw is the Senior Integration and Technical Architect at Michigan Health Information Network (MiHIN), the ONC State Designated Entity for Michigan. He over 6 years' experience in large health IT projects with Covisint, Michigan Public Health Institute, and the State of Michigan. In the past he has worked on several Michigan projects included the Detroit Beacon Project and Michigan Medicaid EHR Incentive Program and in other states including the Tulsa Beacon Project. In his role at MiHIN he leads the efforts to take practical use cases and come up with HIE enabled technical solutions. He is active in ONC's Standards and Interoperability (S&I) Framework, HL7 and IHE standards setting activities.

Edward Shultz, MD, MS

Vanderbilt University Medical Center
Director, Information Technology Integration
ed.shultz@vanderbilt.edu 615-343-3911

Edward Shultz, MD, MS is the former Director of the Program in Medical Information Science at Dartmouth Medical School, Chairman of the Department of Veterans Affairs Inter-Application Communications Committee and is currently the Director of Technology Integration at Vanderbilt University Medical Center. In that capacity he specifies the Vanderbilt application component architecture to maximize re-usability of information and technology resources and thus insure orderly growth and cost-effective scalability.

Ali Sunyaev, PhD

University of Cologne
Assistant Professor, Department of Information Systems
sunyaev@wiso.uni-koeln.de +49-163-686-3426

Ali Sunyaev is working intensely on research topics about design, evaluation and management of health information systems since more than six years. In conducting research in these areas, he is keen on combining both technical and social aspects of information systems development. Ali has (co)-authored several international journal articles (including articles in journals such as Communications of the ACM, ACM Journal of Data and Information Quality, IEEE Computer, International Journal of Medical Informatics, and Communications of the AIS).

In his current position as an assistant professor at the Department of Information Systems, University of Cologne, Germany, he currently runs two scientific projects on the development and management of innovative patient-centered applications in cloud computing environments. His research interests include design and management of information systems in healthcare as well as management of information systems security. Ali received his Master`s degree (diploma) in computer science (with an emphasis on IT security and medical informatics) from the Technische Universität München (Munich, Germany). His Doctoral thesis (PhD) dealt with

design and practical application of a security analysis method for healthcare information systems.

Peter Szolovits, PhD

MIT Computer Science & Artificial Intelligence Lab
Head, Clinical Decision-Making Group
psz@mit.edu 617-253-3476

Peter Szolovits is Professor of Computer Science and Engineering in the MIT Department of Electrical Engineering and Computer Science (EECS), Professor of Health Sciences and Technology in the Harvard/MIT Division of Health Sciences and Technology (HST), and head of the Clinical Decision-Making Group within the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL). His research centers on the application of AI methods to problems of medical decision making, natural language processing to extract meaningful data from clinical narratives to support translational medicine, and the design of information systems for health care institutions and patients. He has worked on problems of diagnosis, therapy planning, execution and monitoring for various medical conditions, computational aspects of genetic counseling, controlled sharing of health information, and privacy and confidentiality issues in medical record systems. His interests in AI include knowledge representation, qualitative reasoning, and probabilistic inference. His interests in medical computing include Web-based heterogeneous medical record systems, life-long personal health information systems, and design of cryptographic schemes for health identifiers. He teaches classes in artificial intelligence, programming languages, medical computing, medical decision making, knowledge-based systems and probabilistic inference.

Prof. Szolovits has served on journal editorial boards and as program chairman and on the program committees of national conferences. He has been a founder of and consultant for several companies that apply AI to problems of commercial interest. He received his bachelor's degree in physics and his PhD in information science, both from Caltech. Prof. Szolovits was elected to the Institute of Medicine of the National Academies and is a Fellow of the American Association for Artificial Intelligence, the American College of Medical Informatics and the American Institute for Medical and Biological Engineering. He also serves as a member of the National Research Council's Computer Science and Telecommunications Board.

Manu Tandon, MBA, MPA

Executive Office of Health and Human Services, Commonwealth of Massachusetts
Secretariat Chief Information Officer & Massachusetts HIT Coordinator
manu.tandon@state.ma.us 617-689-8720

As the SCIO for Massachusetts' EOHHS, Manu is responsible for IT for 17 state agencies including Medicaid, public health, disability services, means based programs and children and youth services. Manu also serves as the Massachusetts State HIT Coordinator and is currently overseeing the development of a statewide Medicaid funded open access HIE infrastructure for the state. Manu is also the Principal Technology Lead on the six state New England Health Insurance Exchange innovator program. He holds a Bachelor of Engineering degree from India, a Master of Business Administration degree from Boston University and a Master of Public Administration degree from Harvard University.

Patrick Taylor, JD

Harvard Medical School
Assistant Clinical Professor
Boston Children's Hospital
Staff Scientist
patrick.taylor@childrens.harvard.edu
617 548-4401

Patrick Taylor is an Assistant Clinical Professor at Harvard Medical School, and a Staff Scientist at Children's Hospital Boston. He just completed a 2-year Fellowship at the Petrie-Flom Center for Health Law Policy, Biotechnology and Bioethics at Harvard Law School. He graduated from the University of Wisconsin-Madison, with Phi Beta Kappa and highest honors. He received his JD from Columbia University Law School in 1986. He was a 2007-2008 Fellow in Medical Ethics at Harvard Medical School, and attended the 2008-9 Program in Leadership Development of the Harvard Business School.

Until July 2010, he was also Deputy General Counsel and Chief Counsel for Research Affairs for Children's Hospital Boston, having previously been Senior Vice President and General Counsel of Albany Medical Center, and health and human services counsel to New York Governor Mario M Cuomo, among other positions. His legal work has taken him from Wall Street, to government, to academic research institutions, with clients ranging from industry giants to struggling not-for-profits, from clinical studies and research collaborations, to co-development of biotechnology, from IRBs, ESCROs and conflict of interest committees to intellectu-

Attendee Profiles

al property offices. His academic work focuses on legal, ethical and policy issues in biomedical research, health care and biotechnology, in particular subjects in which law operates in a sphere of highly contested norms, such as stem cells, conflicts of interest, privacy, and genomics, and he is recognized internationally on these issues. He was a commentator on the proposed stem cell funding rules in the leading specialty scientific journal Cell Stem Cell, and a commissioned commentator on the court decision for the preeminent general scientific journal, Nature in a recent online legal forum, as well as an invited Commentary. He has been a member of two IRBs and an IACUC, and is currently a member of the Children's Hospital Boston ESCRO. He is a co-investigator on three grants funded by the National Institutes of Health. His papers have appeared in many journals, including Nature, Science, Cell, Science Translational Medicine, Nature Biotechnology, Cell Stem Cell, Science and Engineering Ethics, Academic Medicine, Drug Development, the Journal of the American Informatics Association, the American Bar Association's Health Lawyer, the Journal of the New York State Bar Association and the New York Health Law Journal. His views on the recent stem cell funding shutdown have been featured by Nature.

Troy Trygstad, PharmD, MBA, PhD

Community Care of North Carolina
Director, Pharmacy Programs & Pharmacy Informatics
troy@t2email.com 919-260-5241

Troy Trygstad is the Director of the Network Pharmacist Program and Pharmacy Projects for Community Care of North Carolina, a parent organization of 14 regional care management networks. These networks bring together medical practices, county health departments, hospital systems and mental health providers to integrate care delivery for Medicaid, Medicare, private plans, employers and the uninsured. CCNC and its networks are responsible for developing and evaluating accountable care systems in North Carolina. It is also playing an integral role in Health Information Technology adoption and proliferation. The Network Pharmacist program has grown to include more than 60 pharmacists who are involved in a number of diverse activities ranging from patient-level medication reconciliation, to practice level e-prescribing facilitation, to network-level management of pharmacy benefits. Dr. Trygstad received his PharmD and MBA degrees from Drake University and a PhD in Pharmaceutical Outcomes and Policy from the University of North Carolina.

Joris van Dam

Novartis Institutes for Biomedical Research
Strategic Projects Leader, Translational Sciences
joris.vandam@novartis.com 617-871-4949

Joris van Dam is Strategic Projects Leader in Translational Sciences at the Novartis Institutes of Biomedical Research, coordinating the "Trials of the Future Project". Through this project, Novartis is aiming to accelerate the adoption of innovative technologies, tools, and methods in their clinical research – with the objective to reduce the burden of study participation to patients and physicians, and reduce the gap between clinical trials and clinical practice.
Prior to joining Novartis in December 2010; Joris spent 7 years at Johnson & Johnson Pharmaceutical Research & Development, where he led and initiated a number of programs to develop health information technology solutions for improving patient health outcomes,.
Joris has a PhD in Computer Science from the University of Amsterdam, and worked for 7 years in IT project and program management, business development and consulting before coming to the Pharmaceuticals Industry.

Erick Von Schweber, PhD

Surveyor Health Corporation
Executive Co-Chair, CEO & Co-Founder
erick@surveyorhealth.com 650-358-8838

Erick Von Schweber is Executive Co-Chair, CEO and co-founder of SURVEYOR Health Corporation (www.surveyorhealth.com) a biomedical informatics company whose debut product, MedRiskMaps, is an award-winning knowledge environment providing insights-at-a-glance via predictive analytics. The company's vision is Optimized Medicine - enabling the navigation and optimization of care plan trade-offs with respect to safety, cost and effectiveness. Previously Erick was a principal of Synsyta LLC, a for-profit consortium of commercial and academic researchers developing, standardizing and integrating technologies supporting Model Driven Architecture, Service Oriented Architecture, Ontologies and the Semantic Web, Formal Methods and Grid Computing, serving the US Government, including the Defense Advanced Research Projects Agency (DARPA), the office of the Chief Architect of US General Services Administration (GSA) and

intelligence agencies. In 1998 Erick, with his lifelong colleague Linda Von Schweber, published their predictions for the next era of computing, called *Computing Fabrics*. In September 2008 they were recognized by the IEEE Computer Society for this foundational role envisioning Cloud, Grid and Utility Computing, web services and Virtualization. In 1987 the two were among the very first to downsize massive mainframe databases to networks of PCs serving the credit card processing and insurance industries. Erick performed Ph.D. studies in Quantum Logic under Dr. David Finkelstein at the Georgia Institute of Technology's School of Physics.

Linda Von Schweber

Surveyor Health Corporation
Executive Co-Chair
linda@surveyorhealth.com 650-358-8838

Linda Von Schweber is the Executive Co-Chair and co-founder of SURVEYOR Health Corporation (www.surveyorhealth.com) a biomedical informatics company whose debut product, MedRiskMaps, is an award-winning knowledge environment providing insights-at-a-glance via predictive analytics. The company's vision is Optimized Medicine - enabling the navigation and optimization of care plan trade-offs with respect to safety, cost and effectiveness. The current focus is on MTM – Medication Therapy Management. As President and User Experience Designer Linda enables users to manage population risks and easily dive into minute details of individual patients. Previously Linda was principal of Synsyta LLC, a for-profit consortium of commercial and academic researchers developing, standardizing and integrating technologies supporting Model Driven Architecture, Service Oriented Architecture, Ontologies and the Semantic Web, Formal Methods and Grid Computing, serving the US Government, including the Defense Advanced Research Projects Agency (DARPA), the office of the Chief Architect of US General Services Administration (GSA) and intelligence agencies. In 1998, Linda and Erick published their predictions for the next era of computing, called Computing Fabrics. In September 2008 they were recognized by the IEEE Computer Society for this foundational role envisioning Cloud, Grid and Utility Computing, web services and Virtualization. In 1987 the two were among the very first to downsize massive mainframe databases to networks of PCs serving the credit card processing and insurance industries. Linda's degree is in Psychology from Georgia State.

Ann Waldo, JD, CIPP

Wittie, Letsche & Waldo, LLP
Partner
awaldo@wlw-lawfirm.com 919-649-2210

Ann Waldo is a Partner in the law firm of Wittie, Letsche & Waldo, LLP, providing counsel, public policy, and government advocacy on privacy, information management, and health policy. She focuses on HIPAA/HITECH and consumer health privacy and is particularly interested in novel issues involving innovation and health information.

Ann has extensive experience in privacy and health policy. She served as global Chief Privacy Officer for Lenovo, a worldwide computer manufacturer, where she led privacy compliance and served as a public policy advocate on national and international privacy issues. She was also the Chief Privacy Officer at Hoffmann-La Roche, handling privacy compliance and best practices in marketing, HIPAA, and clinical research. She was actively involved with the International Pharmaceutical Privacy Consortium. Previously, she worked in Public Policy at GlaxoSmithKline, handling privacy, infectious disease, and other health policy issues. She has also served as in-house counsel at IBM, working on consumer protection and e-business, and has been a commercial litigator and legislative aide.

A frequent public speaker, Ann is active in the International Association of Privacy Professionals, the Carolina Privacy Officials Network, and the American Health Lawyers Association. She has consulted with foreign governments regarding privacy laws and has represented the U.S. government in APEC privacy talks in Korea and Australia. She is a Certified Information Privacy Professional. She has advised a state Health Information Exchange and serves on the Advisory Board for the Harvard SHARP information technology grant. A member of Phi Beta Kappa, she holds a BA summa cum laude in Religion from Ohio Wesleyan University. Ann graduated from The University of North Carolina School of Law with high honors in 1995 and is licensed to practice law in the District of Columbia and North Carolina.

Keeley Wray

Boston Children's Hospital
Senior Market Research Analyst
Keeley.wray@childrens.harvard.edu 617-919-3010

Keeley joined TIDO of Children's Hospital Boston in 2008. Keeley is responsible for providing market research to help develop a market entry strategy for hospital technologies. She also interfaces with outside partners who can move the technologies to market. Prior to joining Children's Hospital, she was the Director of Life Sciences of the Consulting Services Division of

Foresight Science & Technology. Foresight is one of the leading firms in technology marketing, technology acquisition, and business strategies and systems involving the management and monetization of technology. While at Foresight, Keeley primarily focused on fortifying the life sciences consulting business. Also, she instituted the Pipeline Partners Program to facilitate matchmaking between technologies and commercialization partners.
Keeley holds a Masters in Biochemistry from Brown University and a B.S. in biology from Providence College. Her research experience includes molecular neuroscience and computational biology projects.

Alan Yen, PhD

Boston Children's Hospital
Licensing Manager
Alan.yen@childrens.harvard.edu 617-919-3025

Alan Yen is a licensing manager at the Technology & Innovation Development Office at Boston Children's Hospital. Alan oversees the intellectual property and business development initiatives for the healthcare IT and other life science research portfolio . Prior to joining Boston Children's, Alan worked at the Center for Commercialization at the University of Washington in Seattle where he managed a broad array of technologies in genomics, proteomics, imaging, computational biology and health information technology. Prior to the UW, Alan had been a scientist and director of business development at LifeSpan Biosciences, a company that provides research reagents and molecular pathology support to the bio-pharma industry. Alan has a B.S. degree from the University of California, Davis, a Ph.D. from the University of Washington and completed his postdoctoral research at the Department of Organismic and Evolutionary Biology at Harvard University.

cumstances (such as when a vendor creates a PHR specifically for a covered entity), vendors such as Microsoft and Google are not covered by HIPAA. Microsoft says it will seek patients' consent before sharing data with third parties, but none of these application suppliers are covered by HIPAA. Whatever the business model for PHRs, lawmakers should require that the consumer user be clearly informed about the identity of the system's operator and the financial terms of any direct or indirect use of patient data.

It's difficult to predict what roles Google, Microsoft, and health plans will play in the PHR marketplace in the long run. There aren't major technical barriers to entry, but data sharing will require the development and adoption of technical and content standards — and a desire on the part of physicians and patients to contribute information to commercial repositories, with their growing contingents of third-party application developers. Since the majority of physicians still don't have electronic medical records, and patients often seek care outside their providers' delivery system, these standalone PHRs may serve as data intermediaries. However, if the Obama initiative to replace paper records with interoperable EHRs in the next 5 years succeeds, the landscape will change dramatically, and the need for intermediaries may disappear.

Users of integrated PHRs have demonstrated that creating shared records for patients and their health care team can enhance patients' ability to become active partners in their own health care.[5] This is a try-it-you'll-like-it type of innovation. As physicians increasingly adopt EHRs, we expect community interest in PHRs to grow organically. Ultimately, it will no doubt become difficult for physician groups to survive in the marketplace without them.

Dr. Tang reports serving on the Google Health advisory council. No other potential conflict of interest relevant to this article was reported.

Dr. Tang is vice president and chief medical information officer at the Palo Alto Medical Foundation, Palo Alto, CA. Dr. Lee is the network president for Partners HealthCare System, Boston, and an associate editor of the *Journal*.

1. Steinbrook R. Personally controlled online health data — the next big thing in medical care? N Engl J Med 2008;358:1653-6.
2. Tang PC, Ash JS, Bates DW, Overhage JM, Sands DZ. Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption. J Am Med Inform Assoc 2006;13:121-6.
3. National Committee on Vital and Health Statistics. Privacy and confidentiality in the nationwide health information network. 2006. (Accessed March 6, 2009, at http://www.ncvhs.hhs.gov/060622lt.htm.)
4. Tang PC, Black W, Young CY. Proposed criteria for reimbursing eVisits: content analysis of secure patient messages in a personal health record system. AMIA Annu Symp Proc 2006:764-8.
5. Tang PC, Lansky D. The missing link: bridging the patient-provider health information gap. Health Aff (Millwood) 2005;24:1290-5.

No Small Change for the Health Information Economy

Kenneth D. Mandl, M.D., M.P.H., and Isaac S. Kohane, M.D., Ph.D.

The economic stimulus package signed by President Barack Obama on February 17 included a $19 billion investment in health information technology. How can we best take advantage of this unprecedented opportunity to computerize health care and stimulate the health information economy while also stimulating the U.S. economy? A health care system adapting to the effects of an aging population, growing expenditures, and a diminishing primary care workforce needs the support of a flexible information infrastructure that facilitates innovation in wellness, health care, and public health.

Flexibility is critical, since the system will have to function under new policies and in the service of new health care delivery mechanisms, and it will need to incorporate emerging information technologies on an ongoing basis. As we seek to design a system that will constantly evolve and encourage innovation, we can glean lessons from large-scale information-technology successes in other fields. An essential first lesson is that ideally, system components should be not only interoperable but also substitutable.

The Apple iPhone, for example, uses a software platform with a published interface that allows software developers outside Apple to create applications; there are now nearly 10,000 applications that consumers can download and use with the common phone interface. The platform separates the system from the functional-

ity provided by the applications. And the applications are substitutable: a consumer can download a calendar reminder system, reject it, and then download another one. The consumer is committed to the platform, but the applications compete on value and cost. The Facebook social networking site is another example: it allows users to connect their core accounts to applications that add value for them, from family-tree builders to programs that track flulike symptoms or encourage blood donation. And of course, there is the Web itself, which supports myriad applications — some proprietary, some not — many of which interoperate. For example, users with a personalized Google home page can populate it with widgets from Yahoo. Again, all these programs compete with each other and can be substituted for one another, entirely and modularly.

The platform approach to software design can be used to create and sustain an extensible ecosystem of applications and to stimulate a market for competition on value and price. We believe that the Department of Health and Human Services (DHHS) should encourage the development of such a platform for health care — one that will support applications for communication and computation that span the domains of clinical care, public health, and research. There are early-stage examples of platforms in health care already. For instance, the emerging model of personally controlled health records (PCHRs) is based on a platform that has been adopted by Microsoft and Google, as well as by the Dossia consortium of large employers for its rollout of the Indivo product to employees of consortium companies.[1] There is now an active marketplace of enterprises building PCHR applications.

We take it as a given that health care software must be interoperable and secure and must protect patient privacy. But these qualities are not sufficient to produce an optimal system, which must evolve on a health care platform that extends beyond PCHRs to include other critical infrastructural components, such as medical-practice-based electronic health records (EHRs) and applications that support the complex communication required in health care. We believe that such

Categories of Substitutable Applications with Selected Examples.*

Purpose of Application	Examples
Medication management	Prescribing Clinician-order entry Medication reconciliation Drug-safety alerts
Documentation	Structured text entry Dictation
Panel management	Disease management Appointment and testing reminders Care instructions Results notification Patient behavior modification
Quality improvement	The Healthcare Effectiveness Data and Information Set (HEDIS) Management of patient transfer and transition
Administrative tools	Billing Referral management Risk stratification
Communication	Doctor–patient communication Multispecialty or team communication Patient support Patient or clinician social networking
Public health reporting	Notifiable disease reporting Biosurveillance Pharmacosurveillance
Research	Clinical trial eligibility Cohort study tools Electronic data capture for trials
Decision support	Laboratory-test interpretation Genomics Guideline management
Data acquisition (subscription)	Laboratory data feed Dispensed medication feed Personally controlled health record data feed Public health data feeds (e.g., local context for infectious diseases)

* The proposed platform would allow a clinical practice or hospital to select the combination of applications that are most useful for the local environment. As alternative applications are developed by competitors, the existing ones may be replaced, or new ones added.

a platform should have a number of additional key characteristics.

First, there should be liquidity of data. The platform and its applications should reduce impediments to the transfer of data, in an agreed-upon form, from one system to another. In the banking industry, the automatic teller machine (ATM) is predicated on highly standardized, simple operations. Participation requires at least a minimal amount of data liquidity — ATMs enable consumers from virtually any bank to withdraw money, although only some ATMs can provide a given consumer with his or her account balance.

Second, there should be substitutability of applications (see table). The system should be sufficiently modular and interoperable so that a primary care provider could readily use a billing system from one vendor, a prescription-writing program from another, and a laboratory information system from yet another. Individual systems do not need to perform all functions. (Analogously, a customer cannot apply for a mortgage at an ATM.)

But substitutability goes beyond interoperability. Just as consumers may swap out applications on their iPhones, physicians should be able to readily replace one referral-management system with another. Companies are beginning to offer modular services driven by common data elements found in claims, EHRs, and PCHRs.[2]

Third, the platform should be built to open standards, accommodating both open-source and closed-source software. Though installation of open-source software is not free, its use decouples the software code from implementation and integration tasks and facilitates customization, extension, and innovation.

Finally, just as evolution requires variety in order to create ecosystem niches, a platform that supports diverse applications will lead to a robust health information economy. This architecture reduces dependence on individual systems by allowing competition and "natural selection" for high-value, low-cost products. This approach contrasts sharply with design of a national system by committee. Like standards, system design must be driven by successful, real-world innovations; an incremental and iterative process is more likely than a wholesale advance prescription to be successful.[3] The platform model allows disruptive technologies to emerge and enables evolution to proceed organically. New companies and players that will contribute to transformation must be recognized and welcomed.

The DHHS could promote the creation of such a system by taking certain actions in terms of regulation, the creation of incentives, and the evaluation of results. Although the platform we envision would support a free marketplace of products and ideas, oversight and regulation are important. The DHHS should ensure that the dominant driving force is the maximization of health and that adequate privacy protection is in place. We must decide as a society what kinds of transactions such a system would be permitted to support. For example, should the platform permit direct-to-consumer advertising or procurement of samples for research?

At the same time, federal incentives should be offered to providers to make use of health information technology in clinical decision making and in efforts to improve the quality of care and acquire population data for public health. The design of incentives should be built on a realistic respect for physicians' time and effort in order to avoid turning physicians into scribes. A positive step would be to reduce demands for excessive documentation to support billing and medicolegal defense, so that valuable data-entry efforts could serve nobler goals.

In addition, the DHHS should institute a transparent process for evaluation of the platform, individual applications, and the effects of the system on outcomes (health, patient safety, and public health), process measures (physicians' workflow), and costs (of the information technology as well as the provision of health care that relies on it). Ideally, the platform would support applications that would readily allow trials and observational studies of the technology and of therapies and delivery models, promoting what the Institute of Medicine calls a learning health care system.

To get started on this platform, the DHHS should demonstrate at least the kind of interoperability and substitutability that banks have instituted with ATMs. For example, can we produce a medication list for every American that can be obtained through standards-based,[4] interoperable, substitutable applications? It would be a catalytic investment on the part of the government to ensure that such functionality is comfortably seated on a platform that stimulates evolution and competition among contending, substitutable applications.

Medicine is increasingly becoming a knowledge and information

industry, but it did not invent information technology or the Web.[5] It makes sense to draw on other sectors' successes in making this type of transition, and they teach us that if we are to use information technology to improve health care, the variety of practice sizes and styles needs to be complemented by collections of information functions that are packaged on a consistent platform. The applications enabling these functions should be as substitutable as different stethoscopes in a doctor's office.

Drs. Mandl and Kohane are the developers of Indivo, an open-source personally controlled health record that has been deployed at multiple locations, including through the nonprofit entity Dossia. In the past, Dr. Mandl received support from Children's Hospital Boston to guide the translation of Indivo technology to a Dossia environment. No other potential conflict of interest relevant to this article was reported.

Dr. Mandl is an associate professor of pediatrics, and Dr. Kohane a professor of pediatrics, at Children's Hospital and Harvard Medical School — both in Boston.

1. Mandl KD, Kohane IS. Tectonic shifts in the health information economy. N Engl J Med 2008;358:1732-7.
2. Goedert J. Time to roll for SafeMed. Health Data Manag 2008;16:47.
3. Diamond CC, Shirky C. Health information technology: a few years of magical thinking? Health Aff (Millwood) 2008;27:w383-w390.
4. Kibbe DC, Phillips RL Jr, Green LA. The continuity of care record. Am Fam Physician 2004;70:1220, 1222-3.
5. Stead W, Lin H, eds. Computational technology for effective health care: immediate steps and strategic directions. Washington, DC: National Academies Press, 2009.

The SMART Platform: early experience enabling substitutable applications for electronic health records

Kenneth D Mandl,[1,2] Joshua C Mandel,[1,3] Shawn N Murphy,[4,5] Elmer Victor Bernstam,[6] Rachel L Ramoni,[1,2] David A Kreda,[7] J Michael McCoy,[8] Ben Adida,[9] Isaac S Kohane[1,2]

[1]Children's Hospital Informatics Program at Harvard-MIT Health Sciences and Technology, Boston, Massachusetts, USA
[2]Center for Biomedical Informatics, Harvard Medical School, Boston, Massachusetts, USA
[3]Department of Pediatrics, Harvard Medical School, Boston, Massachusetts, USA
[4]Partners HealthCare Systems, Information Systems, Charlestown, Massachusetts, USA
[5]Laboratory of Computer Science, Massachusetts General Hospital, Boston, Massachusetts, USA
[6]School of Biomedical Informatics, Department of Internal Medicine, The University of Texas Health Science Center, Houston, Texas, USA
[7]SMART Platforms Project, Center for Biomedical Informatics, Harvard Medical School, Boston, Massachusetts, USA
[8]Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, California, USA
[9]Mozilla, Mountain View, California, USA

Correspondence to
Dr Kenneth D Mandl, Children's Hospital Boston, 300 Longwood Avenue, Boston, MA 02115, USA;
kenneth_mandl@harvard.edu

KDM and JCM contributed equally to this work.

Received 3 October 2011
Accepted 12 February 2012

ABSTRACT

Objective The Substitutable Medical Applications, Reusable Technologies (SMART) Platforms project seeks to develop a health information technology platform with substitutable applications (apps) constructed around core services. The authors believe this is a promising approach to driving down healthcare costs, supporting standards evolution, accommodating differences in care workflow, fostering competition in the market, and accelerating innovation.

Materials and methods The Office of the National Coordinator for Health Information Technology, through the Strategic Health IT Advanced Research Projects (SHARP) Program, funds the project. The SMART team has focused on enabling the property of substitutability through an app programming interface leveraging web standards, presenting predictable data payloads, and abstracting away many details of enterprise health information technology systems. Containers—health information technology systems, such as electronic health records (EHR), personally controlled health records, and health information exchanges that use the SMART app programming interface or a portion of it—marshal data sources and present data simply, reliably, and consistently to apps.

Results The SMART team has completed the first phase of the project (a) defining an app programming interface, (b) developing containers, and (c) producing a set of charter apps that showcase the system capabilities. A focal point of this phase was the SMART Apps Challenge, publicized by the White House, using http://www.challenge.gov website, and generating 15 app submissions with diverse functionality.

Conclusion Key strategic decisions must be made about the most effective market for further disseminating SMART: existing market-leading EHR vendors, new entrants into the EHR market, or other stakeholders such as health information exchanges.

BACKGROUND AND SIGNIFICANCE

The structure, function, and cost of the US healthcare system are under ever-increasing scrutiny. But for the system to adapt to the impact of an aging population, growing expenditures, and a diminishing primary care workforce, innovation in medical practice will have to be supported by information technology (IT) that enables rather than hinders experimentation and innovation. The proprietary electronic health record (EHR) offerings currently on the market tend to be architected monolithically, making modification difficult for hospitals and physician practices. In 2009, we proposed that EHRs instead should be designed as platforms supporting a selection of 'substitutable' modular third party applications (apps).[1]

We drew an analogy with mobile phone platforms such as iPhone and Android, which lower the barrier to app development by providing a software platform with a published interface to a set of core services such as camera, address book, geo-location, and cell and wireless networks. The platform functionally separates the core system from the apps, and the apps are substitutable. Thus, for example, a consumer can download a calendar reminder system, reject it, and replace it with another one. Through substitutable apps, the iPhone and Android platforms now support myriad capabilities that the original platform designers never imagined.

A platform with substitutable apps constructed around core services is a promising approach to driving down healthcare technology costs, supporting standards evolution, accommodating differences in care workflow, fostering competition in the market, and accelerating innovation. With the cost of switching kept low, the platform enables a physician using an EHR, a Chief Information Officer running a hospital IT infrastructure, or a patient using a personally controlled health record (PCHR) to readily discard an underperforming app and install a better one. Competition on quality, cost, and usability is enabled, and the pace of innovation increases. This model stands in stark contrast with the largely monolithic and slow-to-evolve health information systems that have been designed and implemented to date, where one size has to fit most providers, customization is arduous and expensive, and only the few established EHR vendor developers can innovate.

The principle of substitutability is the central focus of the Substitutable Medical Applications, Reusable Technologies (SMART) Platforms project. By defining an app programming interface (API) that consistently presents well-specified data, we seek to (a) enable purchasers, users, and administrators of platform-based systems to be able to install and subsequently substitute apps from different vendors without software programming and (b) create a broad market for app developers

across multiple systems, including EHRs, PCHRs, and health information exchanges. The SMART Platforms project is funded by the Office of the National Coordinator for Health Information Technology as a part of the Strategic Health IT Advanced Research Projects (SHARP) Program.[2] Here we report on challenges and successes faced during the first year of the project, and describe the architecture of the system.

MATERIALS AND METHODS

We present a fictional scenario to convey the need for SMART Platforms.

A company—Medtastic—has designed an elegant medications-management app which needs access to a current medications list from the EHR. While the user-interface design is considered exemplary, and it market tests extraordinarily well with end users, the company finds that the necessity of having a long and involved sales cycle at each possible install location is draining their venture capital funds. They had hoped to exercise the 80:20 rule and focus on integration with the top five vendors, but: (1) only two of those are willing to entertain the proposition; (2) the technical teams of those vendors are not enthusiastic about prioritizing the work; (3) the Medtastic technical team has found that there is such variation across different instances of each brand of EHR—because of versioning and extensive local customization—that installation of their app will not be turnkey in any way.

The first year of the SMART Platforms project has focused on defining an API that would enable a company like Medtastic to succeed by providing apps with a common interface for working with health data. The interface must be a simplified and semantically precise abstraction of a medical record with well-structured, normalized data elements that app developers can understand. The approach is to harness standards and technologies behind successful web APIs and to employ open standards and specifications wherever possible.

SMART provides specifications allowing apps to run against existing health IT systems. Our intent is to specify, in detail, everything app developers need in order to create apps rapidly and independently of the SMART team. The scope of the specification encompasses user-interface integration, authentication, authorization, API access, and data payloads.

Definitions

We define 'SMART containers' as health IT systems, such as EHRs, PCHRs, and health information exchanges, that have implemented the SMART API or a portion of it. Containers marshal 'data sources' and present them consistently across the SMART API. 'SMART applications' consume the API and are substitutable.

Developer focus

The SMART architecture aims to reduce barriers that app developers face in building apps on health IT systems. By leveraging web standards, presenting predictable data payloads, and abstracting away many details of enterprise health IT systems, SMART allows app developers to focus on core tasks. In figure 1, a sample app called 'Got Statins?' illustrates the point. 'Got Statins?' is a complete 'hello world'-style SMART app that obtains a patient's medication list, iterates through each entry, and makes a simple determination. The entire app fits in 50 lines of HTML and JavaScript.

Containers

Any SMART container must present normalized clinical data to SMART apps in a reliable and consistent fashion, abstracting away details of the underlying health IT infrastructure. Thus, the same app could run inside our public reference container, an EHR, a PCHR, or a health information exchange.

To enable such substitutability, the SMART architecture imposes a substantial burden of normalization on any container, allowing apps to know upfront what data to expect and what each data element means. An important implication is that

```
<!DOCTYPE html>
<html>
<head><title>Got Statins?</title></head>
<body>
<h1>Got Statins?</h1>
<a id="TheAnswer">...</a>
<script src="http://sample-apps.smartplatforms.org/framework/smart/scripts/smart-api-page.js"></script>
<script>

    SMART.MEDS_get_all(function(meds) {
        var med_list = meds.where("?m rdf:type sp:Medication")
                           .where("?m sp:drugName ?n")
                           .where("?n dcterms:title ?drugname");

        var answer = false;
        for (var i = 0; i < med_list.length; i++) {
            if (is_a_statin(med_list[i].drugname.value)) {
                answer = true;
            }
        }
        document.getElementById("TheAnswer").innerHTML =answer ? "Yes." : "No.";
    });

    var is_a_statin = function(drug) {
        if (drug.match(/statin$/i)) return true;
        if (drug.match(/Advicor/i)) return true;
        // ... additional drug names cut for clarity
        if (drug.match(/Zocor/i)) return true;
        return false;
    }
</script>
</body>
</html>
```

Figure 1 'Got Statins?' is a complete SMART application (app) in 50 lines of HTML and JavaScript. The app includes an external SMART JavaScript library, then makes a call to obtain all medications for the in-context patient record. A list of drug names is created, and a loop checks each drug name against a list of known statin drugs. 'Got Statins?' is designed merely to illustrate the SMART API. A more robust approach would incorporate drug class data from a reference source such as NDF-RT.[3]

Figure 2 Example of a SMART data payload.

```
<?xml version="1.0" encoding="utf-8"?>

<rdf:RDF
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:sp="http://smartplatforms.org/terms#">

    <sp:Problem>
        <sp:onset>2007-06-12</sp:onset>
        <sp:problemName>
            <sp:CodedValue>
                <sp:code rdf:resource="http://www.ihtsdo.org/snomed-ct/concepts/37796009"/>
                <dcterms:title>Migraine (disorder)</dcterms:title>
            </sp:CodedValue>
        </sp:problemName>
    </sp:Problem>

</rdf:RDF>
```

some containers may need to reshape underlying data to support the SMART API.

The container's job is best understood through an example. Health IT systems take a variety of approaches to representing medical problems or diagnoses. Some represent a problem as an entity with a start date and a resolution date, persisting over time; other systems represent problems as a series of observations over time. To allow substitutability, SMART takes the stance that a problem has an onset date, resolution date, and a SNOMED CT disorder code. The container must reshape existing data, and the details of transformation will vary case-by-case, but we expect that, in many instances, simple transformations can be computed on-the-fly. For example, an EHR may maintain a discrete list of dates and ICD9 codes indicating that a patient experienced migraine headaches. To format the appropriate SMART problem list, the EHR would need to bundle up related ICD9 diagnoses into a SMART problem element with an appropriate onset date, resolution date (which may be null for ongoing problems), and a SNOMED CT disorder code for migraine. Figure 2 provides an example.

We emphasize that reshaping data in such ways may not always be a straightforward or even well-defined task. Some systems may be unable to implement the complete SMART API—for example, if underlying data models are too divergent from the SMART specifications. Such limitations arise because substitutability is a high bar.

Data models, coding, and normalization

In practical terms, substitutability is a high bar because it imposes a need for 'semantic interoperability' between apps and containers. To achieve this interoperability, SMART defines a highly normalized abstraction of a medical record that is designed to be intuitive and easy to learn. Key features include: (a) developers work directly with concrete types such as allergy, medication, or problem, not abstract types such as entity, actor, or role; (b) the SMART specification is 'opinionated,' making upfront choices about how data are represented so that developers know what to expect—for instance, every problem in a SMART record is associated with a SNOMED CT[4] disorder code; (c) SMART defines a limited set of broadly applicable data types, rather than permitting a proliferation of interface-specific definitions.

We take this approach because poorly normalized data require developers and apps to expend tremendous effort just 'making sense' of the payloads they receive. For example, consider an app that obtains a list of medications from a container to assess for polypharmacy. If some of the medications are coded with National Drug Codes (NDC),[5] others with RxNorm[6] codes, and still others with codes from a local dictionary, the app must first go through the considerable effort of remapping these codes into some common vocabulary, reducing the integrity of the medication list while creating additional work for an app developer.

Concretely, SMART represents a medical record as a series of statements or 'triples' according to the Resource Description Framework.[7] Multiple statements together form a 'graph' of patient data. The meaning of each element in this graph is precisely defined by the SMART ontology in OWL2 DL,[8] a web standard for representing knowledge based on formal description logics. Thus, each SMART medical record has an explicit, formally defined meaning—but app developers performing simple operations with SMART medical records do not need any deep understanding of OWL2.

Importantly, SMART data models are still a work in progress, and they are limited in scope: the intention is not to provide a detailed model for every possible aspect of a patient's medical history. Rather, at this stage, SMART attempts to provide highly consistent views for the most common data elements. The SMART data models are freely available.[9]

App programming interface

The current version of the SMART API provides a read-only view of the patient record. An app can access the API through two distinct routes: SMART Connect and SMART REST. SMART Connect is the browser-based JavaScript interface illustrated in the 'Got Statins?' app (figure 1), designed to offer a lightweight approach for developers building apps with rich client-side functionality. SMART REST provides a representation state transfer interface to the medical record, allowing an app's back-end component to communicate directly with a container.

Regardless of whether data are accessed through SMART Connect or SMART REST, the set of API calls and payload formats are the same. Each patient, and each clinical statement about that patient, is represented as a resource with a URI. The structure of these URIs is specified with respect to a container's 'base URI.' For example, a public SMART sandbox container is hosted with the base URI: http://sandbox-api.smartplatforms.org/. (The user interface associated with this public sandbox is presented at http://sandbox.smartplatforms.org.) An individual patient in the sandbox might be identified by: <http://sandbox-api.smartplatforms.org/records/123>. A single medication on that patient's medication list is represented as: <http://sandbox-api.smartplatforms.org/records/123/medications/456>.

Authentication and authorization

Installing a SMART app on a container is a statement of trust in the app about its functions and handling of privacy and security of data. In this respect, installing a SMART app is no different than installing any other clinical IT system. The SMART architecture is flexible, allowing apps to be hosted within an institutional intranet, or remotely 'in the cloud'. Existing health IT

systems have heterogeneous methods of authentication and authorization. To allow a single app to run against heterogeneous systems, the SMART specification standardizes the authentication of API access but allows an underlying container to apply its own authorization mechanisms. This means that, when an app makes an API call, the container can be certain that the call has not been forged. But the container retains full power to determine whether the app is, in fact, authorized to retrieve the data it has requested. Two authentication schemes are employed, one for SMART Connect and one for SMART REST calls.

Since SMART Connect calls happen in-browser, they are by definition made in the context of an established user session. In this case, no additional authentication is explicitly required by the SMART specification. SMART REST calls, on the other hand, are made server-to-server and are signed using a token and shared secret via the OAuth 1.0a protocol—an open protocol for secure API authentication.[10] The scope of access tokens is kept narrow so that, for instance, an app requires a separate access token for each patient record it wishes to query. Figure 3 illustrates the SMART API functionality.

User-interface apps

SMART user-interface apps are user-facing, browser-based apps written as HTML5 web apps, which are platform-independent and run in all modern web browsers on desktops or mobile devices. They integrate into an existing health IT system via the HTML inline-frame element. If an existing health IT system is web-based, SMART apps may be integrated by adding an IFRAME to an existing web interface. If an existing health IT system runs a 'thick client,' inclusion of a SMART app may require augmenting the client with a 'web view' widget or launching a separate browser instance.

Background apps

Background apps employ the same API calls as user-interface apps but perform data processing and analysis without the need for user interaction. Since these background apps do not run in the context of a web-browsing session, they must access patient data via SMART REST, not SMART Connect. In addition, SMART provides a preliminary interface for background apps to loop through the patients in a container one-by-one, fetching and processing data for each. Hence, background apps can be used for batch-processing tasks such as executing clinical rules or computing quality measures. Background apps might also be used to simulate population-level queries by serially evaluating one patient at a time, although this approach is unlikely to scale to large datasets.

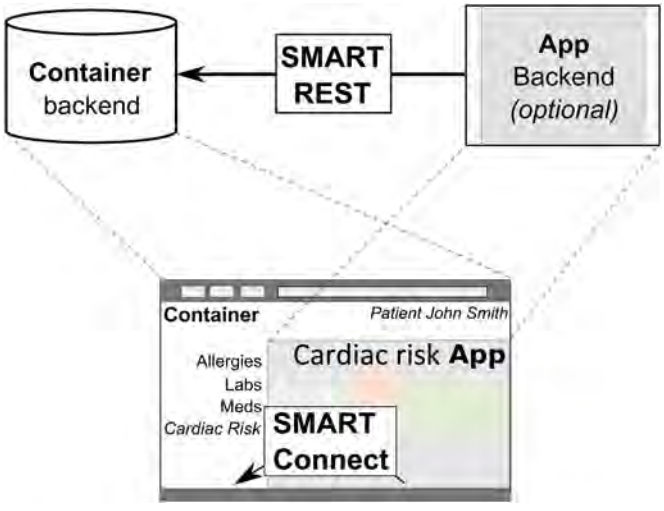


Figure 3 At the center, a web browser window presents two principal components: (1) a white border region belongs to the SMART container, displaying a list of available applications (apps) as well as patient context; (2) a larger gray block belongs to a single 'Cardiac Risk' app. As illustrated, the 'Cardiac Risk' app can request data from the container directly inside the browser via SMART Connect; an app with a back-end component may request data with a server-to-server call via SMART REST. In either case, the SMART-enabled electronic medical record or personally controlled health record responds with the same SMART RDF data payload.

RESULTS

In addition to development of the API, the first-year efforts centered on SMART-enabling select containers and creation of a small set of charter apps to demonstrate functionality and inform system design.

Apps challenge

A focal point of the first year was the SMART Apps Challenge. Sponsored by the Office of the National Coordinator for Health Information Technology, we launched a developer-focused challenge on the Administration's Challenge.gov website.[11] The contest, offering a US$5000 prize and judged by a blue ribbon panel,[12] was announced by the President's Chief Technology Officer, Aneesh Chopra, at the 2010 mHealth Conference during his shared Keynote with Bill Gates,[13] and on his White House blog.[14]

The SMART team created a reference container deployed in a 'sandbox' environment for challenge entrants populated with a hybrid of anonymized and synthesized clinical data for 50 sample patients, published for open use and redistribution.[9] The challenge was to build a SMART app that provides value to patients, providers, or researchers, using patient-level data delivered through the SMART API.

There were 15 entries with functionality such as generating multi-lingual patient-facing medication instructions, or providing a public health dashboard that links EHRs with immunization registry and syndromic surveillance data. The winner was the Meducation app by Polyglot. Meducation pulls the patient's medication list across the API and joins it to simplified patient-friendly instructions for the individual medications in 12 languages. Polyglot is a small company whose business model would clearly be advanced by SMART API access to the wider IT infrastructure. The challenge achieved several objectives: (1) forcing an early (10 months into the project) release of the API and sandbox; (2) necessitating early development of charter apps (see below); (3) requiring extensive documentation and creation of website and promotional materials; (4) widely publicizing the platform; (5) for only a US$5000 investment, generating 15 intriguing apps; (6) demonstrating a key property of SMART—the challenge apps were able to run, unmodified, across multiple platforms.

Building SMART containers

A three-step process converts an existing health IT system into a SMART container: exposing data through the SMART API, providing a place for apps within or alongside the existing health IT system's user interface, and implementing appropriate authentication. In addition to the SMART reference container, we are SMART-enabling three open source systems: the Indivo PCHR[15–17]; the Informatics for Integrating Biology and the Bedside analytic platform—i2b2[18 19]; and the Open Medical Record System (OpenMRS).[20 21]

Using published Cerner APIs, we are working to implement a portion of the SMART API on top of the Children's Hospital

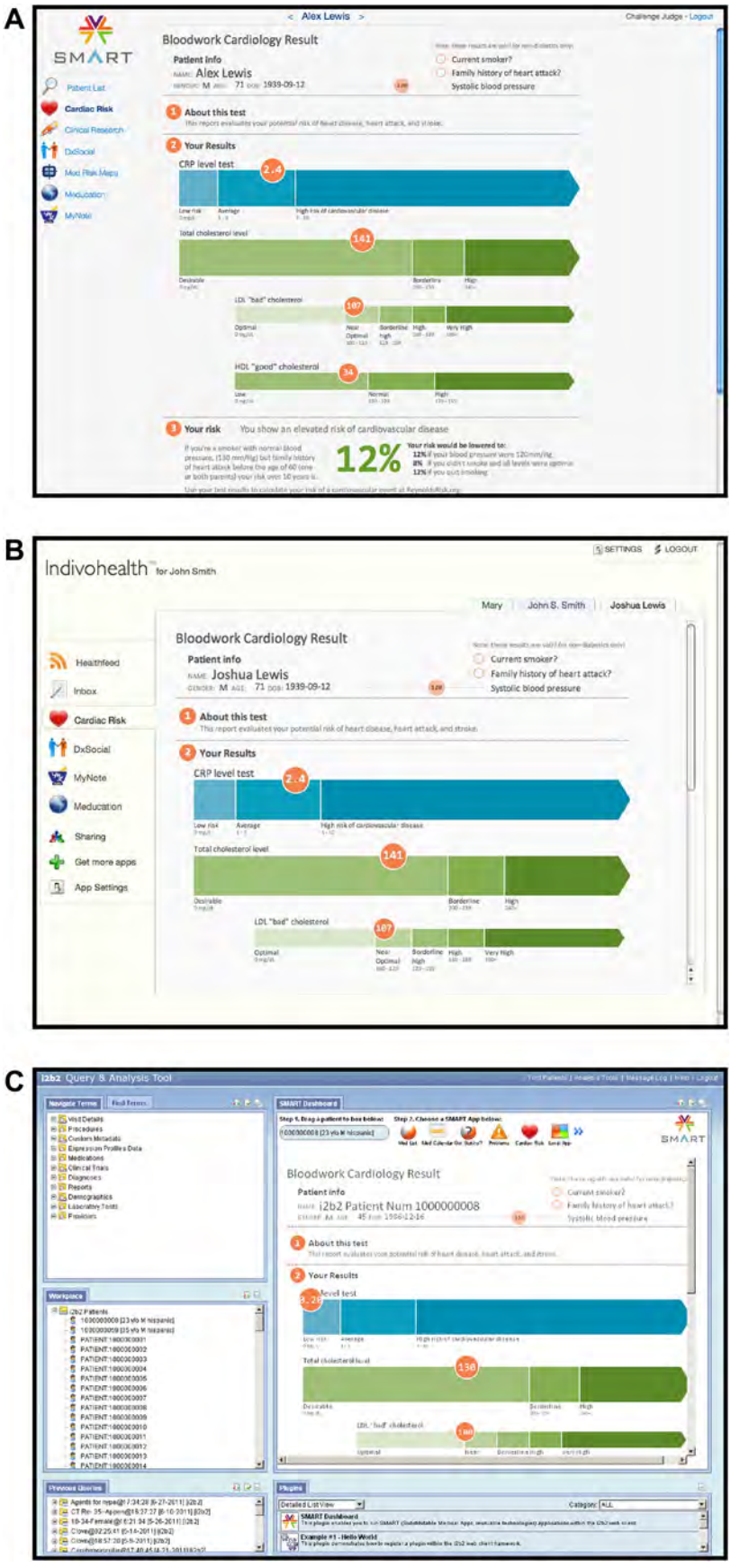


Figure 4 The 'Cardiac Risk' app, based on David McCandless' design (released under a Creative Commons license) shown running unmodified in (A) the SMART reference container, (B) the Indivo PCHR, and (C) the i2b2 analytic platform.

Boston Cerner Millennium installation, with a goal of deploying the 'Pediatric Blood Pressure' app described below. Our initial approach involves loose coupling on the front-end, allowing clinicians to click a link within Cerner's PowerChart patient view to launch a SMART app in a new browser window. On the back-end, we have built a thin translation layer that exposes a few key

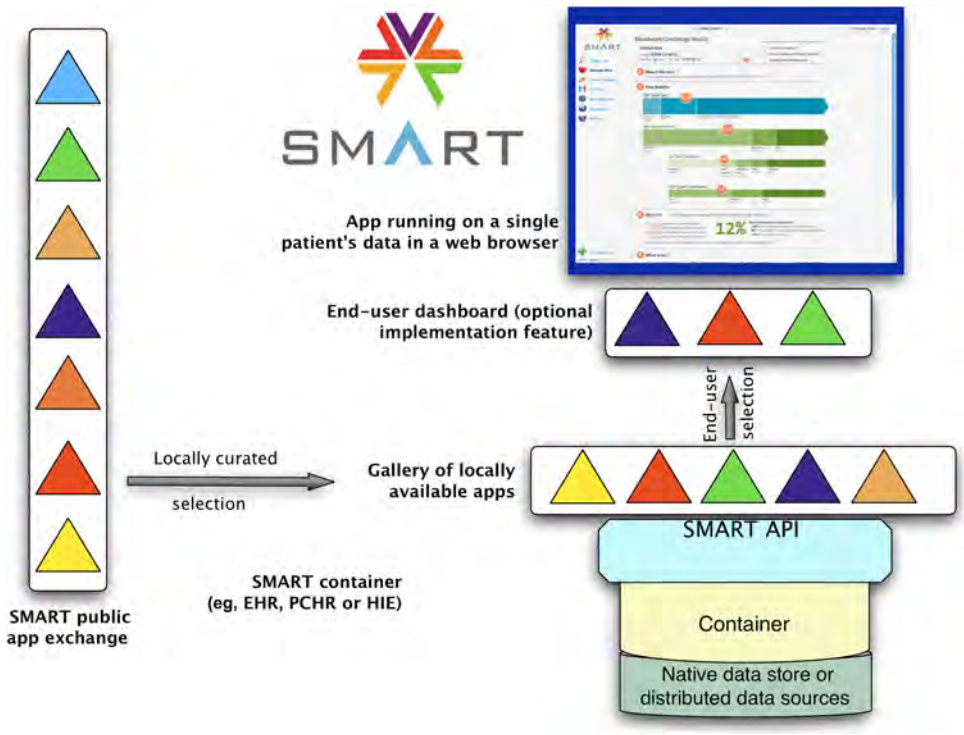


Figure 5 The envisioned SMART ecosystem. Health IT systems, such as electronic health records (EHR), personal health records (PCHR), and health information exchanges (HIE), that use the SMART application (app) programming interface (API) or a portion of it marshal data sources and present data simply, reliably, and consistently to apps. Apps are made available, under a business model to be specified, in one or more app exchanges. Administrators of individual SMART container installations (eg, vendors, chief information officers, practice leaders) can choose which apps are made available to their end users. End users can create a 'dashboard' of apps that they use in their workflow.

data elements including patient demographics, encounters, and vital signs, by issuing queries against the Cerner published 'Millennium Objects' SOAP interface, and translating results to SMART RDF on-the-fly. Early experience indicates that on-the-fly translation is feasible, but pre-fetching and caching results may be required for acceptable performance on larger datasets. The source code for the translation layer, including hooks into the SMART Reference EHR, is available from https://github.com/chb/smart_grails_proxy. In addition, Microsoft has produced a proof-of-concept SMART-enabled version of their HealthVault PCHR.

Charter apps

We have created several charter apps, briefly described here.

The 'Cardiac Risk' app is based on a conceptualization by David McCandless of a consumer-friendly presentation of cardiac risk based on laboratory information about cholesterol, demographics, and risk factors. The image appeared in *Wired* magazine[22] and is posted on McCandless' website for use under the Creative Commons license.[23] The SMART team, programming against the SMART reference container, created a functional, interactive app faithful to McCandless' aspiration. Figure 4 shows the app running in the SMART reference container, on the Indivo PCHR and the i2b2 analytic platform.

The 'Adherence' app accepts medication fulfillment histories, displays gaps in medication possession, and predicts future non-adherence.[24] The 'Blood Pressure' app is the first SMART app designed for a defined population of real-world clinical users; developed according to clinician-derived specifications at the Children's Hospital Boston, it connects to a SMART-enabled Cerner EHR and monitors trends in blood pressure, flagging hypertension in pediatric patients by applying NIH guidelines that incorporate a child's age, gender, and height.

Upcoming research areas and strategic decisions

App distribution and access

While the full business model for distribution of SMART apps is still emerging, a few principles are clear. First, while the SMART API will remain open source and available under the Apache 2.0 license, there is no such obligation for externally developed apps, which may be open or closed source code. Second, we are not committed to a single iTunes-like app store, but rather envision that there may be one or several app exchanges. Assessing quality of apps will be a multi-input process, no doubt involving local opinion leaders, professional organizations, and possibly certification bodies. Administrators of individual SMART container installations (eg, vendors, chief information officers, practice leaders) can choose which apps are made available to their end users (figure 5). End users can create a 'dashboard' of apps that they use in their workflow. Security concerns may inform deployment decisions at a given site. For example, a hospital may want to install all SMART apps on locally hosted servers within the hospital intranet to help ensure the proper treatment of protected health information. By contrast, a PCHR may have much greater tolerance for running cloud-hosted apps, allowing individual patients to determine with which apps they wish to share data.

Write API

To date, the SMART API provides a read-only view of the patient record. We have constrained the API in this fashion in order to lower the barriers for existing health IT systems to adopt SMART and benefit from a growing community of apps. Allowing apps to write data back to a container considerably increases the complexity of implementation. We plan to add write capabilities gradually, as support for the read-only API grows.

Standards

With a goal of maintaining an open stack, we use web standards extensively (eg, HTML, JavaScript,[25] OAuth, RDF) and medical standards for coding systems (eg, RxNorm, LOINC,[25] SNOMED). The space of open clinical data models is underdeveloped. There is no widely implemented, developer-friendly open standard, for example, for what a medication, fulfillment,

or blood pressure looks like. Hence, we have been defining a simple set of abstractions, which we are refining over time.

We believe that the SMART standards and a modern web-based app platform are strong initial steps toward a universal exchange language suggested by the Presidential Council of Advisors on Science and Technology in their report to the President on Health Information Technology.[26] The report recognizes lack of interoperability as a major barrier to health IT adoption and recommends abandoning traditional health data standards and allowing the market to drive semantic harmonization. SMART puts forth a clear model for common health data, starting with medications and fulfillments, problems, allergies, and simple blood laboratory results. The model will continue to evolve, especially over the next year, as the apps market requirements become clear. We have not abandoned current standards, and rely heavily on SNOMED, RxNorm, and LOINC. Our modeling approach allows expression of atomic data points such as single allergies, problems, or a single blood laboratory value, exactly as recommended by the Presidential Council of Advisors on Science and Technology. Further, it allows for the addition of additional semantics over time, without the existing data being affected, or the existing software that relies on these data.

CONCLUSION

Over a period of less than 14 months, we have gone from the point of defining an approach to building a working API which has been used as the basis of several EHR apps developed by groups with no relationship to the SMART team. Nonetheless, we recognize several important challenges and questions. First, where is the most effective market for further disseminating SMART? Is it with the existing market-leading EHR vendors, with the new entrants into the EHR market, or with other stakeholders such as health information exchanges and accountable care organizations? At this time it remains unclear where the major adoption is going to occur. We are currently experimenting with three models of technology diffusion: (1) integration with legacy systems (as described above in our Cerner integration); (2) deployment of apps in health information exchanges; (3) deployment of apps running on a parallel platform (i2b2) with real-time extraction, transformation, and loading from the EHR.

Acknowledgments We are indebted to Dr Charles Friedman and Mr Wil Yu for their dedicated and enabling programmatic support of the project. We are grateful to Aneesh Chopra and Todd Park for their extraordinary commitment to promoting the SMART Platforms project and concept.

Contributors KDM wrote the first and final draft of the manuscript and is the co-PI of SMART. JCM co-wrote the manuscript and is lead architect of SMART. SNM provided valuable sections of the manuscript and is a core member of the SMART leadership team. EVB provided valuable comments on the manuscript and is a core member of the SMART leadership team. RBR provided valuable comments on the manuscript and is the Executive Director of SMART. DAK is a core member of the SMART leadership team, and contributed substantially to the SMART architecture. JMM is a core member of the SMART leadership team, contributed substantially to the SMART architecture and provided substantial input to the manuscript. BA is a core member of the SMART leadership team, contributed substantially to the SMART architecture, and provided valuable input to the manuscript. ISK co-wrote the manuscript and is the PI of SMART.

Funding This work was funded by the Strategic Health IT Advanced Research Projects Award 90TR000101 from the Office of the National Coordinator of Health Information Technology.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. **Mandl KD,** Kohane IS. No small change for the health information economy. *N Engl J Med* 2009;**360**:1278–81.
2. **Office of the National Coordinator for Health Information Technology.** *Strategic Health IT Advanced Research Projects (SHARP) Program*. http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__sharp_program/
3. **U.S. National Library of Medicine.** *2011AA National Drug File—Reference Terminology Source Information*. 2011. http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/NDFRT/
4. **U.S. National Library of Medicine.** *SNOMED Clinical Terms (SNOMED CT)*. http://www.nlm.nih.gov/research/umls/Snomed/snomed_main.html
5. **U.S,** Food and Drug Adminstration. *National Drug Code Directory*. http://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm
6. **U.S. National Library of Medicine.** *RxNorm*. http://www.nlm.nih.gov/research/umls/rxnorm/
7. **W3C.** *Resource Description Framework (RDF): Primer*. http://www.w3.org/TR/rdf-primer/ (accessed 2 Sep 2011).
8. **W3C.** *OWL 2 Web Ontology Language: Primer*. http://www.w3.org/TR/owl2-primer/ (accessed 2 Sep 2011).
9. **SMART Platforms Team.** *SMART Development Site*. http://www.smartplatforms.org/development
10. **OAuth Community.** *OAuth*. http://oauth.net/
11. **Challenge. Gov.** *SMART Apps for Health Challenge*. http://challenge.gov/HHS/134-smart-apps-for-health
12. **SMART Platforms Team.** *SMART Platforms Challenge*. http://www.smartplatforms.org/challenge/
13. **Foundation for the National Institutes of Health.** *2010 mHealth Summit: Meeting 21st Century Health Goals Through Mobile Technology Research & Innovation*. http://www.fnih.org/events/2010-mhealth-summit
14. **Chopra A.** *SMART Prize for Patients, Physicians, and Researchers*. http://www.whitehouse.gov/blog/2011/03/10/smart-prize-patients-physicians-and-researchers
15. **Mandl KD,** Simons WW, Crawford WC, *et al*. Indivo: a personally controlled health record for health information exchange and communication. *BMC Med Inform Decis Mak* 2007;**7**:25.
16. **Mandl KD,** Kohane IS. Tectonic shifts in the health information economy. *N Engl J Med* 2008;**358**:1732–7.
17. **Adida B,** Sanyal A, Zabak S, *et al*. Indivo x: developing a fully substitutable personally controlled health record platform. *AMIA Annu Symp Proc* 2010;**2010**:6–10.
18. **Murphy SN,** Weber G, Mendis M, *et al*. Serving the enterprise and beyond with informatics for integrating biology and the bedside (i2b2). *J Am Med Inform Assoc* 2010;**17**:124–30.
19. **Murphy SN,** Mendis M, Hackett K, *et al*. Clinical research chart from informatics for integrating biology and the bedside. *AMIA Annu Symp Proc* 2007:548–52.
20. **Wolfe BA,** Mamlin BW, Biondich PG, *et al*. The OpenMRS system: collaborating toward an open source EMR for developing countries. *AMIA Annu Symp Proc* 2006:1146.
21. **Mamlin BW,** Biondich PG, Wolfe BA, *et al*. Cooking up an open source EMR for developing countries: openMRS—a recipe for successful collaboration. *AMIA Annu Symp Proc* 2006:529–33.
22. **Leckart S.** *The Blood Test Gets a Makeover*. Wired, 2010.
23. **McCandless D.** Visualizing Blood Tests. *Information is Beautiful: Ideas, Issues, Knowledge, Data—Visualized!* http://www.informationisbeautiful.net/2010/visualizing-bloodtests/
24. **Jonikas MA,** Mandl KD. Surveillance of medication use: early identification of poor adherence. *J Am Med Inform Assoc*. Published Online First: 19 November 2011. doi:10.1136/amiajnl-2011-000416
25. **The Regenstrief Institute.** *Logical Observation Identifiers Names and Codes (LOINC®)*. http://loinc.org/
26. **Executive Office of the President,** President's Council of Advisors on Science and technology. *Report to the President: Realizing the Full Potential of Health Information Technology to Improve Healthcare for Americans: the Path Forward*. 2010. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-health-it-report.pdf

The SMART Platform: early experience enabling substitutable applications for electronic health records

Kenneth D Mandl, Joshua C Mandel, Shawn N Murphy, et al.

J Am Med Inform Assoc published online March 17, 2012
doi: 10.1136/amiajnl-2011-000622

Ten Principles for Fostering Development of an "iPhone-like" Platform for Healthcare Information Technology

June 2009

www.chip.org/platform

Children's Hospital Informatics Program at Harvard-MIT Health Sciences and Technology
Children's Hospital Boston, Boston, MA

Center for Biomedical Informatics
Harvard Medical School, Boston, MA

Summary

The Informatics Program at Children's Hospital Boston (CHIP) recently convened a meeting of leading experts in health, innovation and technology to define ten core principles of a platform that would support healthcare information technology.

The meeting was held May 13 at the Harvard Medical School Center for Biomedical Informatics and took the form of a workshop. It followed publication of a *New England Journal of Medicine* Perspective article authored by CHIP researchers entitled, "*No Small Change for the Health Information Economy*." [1] In the paper, the authors argued that a vibrant and evolving health system requires a healthcare information technology infrastructure based less on monolithic, pre-defined products and more on a general-purpose platform that would support a collection of simple applications each doing a single task consistently and reliably. Under this view of a healthcare infrastructure, as one's needs evolve, one could substitute simple applications within a platform, rather than substitute in an "all or nothing" way, one vendor product for another. The platform would allow a clinical practice or hospital to select the combination of applications that are most useful for the local environment. A practice or a hospital would be able to download, for example, a medication management application from one vendor and a notifiable disease reporting tool from another. As alternative applications are developed by competitors, the existing ones may be replaced, or new ones added.

The authors of the *New England Journal of Medicine* perspective held up the Apple iPhone as an example of the success of substitutability. The iPhone is one of several products that employ a software platform with a published interface to facilitate a low-cost, efficient, and reliable software development process open to the market; there are now more than 20,000 applications that consumers can download and use with the iPhone. The iPhone separates the platform from the functionality provided by the applications, which are easily substitutable by the lay person. One can download a calendar reminder system, reject it, and download another one instead. The consumer commits to the platform because of its flexibility and commits to various applications on the basis of need, value, usability, and cost.

Participants of the May workshop believe that an infrastructure based on "substitutable" components is a highly promising way to drive down healthcare technology costs, allow flexibility, support standards evolution, accommodate differences in care workflow, foster competition in the market, and accelerate innovation. The model stands in stark contrast to the vast majority of health information systems that have been designed and implemented to date. The current trajectory of health information systems development, we fear, may not scale, may not be sufficiently adaptable, and may not meet even near-term national expectations, much less adapt rapidly to innovations in healthcare delivery.

The workshop participants believe this dramatically different, platform-based "substitutable" model is sufficiently promising to warrant consideration by the Department of Health and Human Services, and many other stakeholders, as they consider means of implementing the Health Information Technology for Economic and Clinical Health (HITECH) Act.

[1] Mandl KD, Kohane IS. No small change for the health information economy. *N Engl J Med.* Mar 26 2009;360(13):1278-1281.

Ten Principles for Fostering

Development of an "iPhone-like" Platform for Healthcare Information Technology

1. **Technology platforms that support substitutable applications should be promoted.** We suspect that low rates of technology adoption in practice settings may largely be explained in terms of the mismatch between system needs and available products. Rather than ask: "What electronic health record (EHR) is ideal for my practice?" perhaps we should ask, "What tasks do I 'hire' my EHR to support?" Some of these tasks—particularly basic clinical and administrative tasks—are fairly well-defined. But in many instances, we simply do not have a census on the specific work activities across the ever-growing number of settings in which technology can support and enable better healthcare. Those who understand these tasks are not empowered to create useful applications to support those tasks, because no platform exists to easily adopt such applications. Platforms composed of substitutable components would promote the creation of, and enable the incremental adoption of, useful task-specific applications with low switching costs. Such an approach is ideal when organizations are adapting to external changes in their practice environment, and discovering more effective means of performing their internal work. A platform of such applications also removes the constraint *of a priori* determination of tasks and avoids an over-specification of system requirements.

2. **Messages and protocols for data exchange should be allowed to emerge on demand in a market-driven approach, and specified transparently at every level.** The rapid and recent progress in the standards debate suggests a convergence nationally along a greatly restricted set of standards that can be made interoperable as the need arises and the market dictates. Substitutable applications enable interoperability to evolve with the evolving healthcare system from the bottom up. For example, a suite of wellness applications linked to everyday activities may require unique protocols, but these protocols are currently a matter of debate, and perhaps best resolved through the actual needs of the users of applications—not through forced consensus. While top-down approaches to such problems are at times necessary, they do not foster the nimbleness required to adopt the best of technology in addressing important healthcare needs.

3. **Protocols and application programming interfaces should allow the possibility of multiple platforms co-existing.** Successful evolution of a platform model may involve development of multiple competing platforms as long as each remains open to substitutable third party applications.

4. **Application programming interfaces should be open.** Third-party vendors should be able to develop plug-and-play applications and play without barriers.

5. **Substitutable application or platform vendors should not have control over what is installed on the platform.** In response to provider/practitioner **r**equests, local systems administrators should be able to install modules without permission from the vendor. As long as application developers demonstrate that their software does not adversely interact with other applications, and provides the specified services accurately, consistently, and reliably, platform vendors should have no control over what applications may be created, made available, or installed. Other mechanisms to certify, regulate, or recommend applications should be developed (e.g., through professional societies).

6. **Application installation should be turnkey.** Administrators of platform-based systems should be able to install applications from different vendors without software programming.

7. **The intellectual property of platforms and applications should be kept separate.** Only freely available application programming interfaces should be used for all application development. Undocumented access to platform internals should be prohibited, particularly by platform vendors.

8. **All applications should be removable and none should be required to run a platform.** To avoid “vendor lock,” even base system platform software bundled with substitutable applications should provide an option to remove those applications.

9. **The platform should have a highly efficient delivery mechanism for applications.** Successful platforms, such as the Apple iPhone platform, have demonstrated the importance of efficient mechanisms for delivering applications to customers.

10. **Certification requirements for platforms and applications should be kept minimal to maximize substitutability.** This approach moves away from definition of a product, and toward definition of a platform that supports substitutable applications that meet the tasks they are “hired” to perform. Each application must be rigorously shown to have reliable and proven interactions with the base platform, but should not be required to certify specific user functionality. Such an approach eliminates the risk of premature definitions of products like “EHRs,” and rightly returns the focus towards technologies that accomplish the tasks people “hire” these applications to do.

The following six individuals attended the workshop and support the collaborative statement of principles reflected in this document.

Workshop co-chairs

Kenneth D. Mandl, MD, MPH
Children's Hospital Boston, Harvard Medical School

Isaac S. Kohane, MD, PhD
Children's Hospital Boston, Harvard Medical School

Workshop participants

Clayton Christensen, PhD
Harvard Business School

Henry Chueh, MD, MS
Massachusetts General Hospital, Harvard Medical School

Mark Frisse, MD, MBA, MSc
Vanderbilt University Medical Center

David C. Kibbe, MD, MBA
The Kibbe Group LLC

Acknowledgements

We thank Keith Strier for kindly serving as a facilitator and reactor during the workshop, Jonathan Teich for his input during the workshop, and Enrico Coiera and Ben Adida for their insights in preparation for the workshop.