NATIONAL ACADEMIES Sciences Engineering Medicine

July 25 · 8:30AM – 4:00PM ET

Diagnosis in the Era of Digital Health and Artificial Intelligence

HOSTED BY:
FORUM ON ADVANCING DIAGNOSTIC EXCELLENCE

National Academy of Sciences Building
2101 Constitution Ave., N.W., Room 120
Washington, DC 20001

NATIONAL ACADEMIES
Sciences Engineering Medicine

Workshop on Diagnosis in the Era of Digital Health and Artificial Intelligence
July 25, 2024 | 8:30 AM-4:00 PM ET

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BOARD ON HEALTH CARE SERVICES |
FORUM ON ADVANCING DIAGNOSTIC EXCELLENCE

Diagnosis in the Era of Digital Health and Artificial Intelligence: A Workshop

THURSDAY, JULY 25, 2024—NATIONAL ACADEMY OF SCIENCES, ROOM 120

8:00 AM **BREAKFAST—NAS ROOM 120**

8:30 AM **Welcome and Opening Remarks**

Andrew Bindman, Kaiser Permanente
Forum Chair, Advancing Diagnostic Excellence

Workshop on Diagnosis in Digital Health and Artificial Intelligence Remarks

Daniel Yang, Kaiser Permanente
Planning Committee Chair

Keynote: History of Artificial Intelligence in Diagnosis

Michael Howell, Google Health

9:15 AM **Session 1: Using Artificial Intelligence and Digital Health Technology to Support Patients from Symptom Onset to Seeking Care**

Moderators: *Michael Howell, Google Health*
David Larson, Stanford University School of Medicine

Patient Advocate Perspective

Grace Cordovano, Enlightening Results

Ensuring the Safe and Secure Use of Patient Information

Lucia Savage, Omada Health

Patient Navigation of Digital Platforms to Understand Symptoms and Its Role in Connecting to Care

John Whyte, WebMD

Panel Discussion/Audience Q&A

10:15 AM **Session 2: Utilizing Artificial Intelligence to Improve Information Gathering and Patient-Clinician Communication During Diagnosis**

Moderators: *Julia Adler-Milstein, University of California, San Francisco* ***[Virtual]***
Gene Harkless, University of New Hampshire

Improving Information Gathering Through Natural Language Processing of Patient Signs and Symptoms in the Electronic Health Record

Kenrick Cato, University of Pennsylvania ***[Virtual]***

Opportunities to Engage Patients in Diagnostic Safety Through Open Notes

Sigall Bell, Beth Israel Deaconess Medical Center

Deployment and Implementation of Artificial Intelligence Technologies in Task Prediction and Improving Linkages to Specialists

Jonathan Chen, Stanford University School of Medicine ***[Virtual]***

Panel Discussion/Audience Q&A

11:15 AM **BREAK**

11:30 AM **Session 3: Leveraging Artificial Intelligence to Support Clinician Decision-Making**

Moderators: *Salahuddin Kazi, University of Texas Southwestern Medical Center*
Pari Pandharipande, The Ohio State University

Harnessing Artificial Intelligence to Enhance Diagnostic Reasoning

Adam Rodman, Beth Israel Deaconess Medical Center ***[Virtual]***

Using Artificial Intelligence to Improve Radiology Workflow

Jason Poff, Greensboro Radiology

Artificial Intelligence Advancements in Radiology, Image Analysis, and Diagnosis in Research

Yvonne Lui, New York University Grossman School of Medicine ***[Virtual]***

Panel Discussion/Audience Q&A

12:30 PM **LUNCH BREAK—NAS ROOM 120**

1:30 PM **Session 4: Advancing Health Equity Through Diagnostic Artificial Intelligence**

Moderators: *Thomas Cudjoe, Johns Hopkins University School of Medicine*
Maia Hightower, Equality AI

Mitigating Racial and Ethnic Bias in Clinical Algorithms

Kadija Ferryman, Johns Hopkins School of Public Health ***[Virtual]***

Using Artificial Intelligence and Machine Learning Strategies to Advance Health Equity for Older Adults
Michael Cary, Duke University School of Nursing

Strategies to Address Digital Determinants of Health
Irene Dankwa-Mullan, Marti Health

Panel Discussion/Audience Q&A

2:30 PM **Session 5: A Vision for the Future of Diagnostic Excellence in Artificial Intelligence**
Moderator: *Daniel Yang, Kaiser Permanente*

Panelists:

- Ysabel Duron, The Latino Cancer Institute ***[Virtual]***
- Craig Umscheid, Agency for Healthcare Research and Quality
- Prabhjot Singh, Peterson Health Technology Institute
- Eric Horvitz, Microsoft ***[Virtual]***
- Judy Wawira Gichoya, Emory University

3:45 PM **Workshop Closing Remarks**
Daniel Yang, Kaiser Permanente

4:00 PM **MEETING ADJOURNS**

NATIONAL ACADEMIES Sciences Engineering Medicine

Board on Health Care Services
Health and Medicine Division

Diagnosis in the Era of Digital Health and Artificial Intelligence: A Workshop
Statement of Task

A planning committee of the National Academies of Sciences, Engineering, and Medicine will organize a public workshop to examine the opportunities and challenges for improving diagnosis in the era of digital health and artificial intelligence (AI). Workshop participants will consider policy strategies and research opportunities to improve timely and accurate diagnosis in the context of these diagnostic innovations.

The workshop will feature invited presentations and discussions on:

- The current and developing role of digital health and AI technologies to improve diagnosis, including mechanisms to routinely collect data and to communicate patient information to clinicians in real time;
- Methodologies and data access needs to develop, assess, and validate clinically useful, unbiased, and transparent diagnostic algorithms, and mechanisms (both regulatory and non-regulatory) to ensure safety, effectiveness, and reliability of these algorithms in diverse populations;
- Strategies for broad implementation of effective diagnostic innovations, with emphasis on patient-centered care, and metrics to ensure high-quality diagnosis;
- Ways to ensure data security and protect patient privacy while using these technologies;
- Disparities in access to new technologies, and strategies to reduce barriers to access;
- The potential to leverage digital health and AI to lower costs and redundancies in the diagnostic process, while improving patient safety and health outcomes; and
- Potential unintended consequences of AI in the diagnostic setting, and strategies to mitigate undesired consequences.

In accordance with institutional guidelines, a designated rapporteur will prepare a proceedings-in brief of the workshop based on the presentations and discussion during that workshop. The proceedings-in brief will be subject to the National Academies review procedures prior to release.

NATIONAL ACADEMIES Sciences Engineering Medicine

Workshop on Diagnosis in the Era of Digital Health and Artificial Intelligence
Speaker Biographies

Sigall Bell, M.D., is a healthcare innovator focused on building strong relationships between patients and clinicians to improve safety and quality of care. An associate professor of medicine at Harvard Medical School and Director of Patient Safety and Discovery at OpenNotes, based at Beth Israel Deaconess Medical Center in Boston, MA, Dr. Bell's work concentrates on patient engagement and empowerment through health information transparency. Her work on open notes has been cited by the National Academies of Science, Engineering, and Medicine; the National Quality Forum; the IHI National Action Plan; and is recognized as a transforming concept in patient safety. As a recipient of the Arnold P. Gold professorship for humanism in medicine and a contributor to several AHRQ medical liability reform grants, she has trained over 1,000 clinician leaders in medical error disclosure and contributed to national guidelines on compassionate and transparent communication after harmful events. Dr. Bell's current research on diagnostic excellence aims to develop the evidence base, systems, and culture to make patient and family engagement an expected, supported, and celebrated norm. She strives to bring a culture of engagement to pediatric and adult patients, empowering kids and communities for healthier futures. Prior to her work in patient safety, Dr. Bell was an HIV doctor and researcher, international health specialist, and an inductee to the CoSIDA National Athletic Hall of Fame.

Michael Cary, Ph.D., RN, is Associate Professor and Elizabeth C. Clipp Term Chair of Nursing in the Duke University School of Nursing. Dually trained as a health services researcher and applied data scientist, Dr. Cary uses AI and machine learning to study health disparities related to aging and develop strategies to advance health equity and improve healthcare delivery to older adults in diverse populations. His research has been supported by the National Library of Medicine, National Institute of Nursing Research, and the Duke Clinical and Translational Science Institute. He has published more than 60 manuscripts, book chapters, and editorials and has mentored numerous students and faculty members. In 2022, he was inducted as a Fellow of the American Academy of Nursing for his significant contributions to improve health and healthcare. Most recently, he was selected by Duke Health to be the inaugural AI Health Equity Scholar. In this health system leadership position, he leads an interdisciplinary team in identifying clinical algorithms that perpetuate racial and ethnic health and health care disparities and implementing system-wide standards for mitigating their harmful discriminatory effects on patients. These meaningful contributions are vital to addressing health disparities and promoting equitable health outcomes for all patients at Duke and beyond. More information can be found on his website: https://aihealth.duke.edu/equity-scholar/ Dr. Cary is the Co-Director of a new initiative at the Duke University School of Nursing named the Fostering AI Research for Health Equity And Learning Transformation Hub. This unique program aims to enhance AI literacy among nurses and promote research focused on incorporating AI into healthcare equitably and without bias, ensuring its benefits extend to diverse populations. Dr. Cary received a bachelor's degree in health services administration from James Madison University. He also earned a bachelors, masters, and doctoral degree in nursing from the University of Virginia.

Kenrick D Cato, Ph.D, RN, CPHIMS, FAAN, is a clinical informatician whose research focuses on mining electronic patient data to support decision-making for clinicians, patients, and caregivers. Operationally, he spends his time mining and modeling Nursing data to optimize Nursing value in

Healthcare. He is also involved in several national-level informatics organizations, including as a board member of the American Medical Informatics Association (AMIA), Chair of the Nursing Informatics Working Group(NIWG) of AMIA, as well as a convening member of the AMIA-sponsored 25 x 5 initiative to reduce documentation burden. Dr. Cato received his BSN, MS, and Ph.D. in Clinical informatics at Columbia University.

Jonathan H. Chen, M.D, Ph.D leads a clinical informatics research group to empower individuals with the collective experience of the many, combining human and artificial intelligence to deliver better care than either. Dr. Chen founded a company to translate his Computer Science graduate work into an AI system still used by students around the world. His expertise is featured in the popular press with over 100 research publications and awards. Dr. Chen continues to practice medicine for the reward of caring for real people and to inspire his research to discover and distribute the latent knowledge embedded in clinical data.

Grace Cordovano, Ph.D., BCPA, founder of Enlightening Results and co-Founder of Unblock Health, is dedicated to providing personalized patient advocacy services, specializing in the oncology space. With over 25 years of advocacy experience, she strategically guides patients through survivorship or end-of-life care planning with empathy, ensuring they are armed with the most pertinent, medically credible, easy to understand information to make informed decisions about their care. Through her advocacy work, she is humbled to witness the challenges, barriers to access, unmet needs, grief, financial toxicities, joys, and losses patients face in the midst of a diagnosis. Dr. Cordovano is an advocate for leveraging digital technologies to enhance treatment of the whole person in the context of life-altering diagnoses as well as for digital health to give patients a competitive advantage over their diagnosis. A recognized authority on Patient Administrative Burden (PAB), Dr. Cordovano's co-founded Unblock Health, the master key to unlocking all access to patient health information while enabling patients to exercise their right of access. Her policy work is far-reaching, contributing to the U.S. Core Data for Interoperability Taskforce, HITAC Interoperability Standards Work Group, HIMSS Public Policy Committee, the Sequoia Project's Consumer Voices Workgroup, and the National Academy of Medicine's AI Code of Conduct Project. Her advisory role at CancerX reflects her passion for equitable, affordable cancer care for all patients. Dr. Cordovano completed her Master's and Ph.D. in Biochemistry at Albert Einstein College of Medicine (Bronx, NY). She is a board-certified patient advocate via the international credentialing of the Patient Advocate Certification Board. She served as one of 5 national e-patient ambassadors for the Coalition of Compassionate Care of California, a PCORI research project funded by the Eugene Washington PCORI Engagement Award. Dr. Cordovano has been repeatedly recognized as Patient Advocate of the Year. She has been featured in StatNews, Medscape, KevinMD, Tincture, The Health Care Blog, U.S. News & World Report, Kaiser Health News, etc.

Irene Dankwa-Mullan, M.D., M.P.H., is a physician executive and national thought leader with diverse regional, and national leadership experience in primary care, public health, and the community. She is currently Chief Health Officer at Marti Health, a health services and digital health equity start-up with a mission to promote quality health, address inequities and change the way patients receive care. Marti Health started with services support for the sickle cell disease patient, caregiver, and advocacy community – as the priority population to tackle. She also serves in an advisory capacity for two health technology start-up companies leveraging artificial

intelligence - machine learning technologies and predictive analytics to inform precision health and care. She is an adjunct professor at The George Washington University Milken Institute School of Public Health. Dr. Dankwa-Mullan previously served as Chief Health Equity Officer at IBM Watson Health. Her work at IBM received recognition and she was appointed to the IBM Industry Academy of distinguished leaders, to work collaboratively with other industry leaders on creative and cutting-edge technology innovation. Prior to IBM, Dr. Dankwa-Mullan served as a medical officer in various leadership roles within the National Institute on Minority Health and Health Disparities (NIMHD), NIH. She helped launched the transformational research agenda at the NIH to advance the science of health disparities research in a deliberate and inclusive engagement process involving the NIH, community partners and the broader scientific community. She received numerous awards including the distinguished individual NIH Director's award for sustained and outstanding leadership in advancing the science of health disparities research. Prior to NIH, she served as Medical Director for public health services, working with community coalitions, youth, and school-based programs to develop community prevention, education, and screening programs. Dr. Dankwa-Mullan has maintained keen passion for science innovation, patient-centered care, promoting equitable health outcomes and the patient experience while identifying opportunities to create more inclusive, culturally competent, equitable and compassionate clinical care services. She has published widely on health disparities, including on the integration of health equity, artificial intelligence and machine-learning, ethical artificial intelligence (AI) and social justice principles into data science methods and technology development lifecycle with over 90 publications. She is also the lead scientific editor and author of the first authoritative resource scientific textbook, "The Science of Health Disparities Research" designed to help researchers, the healthcare and medical community identify research questions, design, and conduct studies with culturally appropriate interventions, and advance the science.

Ysabel Duron is a pioneering, award-winning Latina journalist, and a leading figure in cancer education in the Latino community in the US. Ms. Duron was a journalist and TV news anchor for more than 43 years winning numerous awards, including two EMMYS. She has been inducted into the Hall of Fame of the National Association of Hispanic Journalists and given the Living Legacy Award by the Chicana/Latina Foundation. In 2019 she received a Lifetime Achievement Award from the International Women's Media Foundation, which she helped found 30 years earlier to help put women's voice front and center in covering the news. As a journalist she covered her own battle against Hodgkin's Lymphoma, using her reporting to help raise awareness about the disease and health disparities involved in treating it in communities of color. In 2003, as a result of her own experience, she founded Latinas Contra Cancer, a non-profit organization that advocates for and serves the Latino community. She drove development of programs to address gaps across the cancer continuum from community education and navigation into screening to psychosocial support groups, treatment and survivorship. Her early mantra when she launched Latinas Contra Cancer was *talking about cancer won't kill us, the silence will*. She successfully piloted a lay community navigator program in the public health care system's Sobrato Cancer Center in San Jose, California, dedicated to providing support and guidance for low income, Spanish-speaking patients. In 2008, she launched the biennial National Latino Cancer Summit bringing community together with researchers to network, learn from each other and find ways to collaborate. In 2016 the Summit spotlighted Precision Medicine – concerned the cutting-edge science would exacerbate disparities if underserved communities could not access it. In 2017 she was appointed, by NIH Director Francis Collins, to the Institutional Review Board (IRB) for the All

of Us Research Program, formerly known as President Obama's Precision Medicine Initiative. The role of the IRB is to protect the rights, welfare and privacy of research participants. As a patient advocate, Ms. Duron also works to ensure that research is inclusive of racial/ethnic minorities, and is sensitive to historic, cultural and language barriers, and bias, that hinder their successful engagement. She is now the President of The Latino Cancer Institute (TLCI), a national network of Latino cancer service agencies addressing the community's cancer disparities.

Kadija Ferryman, Ph.D., is an anthropologist who studies the ethical, social, and policy dimensions of digital health technologies. Specifically, her research examines racialization and health equity in digital health technologies. Dr. Ferryman is Core Faculty at the Berman Institute of Bioethics and Assistant Professor in the Department of Health Policy and Management at the Johns Hopkins Bloomberg School of Public Health.

Eric Horvitz, M.D., serves as Microsoft's Chief Scientific Officer. He spearheads company-wide initiatives, navigating opportunities and challenges at the confluence of scientific frontiers, technology, and society, including strategic efforts in AI, medicine, and the biosciences. Dr. Horvitz is known for his contributions to AI theory and practice, with a focus on principles and applications of AI amidst the complexities of the open world. His research endeavors have been direction-setting, including harnessing probability and utility in machine learning and reasoning, developing models of bounded rationality, constructing systems that perceive and act via interpreting multisensory streams of information, and pioneering principles and mechanisms for supporting human-AI collaboration and complementarity. His efforts and collaborations have led to fielded systems in healthcare, transportation, ecommerce, operating systems, and aerospace. Beyond his scientific work, he has pursued programs, organizations, and studies on ethics, values, and safety with applications and influences of AI. He founded and chairs Microsoft's Aether committee on AI, effects, and ethics in engineering and research. He established the One Hundred Year Study on AI at Stanford University and co-founded and serves as board chair of the Partnership on AI (PAI). He served as a Congressionally appointed commissioner on the National Security Commission on AI, where he chaired the line of effort on ethical and trustworthy AI. Dr. Horvitz received the Feigenbaum Prize and the Allen Newell Prize for his fundamental contributions to the science and practice of AI. He received the CHI Academy honor for his work at the intersection of AI and human-computer interaction. He has been elected fellow of the National Academy of Engineering (NAE), the Association of Computing Machinery (ACM), Association for the Advancement of Artificial Intelligence (AAAI), the American Association for the Advancement of Science (AAAS), the American Academy of Arts and Sciences, the American College of Medical Informatics, and the American Philosophical Society. He currently serves on the President's Council of Advisors on Science and Technology (PCAST) and advisory boards of the Allen Institute for AI and Stanford's Institute for Human-Centered AI (HAI). He served as president of the AAAI, as a board member on the Computer Science and Telecommunications Board (CSTB), and on advisory committees for the National Science Foundation (NSF), National Institutes of Health (NIH), Defense Advanced Research Projects Agency(DARPA), and the Computing Community Consortium (CCC). He received his Ph.D. and M.D. degrees at Stanford University. Before moving into the role of Chief Scientific Officer, he served as director of Microsoft Research overseeing research labs in Redmond, Washington; Cambridge, Massachusetts; New York City, New York; Montreal, Canada; Cambridge, United Kingdom; and Bangalore, India.

Yvonne W. Lui, M.D., FACR is Professor and Vice Chair of Research for the Department of Radiology at NYU Grossman School of Medicine and the Vilcek Institute of Graduate Biomedical Sciences. She previously served as the Chief of Neuroradiology in the department for 7 years and as the inaugural Associate Chair for Artificial Intelligence, building an innovative program to leverage technological advances in computer vision and machine learning for medical imaging. In this latter role, she worked on expanding novel research applications of machine learning in imaging as well as governance and deployment strategies of AI in the department. A native of New York City, Dr. Lui is a graduate of Swarthmore College and Yale University where she studied Physics and Medicine. She completed her residency and fellowship at NYU. She now leads a world-renown radiology research program known for being a leader in imaging technology development, innovative translational research and novel applications of machine learning in medical imaging. The program ranks consistently in the top 10 in the nation for NIH-funding and there are over 35 faculty and 100 non-faculty personnel including postdoctoral fellows and research scientists. She serves as the collaboration lead on major research partnerships with both academia and industry including NYU Courant Institute and NYU Center for Data Science, Siemens Healthineers, and Facebook AI Research (now Meta AI). She facilitates open access scientific advances through initiatives such as MRI4ALL Hackathon and the fastMRI initiative which created a table-top, low-field 44 milliTesla MRI scanner in 1 week and established one of Amazon web services top-10 publicly available health sciences datasets, respectively. Dr. Lui herself is a NIH-funded researcher in translational neuroimaging to study traumatic brain injury since 2011. Her lab seeks to use MRI as an in vivo microscope to see into the brain and better understand neurological health and disease after injury and was the first to use machine learning to analyze complex MRI data in head injury patients. She serves on multiple NIH scientific review committees, is Past President of the New York Roentgen Society (NYRS), former oral board examiner for the American Board of Radiology (ABR) and a member of their Standard Setting Committee. She has previously served as Senior Editor for the American Journal of Neuroradiology (AJNR), is Immediate Past President of the American Society of Neuroradiology (ASNR) and a member of the ASNR board of directors, and a fellow of the American College of Radiology (ACR).

Jason Poff, M.D., serves as the director of innovation deployment at Radiology Partners where he has helped to lead one of the world's largest clinical deployments of imaging AI tools. Dr. Poff completed his radiology residency and an abdominal imaging fellowship at the Hospital of the University of Pennsylvania. He has been a private practice radiologist specializing in abdominal, thoracic and oncologic imaging at Greensboro Radiology in Greensboro, North Carolina since 2016, where he serves on the local practice board. He also serves on the Technology & Practice subcommittee of the RSNA Committee on Government Relations. Dr. Poff's interests include the development of best practices for clinical validation of radiology AI models and exploring the intersection of AI, radiologist workflow and clinical quality improvement.

Adam Rodman, M.D., M.P.H., FACP is a general internist and medical educator at Beth Israel Deaconess Medical Center and an assistant professor at Harvard Medical School, where he leads the task force for integration of AI into the medical school curriculum. He is also an associate editor at NEJM AI. His research focuses on medical education, clinical reasoning, integration of digital technologies, and human-computer interaction, especially with AI. His first book is entitled "Short Cuts: Medicine," and he is the host of the American College of Physicians podcast Bedside

Rounds. Adam completed his residency in internal medicine at Oregon Health and Science University in Portland, OR, and his fellowship in global health at Beth Israel Deaconess Medical Center while practicing in Molepolole, Botswana. He lives in Boston with his wife and two young sons.

Lucia Savage, J.D., is a nationally recognized expert on health care regulation, digital health and health information privacy. Using strategic advice to advance digital technology to deliver health care, she drives the Omada Health's privacy, regulatory and public policy strategies. Founded in 2011, Omada Health is one of the oldest virtual-first digital healthcare providers in the U.S. and has provided well-established cardio-metabolic and physical therapy protocols via a virtual-first approach to over 1 million individuals. Ms. Savage also is: An Advisor to ClaimsHero, Inc., which seeks to simplify appeals of healthcare claims denials using AI and Machine Learning to help individuals navigate processes set by regulations. She is also a member of the Board of Directors of Tidepool, a 501(c)(3) that is developing an open-source, fully interoperable closed-loop insulin pump (clearance pending at FDA) that allows people with diabetes to see and understand their own data; and a member of the Board of Directors of Academy Health, where she is chair of its Committee on Advocacy and Public Policy. Lucia is Rock Health's 2021 "Top 50 in Digital Health" for her policy acumen and digital health advocacy and is a contributing author to Amazon bestsellers "Mobile Medicine: Overcoming People, Culture and Governance," and "Advanced Health Technology: Managing Risk While Tackling Barriers to Rapid Acceleration. She has testified before the Senate Committee on Health, Education, Labor and Pensions on health information interoperability and digital health, and published with colleagues on safe, responsible, and private use of individuals' data to develop AI for healthcare. Prior to joining Omada, she served the Obama Administration as Chief Privacy Officer at the U. S. Department of Health and Human Services Office of the National Coordinator for Health IT. Lucia has a B.A. with Honor from Mills College and received her Juris Doctor summa cum laude from New York University School of Law.

Prabhjot Singh, M.D., Ph.D., is a physician who believes in a future of healthcare that is advanced, affordable, and available to all. He is a Senior Advisor for Strategic Initiatives at the Peterson Center on Healthcare and the Peterson Health Technology Institute. Most recently, he was Chief Medical Officer of CHW Cares (acquired by Oak Street Health, now part of CVS). He is also the author of Dying and Living in the Neighborhood: A Street Level View of America's Healthcare Promise (Hopkins Press). Prabhjot completed a BA in history and BS in biology at the University of Rochester. He earned his MD at Weill Cornell and his PhD in neural and genetic systems at Rockefeller University. He is board-certified in internal medicine and completed a postdoctoral fellowship in sustainable development at Columbia University's Earth Institute. He was a Robert Wood Johnson Foundation 40th Anniversary Young Leader, Paul and Daisy Soros Fellow, and a Presidential Leadership Scholar.

Craig Umscheid, M.D., M.S., is a general internist and clinical epidemiologist who serves as the Director of the Center for Quality Improvement and Patient Safety (CQuIPS) at the Agency for Healthcare Research and Quality (AHRQ) in the U.S. Department of Health and Human Services. CQuIPS is one of three centers at AHRQ, includes divisions of patient safety, patient safety organizations, healthcare associated infections, quality improvement and measurement, and data analytics, and supports the safety, quality and value of healthcare through research, practice improvement, and data analysis and measurement. Prior to AHRQ, Dr. Umscheid was Chief

Quality and Innovation Officer at the University of Chicago. He began his career at the University of Pennsylvania, where he became Vice Chair of Quality and Safety for the Department of Medicine, and co-founder and Director of Penn's Center for Evidence-based Practice. His career has been dedicated to disseminating and implementing research evidence into clinical practice to support patient care quality and safety. His work has been supported by AHRQ, PCORI, CDC and NIH, and described in over 125 peer-reviewed publications. Dr. Umscheid volunteers as a hospitalist at Georgetown, where he is an Adjunct Professor.

John Whyte, M.D., M.P.H., is a physician and author with a unique combination of government and private sector work that provides him with an exceptional perspective on health care services, wellness, clinical trials, information technology, artificial intelligence and medical consumerism. He is currently the Chief Medical Officer, WebMD. In this role, Dr. Whyte leads efforts to develop and expand strategic partnerships that create meaningful change around important and timely health issues. He is an expert on the changing nature of search through his work in iterating digital platforms from simply providing content, to instead playing a pivotal role in connecting to care. He has been a leading voice when it comes to health topics, consistently being named as one of the top 20 influencers. Prior to WebMD, Dr. Whyte served as the Director of Professional Affairs and Stakeholder Engagement at the Center for Drugs Evaluation and Research at the U.S. Food and Drug Administration. In this role, Dr. Whyte spearheaded numerous efforts to address diversity in drug development programs especially as it relates to necessary changes in clinical trial design. This includes strategies around patient recruitment and acquisition, as well as the use of adaptive clinical trial design and master protocols. Dr. Whyte also helped provide regulatory insight into the potential uses of real-world evidence in regulatory decisions, especially around patient-focused drug development. Dr. Whyte led a research agenda around drug safety issues, including prescription and over-the-counter products. Prior to this, Dr. Whyte worked for nearly a decade as the Chief Medical Expert and Vice President, Health and Medical Education at Discovery Channel. Dr. Whyte developed, designed and delivered educational programming that appealed to both a medical and lay audience. He provided strategic direction, aligning medical and public health interests, viewer demands and corporate funding opportunities. His shows run numerous awards, including Tellys and CINE Golden Eagle. Dr. Whyte also served in numerous leadership roles at the Centers for Medicare & Medicaid Services. While there, he formalized the process by which the Medicare program determines coverage decisions, including the criteria meant by "medically necessary and reasonable." He helped determine, evaluate and implement the national Medicare coverage policies on multiple products and services. He also oversaw an ongoing analysis of innovative treatment patterns and activities that improve health care outcomes. He is a recognized expert on various payment policies and models. Dr. Whyte is the author of five best-selling books. He writes extensively in the medical and lay press. He is board-certified in internal medicine and continues to see patients.

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Workshop on Diagnosis in the Era of Digital Health and Artificial Intelligence
Planning Committee Biographies

Daniel Yang, M.D., (Chair) is vice president of Artificial Intelligence (AI) and Emerging Technologies for Kaiser Permanente. In this role, Dr. Yang is responsible for ensuring quality oversight for all AI applications across the organization, including those used in clinical operations, research, education, and related administrative functions. Dr. Yang was previously a program director of patient care at the Gordon and Betty Moore Foundation where he founded and led a $120M philanthropic program focused on diagnostic excellence. In this capacity, he helped to establish several public-private partnerships to promote the responsible use of AI in healthcare including the National Academy of Medicine's AI Code of Conduct, the Coalition for Health AI, and the Health AI Partnership. He has also created "public good" infrastructure to support the development, implementation and evaluation of diagnostic AI algorithms, including publicly accessible clinical datasets and third-party evaluation services to independently assess algorithm performance. Dr. Yang has also advanced research methods for rigorously evaluating the clinical impact of AI and machine learning algorithms in real-world settings. Dr. Yang is a practicing internal medicine physician. He completed his undergraduate and medical degrees at the University of Illinois Chicago, his internal medicine residency at the University of California, San Francisco and a fellowship in health care systems design at Stanford University.

Julia Adler-Milstein, Ph.D., is a renowned health IT researcher at the University of California, San Francisco (UCSF). She is a Professor in the Department of Medicine, Chief of the Division of Clinical Informatics and Digital Transformation, and Director of the Center for Clinical Informatics and Improvement Research. Dr. Adler-Milstein's research focuses on the intersection of health information technology and healthcare delivery. She has conducted extensive work on the impact of EHRs and interoperability on clinical workflow, patient safety, and healthcare quality. Her research, including over 200 articles, has been published in numerous high-impact journals, including the New England Journal of Medicine, Health Affairs, and JAMA. Dr. Adler-Milstein also serves as a consultant to federal and state agencies, including the Office of the National Coordinator for Health Information Technology and the California Department of Health Care Services. She is a member of the National Academy of Medicine and serves on the Board of the American Medical Informatics Association. She holds a PhD in Health Policy from Harvard University and an AB in Human Biology from Stanford University.

Thomas K.M. Cudjoe, M.D., M.P.H., M.A., is the Robert and Jane Meyerhoff Endowed Professor, Assistant Professor of Geriatric Medicine and Gerontology at the Johns Hopkins School of Medicine. He leverages community-based strategies, mixed-methods and human centered design to understand and address social isolation. Dr. Cudjoe also serves on the Scientific Advisory Council for the Foundation for Social Connection and as the co lead to the Stakeholder Core for the Johns Hopkins Artificial Intelligence and Technology Collaboratory for Aging Research. His work has been featured in the New York Times, Wall Street Journal, NPR, and on Good Morning America. He is a Major in the US Army Reserve Corps. Dr. Cudjoe received his undergraduate degree in Cellular and Molecular Biology at Hampton University and was active in the Honors College and Army ROTC program. He graduated from Robert Wood Johnson Medical School and earned a master's in public health in health policy at Harvard School of Public Health. He completed his internal medicine residency Internal Medicine at Howard University Hospital and

clinical and research fellowship at the Johns Hopkins School of Medicine. In 2023, Dr. Cudjoe completed a master's degree in social design at Maryland Institute College of Art.

Gene Harkless, DNSc, APRN, FNP-BC, CNL, FAANP, is Associate Professor and Chair of the University of New Hampshire Department of Nursing has taught and led undergraduate and graduate program development there for 38 years. A family nurse practitioner since 1980, she continues to practice at the Greater Seacoast Community Health Center. Dr. Harkless has focused her teaching on evidence-based practice, clinical judgement, and family nursing theory. Her scholarship includes work on the diagnostic process, clinical decision-making, quality improvement, and long-term care for frail elders. She has been awarded three Fulbright Scholar awards in Norway, India, and Indonesia over her career. In 2010, Dr. Harkless was named a Fellow of the American Academy of Nurse Practitioners and in 2014 she received the New Hampshire Nurse Practitioner Association Lifetime Achievement Award. In 2017, Dr. Harkless was selected by the Society to Improve Diagnosis in Medicine to serve on the Macy Foundation-funded national workgroup convened to develop an interprofessional curriculum to improve diagnosis in medicine. Dr. Harkless received her BSN from Duke University, her MSN FNP education at Vanderbilt, and her DNSc at Boston University.

Maia Hightower, M.D., M.P.H., M.B.A., is the CEO and Founder of Equality AI, and former EVP, Chief Digital Transformation Officer at University of Chicago Medicine. Dr. Hightower is a leading voice in the intersection of healthcare, digital transformation, and health equity. She is a champion for responsible AI, ensuring that the digital future of healthcare is equitable and just. At Equality AI, we detect and bust AI bias in healthcare. We align AI strategy with outcomes and health equity through a technology platform for AI lifecycle management. Thus, enabling healthcare systems to realize the total value of their AI investments. She is a 4-time C-suit physician executive with fifteen years of executive leadership spanning healthcare IT, medical affairs, and population health across four academic medical centers, clinically integrated networks, and healthcare tech companies. She is an internationally sought after speaker on responsible AI and digital health equity for academic, government, consumer, and industry audiences. Dr. Hightower received her BA at Cornell University, MD, and MPH, from the University of Rochester School of Medicine, followed by residencies in Internal Medicine and Pediatrics at the University of California, San Diego. She also holds an MBA from the University of Pennsylvania's Wharton School.

Michael Howell, M.D., M.P.H., is the Chief Clinical Officer at Google, where he leads the team of clinical experts who provide guidance for Google's health-related products, research, and services. Michael's career has been devoted to improving the quality, safety, and science of how care is delivered and helping people get the best information across their health journey. An active investigator, he has published more than 100 research articles, editorials, and book chapters, and is the author of Understanding Healthcare Delivery Science, one of the foundational textbooks in the field. He previously served as the University of Chicago Medicine's Chief Quality Officer, was associate professor of medicine at Harvard Medical School and at the University of Chicago, and practiced critical care medicine for many years. He has also served as an advisor for the CDC, for the Centers for Medicare and Medicaid Services, and for the National Academy of Medicine.

Salahuddin Kazi, M.B.B.S., graduated from Dow Medical College in Karachi, Pakistan in 1987. After completing a transitional internship at Civil Hospital Karachi, he completed internal medicine residency training at the University of Texas Health Science Center at Houston. He went on to serve as chief resident and stayed at the same situation to complete a fellowship of rheumatology. In 1995 he moved to UT Southwestern and initially served as a physician at the Dallas VA Medical Center. There he was appointed the Chief of the Section of Rheumatology and Assistant Chief of Medical Service. From 2007 - 2010 Dr. Kazi joined Texas health Resources as the Chief of Rheumatology but returned to the Dallas VA Medical Center in 2010 as the Chief Health Informatics Officer. In 2012, Dr. Kazi was appointed as the Program Director of the Internal Medicine residency training program at UT Southwestern, a position he currently holds. He also serves as the Vice Chair of Education for the Department of Internal Medicine. Dr. Kazi has served as the past chair of the Registries and Health Information Technology committee of the American College of Rheumatology helping launch and grow the Rheumatology Informatics System for Effectiveness (RISE), a nationwide registry of rheumatic diseases. Dr. Kazi also serves on the American Board of Internal Medicine Rheumatology Subspecialty Board. Dr. Kazi is engaged in curricular design including high value care, quality of care, and in health equity initiatives in the residency training program.

David B. Larson, M.D., M.B.A., is Professor of Radiology (Pediatric Radiology) and Executive Vice Chair in the Department of Radiology at Stanford University. He also serves as the Associate Chief Quality Officer for Improvement for Stanford Health Care, overseeing improvement training programs at SHC. Dr. Larson is a national thought leader in radiology quality improvement and patient safety, and a regular speaker regarding topics ranging from pediatric CT radiation dose optimization to radiology peer learning. He is the founder of Stanford's Realizing Improvement through Team Empowerment (RITE) program and co-founder of the Clinical Effectiveness Leadership Training (CELT) program, continuing to serve as co-executive director of both programs. He also founded and leads the Stanford Medicine Improvement Capability Development Program (ICDP) and the Advanced Course in Improvement Science (ACIS). Dr. Larson is the founder and program chair for the annual Radiology Improvement Summit held annually at Stanford, which began in 2015. He currently serves on the Board of Trustees of the American Board of Radiology, overseeing quality and safety, and on the Board of Chancellors for the American College of Radiology as the chair of the ACR's Commission on Quality and Safety. He also founded and leads the ACR Learning Network, which was launched in 2021. Dr. Larson graduated with his BS in mechanical engineering from Brigham Young University and his MD and MBA from Yale. He completed his internship in pediatrics, residency in diagnostic radiology, and fellowship in pediatric radiology at the University of Colorado in Denver.

Pari Pandharipande, M.D., is Professor and Chair of Radiology at The Ohio State University. She is a practicing abdominal radiologist. She also oversees an outcomes research program centered in cancer modeling, risk analysis, and cost-effectiveness analysis, which broadly seeks to quantify the benefits, risks, and costs of diagnostic and therapeutic interventions for reducing the burden of cancer. She is the Principal Investigator of two R01 research awards R01CA237133 (PI), R01CA266402 (PI of MPI award), serves as a board member of the Radiological Society of North America, and as an Advisory Board member of the Harvey L. Neiman Health Policy Institute of the American College of Radiology. She is a standing member of the NIH ODHS Study Section, serves on multiple journal editorial boards, and has closely mentored 20+ individuals in radiology

and health outcomes research. She obtained her undergraduate degree (BA) from Cornell University (1994), and her MD from Weill Cornell University Medical College (1998). She completed her Radiology Residency at NYU (2004), and fellowship in Abdominal Imaging and Cancer Outcomes Research at Massachusetts General Hospital (2006). During fellowship, she also completed an MPH degree at the Harvard T. H. Chan School of Public Health (2005). Her career goal is to ensure that every patient's encounter with imaging adds value to their care.

Judy Wawira Gichoya, M.D., is an Associate Professor at Emory University in Interventional Radiology and Informatics leading the Healthcare AI Innovation and Translational Informatics (HITI) lab . Her work is centered around using data science to study health equity. Her group works in 4 areas - building diverse datasets for machine learning (for example the Emory Breast dataset); evaluating AI for bias and fairness; validating AI in the real world setting and training the next generation of data scientists (both clinical and technical students) through hive learning and village mentoring. She serves as the program director for Radiology: AI Trainee Editorial Board and the medical students machine learning elective. She has mentored over 60 students across the world (now successful faculty, post doc, PHD and industry employees) from several institutions around the world. She has received several awards including the most influential radiology researcher in 2022, and is a 2023 Emerging Scholar in the National Academy of Medicine.

NATIONAL ACADEMIES Sciences Engineering Medicine

Diagnosis in the Era of Digital Health and Artificial Intelligence: A Workshop

Selected Readings and Resources

JAMA

Alder-Milstein, J, J. H. Chen, and G. Dhaliwal. 2021. Next-Generation Artificial Intelligence for Diagnosis from Predicting Diagnostic Labels to "Wayfinding". JAMA. 326(24): 2267-2468. doi:10.1001/jama.2021.22396

Howell, M.D., G.S. Corrado, and K.B. DeSalvo. Three Epochs of Artificial Intelligence in Health Care. JAMA. 2024 Jan 16;331(3):242-244. doi:10.1001/jama.2023.25057.

National Academies of Sciences, Engineering, and Medicine (NASEM)

National Academy of Medicine. Health Care Artificial Intelligence Code of Conduct.

Adams, L., E. Fontaine, S. Lin, T. Crowell, V. C. H. Chung, and A. A. Gonzalez, editors. 2024. Artificial intelligence in health, health care and biomedical science: An AI code of conduct framework principles and commitments discussion draft. NAM Perspectives. Commentary, National Academy of Medicine, Washington, DC. https://doi.org/10.31478/202403a.

National Academy of Medicine. 2019. Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril. Washington, DC: The National Academies Press. https://doi.org/10.17226/27111.

NATIONAL ACADEMIES Sciences Engineering Medicine

FORUM ON ADVANCING DIAGNOSTIC EXCELLENCE

Diagnostic errors are the most common cause of medical errors reported by patients, accounting for nearly 60 percent of all errors and an estimated 40,000-80,000 deaths per year. The 2015 Institute of Medicine consensus report, *Improving Diagnosis in Health Care*, found that diagnostic errors are a persistent and underappreciated quality and safety challenge throughout all settings of health care. The study committee estimated that every person is likely to experience a diagnostic error in their lifetime, sometimes with devastating consequences, and concluded that improving diagnosis is "not only possible, but also represents a moral, professional, and public health imperative." To improve the diagnostic process, the committee called for a widespread commitment from health care professionals, health care organizations, patients and their families, researchers, and policy makers.

In 2018, the Gordon and Betty Moore Foundation announced the Diagnostic Excellence Initiative, with the aim of reducing harm from diagnostic errors, improving health outcomes, and saving lives. The initiative included a workshop series on Advancing Diagnostic Excellence hosted by the National Academies. The six workshops in the series focused on sepsis, acute cardiovascular events, cancer, diagnostic lessons learned from the COVID-19 pandemic, diagnosis for older adults, and diagnosis in maternal health care.

To provide a more sustained platform for this work, while engaging a broader range of funders and stakeholders, the National Academies of Sciences, Engineering, and Medicine established a **Forum on Advancing Diagnostic Excellence** in 2023 to provide a structured environment and neutral venue to discuss data, policies, practices, and systems that affect the quality of diagnosis in health care. The Forum fosters an ongoing dialogue on a range of topics to examine the current scientific landscape and research opportunities for improving diagnosis within the U.S. health care system, with emphasis on conditions and populations with the greatest risk of harm from diagnostic errors.

PUBLIC WORKSHOPS

Diagnosis in the Era of Digital Health and Artificial Intelligence: A Workshop
July 25, 2024, Washington, D.C.
A National Academies of Sciences, Engineering, and Medicine planning committee will organize and host a hybrid public workshop to examine the opportunities and challenges for improving diagnosis in the era of digital health and artificial intelligence.

https://www.nationalacademies.org/our-work/diagnosis-in-the-era-of-digital-health-and-artificial-intelligence-a-workshop

Advancing Equity in Diagnostic Excellence to Reduce Health Disparities: A Workshop
September 23-24, 2024, Washington, D.C.
A National Academies of Sciences, Engineering, and Medicine planning committee will organize and host a hybrid public 1.5-day workshop to examine equity in access to high-quality diagnosis to reduce health disparities.

https://www.nationalacademies.org/our-work/advancing-equity-in-diagnostic-excellence-to-reduce-health-disparities-a-workshop

FORUM MEMBERSHIP

Andrew Bindman, Kaiser Permanente (Chair)
Nicole Everline Alexander-Scott, Brown University
Amit Agrawal, Danaher
Helen Burstin, Council of Medical Specialty Societies (Representing The Mont Fund)
Daniel K. Cassavar, The Doctors Company
Linda N. Geng, Stanford University
Cristina Maria Gonzalez, New York University Grossman School of Medicine
Gene Elizabeth Harkless, University of New Hampshire (Representing AANP)
Donald Karcher, George Washington University Medical Center (Representing CAP)
Salahuddin Kazi, University of Texas Southwestern Medical Center (Representing ABIM)
David Larson, Stanford University (Representing ACR)
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Kristen Elizabeth Miller, MedStar Health
Pari Pandharipande, The Ohio State University (Representing RSNA)
Cheryl Phillips, The John A. Hartford Foundation
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The Gordon and Betty Moore Foundation
The John A. Hartford Foundation (JAHF)
The Mont Fund
Radiological Society of North America (RSNA)

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Anesia Wilks, Senior Program Assistant
Sharyl Nass, Director, Board on Health Care Services

Forum website: https://www.nationalacademies.org/our-work/forum-on-advancing-diagnostic-excellence