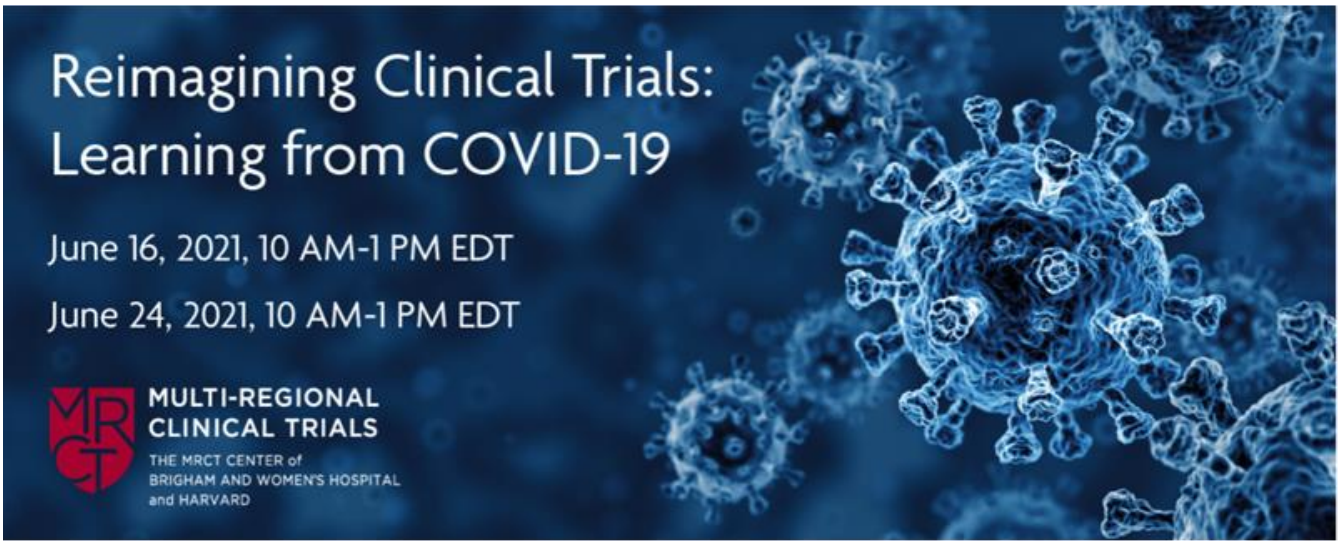

VIRTUAL MEETING

Proceedings

June 16, 2021

Focus on permissible flexibilities to study conduct and coordination, and the implications for the clinical research workforce in this new environment

June 24, 2021

Focus on regulatory flexibilities, international cooperativity, and governance

MULTI-REGIONAL CLINICAL TRIALS
THE MRCT CENTER of BRIGHAM AND WOMEN'S HOSPITAL and HARVARD

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First Meeting: June 16, 2021

Ms. Sarah White, MRCT Center Executive Director, welcomed participants to this conference, "Reimagining Clinical Trials: Learning from COVID-19," and gave a short introduction of the Multi-Regional Clinical Trials Center of Brigham and Women's Hospital and Harvard (MRCT Center).

Ms. White explained the goal of this conference: drawing upon the experience from the COVID-19 pandemic, we aim to discuss a long-term vision on how to prepare for clinical trials in the future, taking into consideration the complexities of clinical research. It is important to appreciate what worked and what did not work during the pandemic shutdown and subsequent re-opening, and what approaches would benefit from more information prior to integrating into the routine of clinical trial processes.

Dr. Barbara Bierer, Faculty Director of the MRCT Center, added her welcome, thanked the planning committee and introduced the keynote speaker.

Keynote: Esther Krofah, Executive Director, FasterCures

Ms. Esther Krofah explained that FasterCures has documented lessons learned during the COVID-19 pandemic and has released a White Paper summarizing that learning earlier this year.

Ms. Krofah took a step back to review the clinical trial infrastructure in the United States. The U.S. spends nearly twice as much as the average Organization for Economic Co-operation and Development (OECD) country on health care yet has a life expectancy that is two years lower than the OECD average and has the highest chronic disease burden. The U.S. makes the greatest investment in Research & Development (R&D), although the clinical trials ecosystem remains insufficient and siloed.

This siloed nature was revealed during the COVID-19 pandemic and was detrimental to achieving progress: the FDA has published that only 5% of the nearly 3,000 clinical trials associated with COVID-19 studies and registered on ClinicalTrials.gov were randomized and adequately powered. Ms. Krofah noted that there was very little consensus around outcome measures related to COVID-19 and in some cases competition for patients enrolling into COVID-19 related trials. A heat map showed that most research trials related to COVID-19 were in California, Texas, Florida, and the Northeast. Most trials were in academic research settings and very few networks were in community-based settings. There was a lack of representation of underserved populations as trial participants did not reflect the demographics of the burden of disease.

One bright spot was COVID -19 vaccine trials, where in many cases a concerted effort was made to include diverse populations and to enroll patients who were disproportionately affected by disease. In notable cases, COVID -19 trials slowed down to make sure enrollment reflected those groups. There is a renewed focus on designing a better clinical research ecosystem, with a focus on efficiency, engagement, and coordination. Ms. Krofah highlighted the importance of each area and reviewed key approaches.

Efficiency: Simpler, more pragmatic trials demonstrated their value during the response to the COVID-19 pandemic. Recommended approaches include: (1) streamline trial startup and enrollment, (2) simplify contracting, IRB approvals, and start-up processes, (3) simplify data collection from multiple sources, (4) enhance the role of routine data capture, (5) encourage data, informatics, and knowledge exchange among stakeholders, and (6) clarify rules governing use of technology in clinical trials.

Engagement: Ensure that more people—and a diversity of people—can participate in clinical trials and include more community-level participation. Key approaches to ensure that people can participate in clinical trials include: (1) enhance "user friendliness" and health literacy to bridge the technology divide, (2) extend reach so as to not leave entire communities behind, (3) include processes and decision making tools for diverse participation, (4) lower barriers to recruitment, (5) enable rural and underserved participation and older populations, and (6) engage a more diverse clinical trials workforce.

Coordination: A new vision is emerging around a need for a robust community-based clinical trials network. Key approaches include enabling more efficient information sharing and collaborative trial design, conduct, and analyses. This needs a strong governance structure and community-based partnerships with community-based partners as equal partners.

Ms. Krofah noted that a U.S. government effort is examining lessons learned from COVID-19 therapeutic trials. Key emerging issues address: (1) need for clear communication and engagement of all stakeholders, including how patients can engage in research studies, (2) need to build a clinical trial infrastructure with networks that focus on all public health priorities so that other priorities are not delayed or disbanded during a public health emergency, (3) setting strategic principles, providing tools and guidelines for clinical trial design, (4) disseminating tools and best practices consistently across the U.S. clinical trial ecosystem, and (5) prioritizing and partnering with the international community for a joint effort across regulatory bodies.

Ms. Krofah noted two broad areas to consider for a vision of the future: (1) move toward a national network of clinical trials embedded in community practice, to achieve efficiency, engagement, and coordination, and (2) define concrete goals and metrics, so that all are working toward the same goal.

Ms. Krofah responded to one question from the audience with regard to international trials and global preparedness. The Solidarity trial (NCT04647669) involved many countries, thereby slowing trial start-up; the study results, however, were more relevant to regional locations because the study participants appropriately reflected local populations.

Panel 1: Useful and permissible flexibilities: A discussion of regulatory protocol, and study conduct flexibilities that can and should be sustained in the future, that should be eliminated, and for which further experience is necessary

This panel was moderated by **Paul Kluetz**, Deputy Director of the Oncology Center of Excellence at U.S. FDA.

Panel members introduced themselves briefly:

Valen Keefer, Patient Advocate, is a representative of the transplant community and participated in a research study during COVID-19 that collected data remotely from participants at home.

Isaac Rodrigues-Chavez, Senior Vice President for Scientific & Clinical Affairs at the Global Center of Excellence Strategy for Decentralized Clinical Trials, PRAHealthSciences, now ICON plc.

Lindsey Baden, Physician and Researcher at Brigham and Women's Hospital, Principal Investigator (PI) of the Moderna COVID-19 vaccine study.

Penny Carlson, Head of Global Development Support at Takeda.

The panel discussed the following experiences and thoughts in making progress related to flexibilities in study conduct:

- Patients prefer flexibility. Sometimes patients prefer to travel, even out-of-state, since they are comfortable with the doctors at the site, while some patients are incapacitated and cannot travel. The key is to have patients involved from the beginning and to understand the value of the study not only for oneself but for humanity. Patients also wish to hear from other patients and/or from the principal investigator though data privacy must be considered.
- Digital health technologies represent a unique opportunity to do things differently:
    - allow measurements to be taken remotely,
    - improve ability to remotely communicate between patient and provider,

    - provide under-served communities access to clinical research,
    - allow continuous data collection and corrective measures essentially in real time.
- There are also notable limitations to digital health technologies:
    - need to be carefully mapped out early on in the trial design,
    - technological inequities exist for communities that currently do not have access to these digital devices and/or to stable WIFI connections,
    - may introduce variability in data collection, require more integration of data by different organizations and stakeholders, and necessitate early participant engagement.
- The panelists agreed there is need to characterize data variability that may be introduced by remote assessments and identify mitigation strategies for future prospective design and conduct of hybrid decentralized trials. The extent and impact on overall data integrity of variability from remote assessments is of importance to FDA and all stakeholders who rely on trial evidence to make treatment and policy decisions.
- Effective communication is important and must be appropriate for the circumstance. To be successful, all communities have to be engaged--not just those who are most accessible. A multi-pronged approach must include meaningful communications that resonate in different communities.
- Ms Keefer provided a specific example of her own experience: The research team sent a blood draw kit to her home as well as scheduled pick-up, making access to participate safe and easy. Information was shared through webinars, which led to patients feeling part of the study. This helped participants feel like they were part of something important not only for themselves but for the community at large. Ms. Keefer expressed concern that the immunosuppressed community was initially not included in research on COVID-19 vaccines.
- Dr. Baden provided his experience as a PI. Lessons learned during the shutdown include: (1) importance of data sharing - having the sequence of the pathogen available globally, (2) considerations about the regulatory framework – deciding how to design the study and what can be done remotely, and (3) importance of studies relevant to the communities that are impacted, considering equity and the disproportionality of disease.

- Panelists stated aspects of cancer drug development that were seen during the COVID-19 pandemic they hope will be maintained and challenges that should be addressed:

- Hope to maintain:
  - Keep ease of participation, accessibility from home, partnership with patients.
  - Have sense of collective urgency and leverage this urgency for other diseases.
  - Continue unparalleled collaboration and data sharing (with patients, regulators, vendors, media, cross-border).
- Challenge:
  - Need to increase education efforts about clinical trials in order to reach different communities.
  - Harmonize regulatory frameworks to conduct clinical trials in a more meaningful way globally.

Panel 2: Implications for and need to re-imagine the workforce in a reimagined clinical research enterprise

This panel was moderated by **Craig Lipset**, Co-Chair of the Decentralized Trials & Research Alliance

Panel members introduced themselves briefly:

Nicholas Brooke, Founder & Executive Director of The Synergist, Chief Executive Officer of Patient Focused Medicines Development.

Andrea Ferris, President and Chief Executive Officer of LUNGEvity.

Harpreet Singh, Director of the Division of Oncology, U.S. FDA.

Andrew (Andy) Lee, Senior Vice President, Head of Global Clinical Trial Operations at Merck.

The panel made the following **suggestions** for a reimagined workforce:

- **Technical needs or gaps** in the workforce that need to be addressed:
  - Workforce is changing quickly. Companies must rethink the types of people working in an organization given the more digitized way of working and the diversity of data from trials, including real-world data. The workforce must be able to integrate data from disparate sources into central platforms. Putting data in tabular format may require outsourcing.

- Qualified practitioners are needed in several areas: (1) navigators to engage with underrepresented populations and bring their voices to bear, (2) practitioners to create health literate, culturally sensitive and linguistically appropriate materials to communicate what a clinical trial is and how to engage, (3) technical experts to create simplified informed consent forms.
- Dr. Singh emphasized the need for agility and flexibility when thinking about the workforce as well as emphasized the need for data to inform the "new normal." The FDA is asking for specific data sets regarding remote assessments in clinical trials and hoping to learn from that.
- Dr. Lee noted that many trials were initiated 3-5 years ago using a different model of performance. Some studies were impacted adversely, some trials accelerated. Study monitors had to adapt to remote monitoring. Data obtained through digitization and telehealth needed to be curated. Recent experience has changed thinking of the workforce around data curation.

- This led to the following considerations from the panel:
  - Do I have the right people inside my organization to actively engage with patients for planning studies?
  - Do I have the right legal and compliance colleagues aligned to the strategy of the organization that will work with colleagues and find a way to say yes rather than apply the legal mindset to protect the organization at all cost?
  - Do we have the right statisticians and others in study design to fully embrace platform trials and other models that we know can better integrate research and healthcare rather than treat studies as one-by-one disruptive instance?
- Dr. Lee explained that one helpful concept was "No patient left behind" and "No colleague left behind" which included supporting people working from home, using new technologies and electronic digitization for sharing private and protected documents. Execution required training, new ways of working including telehealth medicine and considerations how to monitor telehealth and home nurse visits, and new skill sets for field monitors and data managers. Evaluation and analysis will now proceed.
- The panel discussed changes to the conduct of global trials that affected the workforce:
  - Inspection of facilities to ensure the appropriate manufacture of drugs required international travel, a challenge during the pandemic, leading to

delays of approvals. While some virtual inspections have taken place, some required in-person inspections or visits.
- Rethinking the paradigm from a patient perspective to do things differently: determine what is necessary for efficacy and to demonstrate safety and what is "nice to have."
- Dealing with internal legal, ethics and compliance review at institution level or at sponsor level.
- Including patients when designing clinical trials, to reflect actual patient experience.
- Community-based organizations are considered the "augmented and advanced workforce" that is supporting clinical research and a partner in the clinical trial ecosystem. They are the trusted resources for patients. Consideration of matching patients with someone who has been through a trial, and match caregivers with caregivers.
- Adoption of new practices to be driven by the data that are submitted to and approved by regulators. Regulatory approvals will be watched over the next 12 months to determine what is and is not approved. Of note, submissions in last 12 months included trials that started several years ago.
- Need to clarify with regulatory agency who is qualified to be listed as investigator and engage people accordingly.

First Meeting: Discussion and Wrap-up

Moderators summarized the main points from today's discussion:

- The transparency about how and why regulators make a decision will be informative to the community, more so than any one decision, and a barometer for the future.
- There are differences in global regulatory decision-making because different agencies operate with different laws and regulations.
- Categories of workforce evolution include: (1) skills: do we have the right people (a) to handle, manage, and navigate the diversity of data we plan to include and (b) to actively listen, engage, and partner with patients and other critical voices; (2) new stakeholders: new people are needed in our workforce such as care navigators and trusted voices in the community, rethinking whom to list as investigator; (3) mindset: an agile mindset that supports collaboration and transparency as we develop a workforce that can adapt and balance risk.

- The degree of collaboration over the last 16 months has been unique and should not be lost. While we should strive for speed, efficacy, and safety, we must realize that for each patient their disease is the most important and most urgent for them.
- These developments should be viewed as an opportunity and we should learn from them. We need to understand what worked well and learn.

Second Meeting: June 24, 2021

Ms. Sarah White, MRCT Center Executive Director, welcomed participants to the second part of this conference, "Reimagining Clinical Trials: Learning from COVID-19." The first meeting focused on flexibilities in study conduct and the reimagined workforce; flexibility by design, the need for collaboration, and the need for the same urgency we applied in developing COVID-19 vaccines for all diseases was discussed. The new technical needs of a workforce in a decentralized and hybrid research environment and the need to engage community organizations as partners were discussed. The group agreed that regulatory review decisions over the next 12 months will become a barometer of risk and flexibility with respect to the approval.

This second part of the meeting focused on regulatory flexibilities and international cooperativity. Speakers and panelists discussed the vision for multi-site, multi-national clinical trials, what worked and what did not work, and how to build upon this experience.

Keynote: Fergus Sweeney, Head, Clinical Studies and Manufacturing Taskforce, European Medicines Agency (EMA)

Dr. Sweeney gave a timeline of the pandemic and the enormous effort to compress vaccine development timeline from 10 years to 1 year. Transparency and outreach were necessary. A system of rolling review cycles, where each element of the development process was analyzed as the information became available, helped to speed authorization. Dr. Sweeney noted that the pace of work required for individuals to meet this compressed timeline is not sustainable.

The compressed process nevertheless encompassed all regular safeguards and controls. There was international cooperation through the International Coalition of Medicines Regulatory Authority (ICMRA) with over 30 countries involved. There were bi-weekly policy teleconferences, and early exchange of information on pharmacovigilance, regulatory agility, consideration of good clinical practice (GCP) and good manufacturing practice (GMP) related to the digital transformation. The COVID-19 pandemic necessitated different ways of interacting with patients and participants remotely. There were associated changes to the informed consent process, distribution of investigational medicinal products (IMP), diagnostics, monitoring and auditing--all of which involved application of risk assessment. The OPEN initiative shared procedures with a number of countries and with the World Health Organization (WHO), allowing regulators outside the European Union (EU) to take part in the European Medicines Agency (EMA) and scientific evaluations. Lessons learned include the need for: rapid responses and regulatory flexibilities, use of digital tools, dialogue along development pathway, sharing of experiences, feasible/sustainable tools for the longer term, acting more by

design and less by reaction, and keeping regulatory standards high despite the need for speed and innovation.

Dr. Sweeney envisioned what trials of the future might look like: digital data collection, fewer and better designed trials, more sufficiently powered large trials, enabled platform trials. There is a need to understand the drivers of small trials, sustain large investor networks, and provide funding for the infrastructure to link across regions. Change management may be the greatest challenge. Good standards are needed to build the future, to address participant privacy, properly powered trials, and regulatory models for platform trials from multiple regions. This will involve regulators from all regions.

Dr. Sweeney noted that the key is to get the process and standards for digital tools in place, and to become more comfortable with them. He noted the need to provide guidance for how to document consent in a digital interaction, and whether trials can "mix and match" results from different products--for example a Fitbit and a heart monitor. There is also a need for building national and international infrastructure for research, including platform trials.

Keynote: Ginny Beakes-Read, Executive Director, Global Regulatory and R&D Policy, Amgen

Ms. Beakes-Read remarked that dozens of regulators published guidance in and after March 2020. Industry and others utilized these different informative guidance documents to provide information to study teams.

Amgen used a color coded SmartSheet database to collect and provide internal interpretation of the rapidly evolving global regulatory guidelines (e.g., additional procedures needed, no guidance available, guidance permits a flexible approach) to their study teams. The company created a dashboard that drew from the database, was updated daily, and underscored the complexity of international clinical trials.

Ms. Beakes-Read highlighted the importance for industry to understand the reasons for the differences in regulatory guidelines so that industry sponsors can incorporate the lessons learned from the differences and flexibilities into future trials. Similarly, she highlighted that regulators should look at the differences, and align on common approaches when differences are not warranted.

Communication is and will continue to be very important.

Panel 1: Enabling regulatory flexibilities in a global context

This panel was moderated by **Barbara Bierer,** Faculty Director of the MRCT Center.

Panel members introduced themselves briefly:

Taras Carpiac, Executive Director, Innovation & Process Improvement at Amgen.

Lauren Hartsmith, Director of Regulatory Affairs at Advarra.

Névine Zariffa, Principal and Founder of NMD Group.

Richard Moscicki, Chief Medical Officer and Executive Vice President of Science and Regulatory Advocacy at PhRMA.

The **panel** made the following suggestions for regulatory flexibilities in global context:

- What level of **cooperation and governance** is needed?
    - Input from concerted voices into regulatory frameworks are needed earlier, during the draft guidance stage.
    - Public comments need a diversity of voices, specific suggestions and specific language.
    - There is power in stories. We need case studies, followed by a workshop and then draft guidelines.
    - Dr. Moscicki provided a specific example of cooperation and guidance by explaining that PhRMA worked with member organizations to catalogue the impact of the pandemic on ongoing clinical trials and efforts. PhRMA is compiling a document with issues and proposed solutions—to be shared with FDA and the International Federation of Pharmaceutical Manufacturers & Associations (IFPIA).
    - A key issue with decentralized clinical trials is how to conduct remote assessments and inspections. ICMRA (International Coalition of Medicines Regulatory Authorities) is an important group to share this information and create alignment on strategy; it includes EU member states in addition to other regulatory agencies. The International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) is a premier organization for policy harmonization: the current revision of Guideline ICH GCP E6 (R3) is a good opportunity to memorialize lessons learned from the COVID-19. Thus,

collaboration with ICMRA and ICH provide good opportunities to tie in lessons learned.
    - As another example of cooperation, Ms. Zariffa introduced the International COVID-19 Data Alliance (ICODA) which provides summary level data to answer research questions that cannot be answered by a single trial but requires understanding across global trials. ICODA has designed a data dictionary so that data can be standardized and harmonized. ICODA has encountered some roadblocks when it came to data sharing. For data sharing 2.0, Ms. Zariffa recommended that: (1) those who conduct trials share their data, (2) those who fund trials hold investigators responsible and support them in sharing data, and (3) those who work with aggregated data make it easy for the investigators to share their data with them.

- What **lessons** have we learned that we would want to see corrected or repeated?
    - Need better organizational structures for clinical trials in a public emergency: Need a national system to control access to trials and reduce or eliminate "small crappy trials" so that more resources are available for meaningful trials.
    - Provide more rigorous trial oversight by IRBs, starting at a national scale.
    - Have an end-to-end process for studying the repurposing of drugs with real world data. Platform trials are a component of such a system.
    - Realize that for each individual, their disease is an emergency. Apply the pandemic's data infrastructure, urgency, and coordination to all diseases.
    - Put aside competition and turn to cooperation.
    - Leverage not only coordination and cooperation, but also international exchange of information. Include explanations for why something needs to be done differently.
    - Address diversity-related health equity issues and engage community-based approaches.
    - Realize that there will be a diversity in approaches going forward in how we collect data and how we navigate data collection.

Panel 2: Regulatory cooperation and communication and issues of governance in a global pandemic

This panel was moderated by **Mark Barnes,** Faculty Co-Director of the MRCT Center and Partner at Ropes & Gray.

Panel members introduced themselves:

Owen Fields, Vice President for Regulatory Strategy, Research and Development at Pfizer.

M. Khair ElZarrad, Deputy Director, Office of Medical Policy at Center for Drug Evaluation and Research (CDER) at US FDA.

Steven Kern, Deputy Director of Quantitative Sciences at the Bill & Melinda Gates Foundation.

Fergus Sweeney, Head, Clinical Studies and Manufacturing Taskforce at European Medicines Agency (EMA).

The **panel** discussed experiences related to regulatory cooperation and communication during the pandemic and made the following suggestions:

- Need for global cooperation
    - Cooperate on efficient clinical trial design (Quality by Design) and proactively provide parameters for transparency and documentation globally.
    - Address multiple challenges simultaneously, such as data flow and privacy issues.
    - Allow for innovation of regulatory processes and platforms, including those enabling fully or partial siteless/virtual trials where appropriate.
    - Increase the non-competitive space in research and clinical trials to allow for more sharing of ideas and data, without destroying intellectual property rights.
- Need for multi-stakeholder discussion
    - Include researchers, investigator sites, government agencies, industry, patients, and health care providers. Discussions should not occur in "silos."
    - Communicate globally with a variety of stakeholders.
    - Create a place where a multi-stakeholder entity can have legitimacy and international, regional, and national impact.

An international, multi-stakeholder entity could address the following:

- Eliminate "small crappy trials" (SCTs) at a large scale

  - Put a structure in place that re-envisions academic scholarship so that collaboration is rewarded; this will likely be a hierarchical organization that included a variety of collaborating professional societies, academic institutions, and others. Start building a structure and people will follow.
  - Get input from the community at large; e.g., a real world evidence (RWE) Subcommittee engaging stakeholders from outside the clinical trial enterprise who use real world evidence to help define the role of RWD/RWE in the future.
  - Regulatory agencies can play a role; e.g., FDA has legal authority to place a clinical hold on a trial that does not have a firm scientific basis.
  - Funders can play a role by not funding SCTs.
- Explore real time data sharing
  - Dr. Kern advocated for data flow so that people can make timely decisions. While the pandemic instilled a willingness for collaboration, institutions and investigators were concerned about the responsibility for the safety and security of data and were hesitant or unwilling to take the risk of sharing data. From a governance standpoint, it would be helpful if data could flow into a cooperative platform that people can access for aggregation and analysis, and to help in real time decision-making. Regulators could take a lead, for instance, by creating a mandate for a centralized organization that oversees data sharing. In contrast, there are examples of systems at the grassroots level. Dr. Kern shared an example of the LAM Foundation, a self-organized group of women affected by lymphangioleiomyomatasis (LAM) who started an organization and data sharing since they were often the only patient their doctors treated with their particular disease.
  - Mr. Barnes noted that data sharing is complicated by privacy rules such as the European Union General Data Protection Regulation (GDPR) and similar rules in Japan.

Further details were provided on the European Union General Data Protection Regulation (GDPR):

- EU's GDPR allowance of temporal data transfer and real world evidence:
  - GDPR covers all industry sectors and was not designed to tackle research. Key is to find a path to align the requirements in a positive way and to put in place processes that enable data exchange but protect personal privacy.
  - Secondary use of data needs to be supported for people who are willing to share their information. Industry associations are working on a code of conduct to

advance cross-border data transfer; they plan to bring the code of conduct to the data protection authorities for review.
    - Harmonization or convergence of data protection policies is needed across different parts of the world to enable better exchange.
    - Industry-wide codes of conduct, acceptable to data protection authorities and industry partners in different countries, would be a way of standardizing transnational data transfers.
    - Biobanks could be a great potential catalyst to start with aggregate samples for repeat analyses and could be a place to build a data trust. Specimens by themselves are not covered by GDPR.

- **Final comments:**
    - To facilitate multi-regional platform trials, would need a mechanism for major agencies to converge and/or harmonize on appropriate designs and inclusion/exclusion criteria as well as key endpoints.
    - To deal with intercompany intellectual property and rivalry issues, major global industry partners, including contract research organizations (CROs) could propose a model of working together, including who owns the data.
    - To build on the process of platform trials across multiple countries and regions:
        - Build a non-competitive space (although the complexity of intellectual property and other issues can make this challenging). Pediatric networks may be a good example to emulate.
        - Create a common area and infrastructure; perhaps a public-private entity or model could be adopted.
        - Designate one entity as the "face" of this proposed new structure.
        - Consider whether the MRCT Center can have a role to facilitate or catalyze this discussion, and then reach out to ICMRA, industry, and others.
        - Risk aversion within institutions and companies may be mollified by cooperation and common agreement on process.
    - Need to continue to discuss data trust: who would be the convener for the model and pre-competitive multi-stakeholder group.

Discussion and Wrap-up

Dr. Barbara Bierer thanked everyone who participated in both days of the conference and acknowledged how much we have learned. Dr. Bierer asserted that we must not just "make changes at the edges" but use this time and learning to transform the global clinical research enterprise. There will be another pandemic, and we should not repeat the same mistakes. There are also a number of elements that can be applied to rare and other diseases.

Dr. Bierer cautioned that one of the challenges of the pandemic was the politicization of science and medicine, particularly in the U.S. We must build back trust in the science of evidence and data and address the challenge of misinformation. We should also consider how to build an international multi-stakeholder community dedicated to continuing this work when we are not in a crisis and consider funding to support the activity.

Ms. Sarah White confirmed that we are in a moment of opportunity. She thanked all the panelists and moderators of Day 1 and Day 2 and the keynote speakers. Ms. White informed the audience that the recordings of Day 1 are already available and the proceedings will follow shortly.

Appendix 1: Meeting Agenda

June 16, 2021

TIME	TOPIC	SPEAKERS
10:00 AM – 10:30 AM EDT	**Introduction** **Keynote speaker:** The Future of Clinical Trials	• Barbara Bierer, Faculty Director, MRCT Center • Esther Krofah, Executive Director, FasterCures
10:30 AM – 11:30 AM EDT	**First Panel:** Useful and permissible flexibilities: A discussion of regulatory, protocol, and study conduct flexibilities that can and should be sustained in the future, that should be eliminated, and for which further experience is necessary	• Lindsey Baden, Division's Director of Clinical Research, Brigham and Women's Hospital/ Dana-Farber Cancer Institute • Penny Carlson, Vice President, Head of Global Development Support, Takeda • Valen Keefer, Patient Advocate for polycystic kidney disease (PKD) and Organ Donation • Isaac R. Rodriguez-Chavez, Head, Global Center of Excellence Strategy for Decentralized Clinical Trials, PRAHealthSciences **Moderator:** • Paul Kluetz, Deputy Director, Oncology Center of Excellence, U.S. FDA
11:30 AM – 11:40 AM	**BREAK**	

11:40 AM – 12:40 PM EDT	**Second Panel:** Implications for and need to re-imagine the workforce in a reimagined clinical research enterprise	• Nicholas Brooke, Founder & Executive Director of The Synergist, Chief Executive Officer of Patient Focused Medicines Development (PFMD) • Andrea Ferris, President and Chief Executive Officer, LUNGEvity • Andrew (Andy) Lee, Senior Vice President, Head of Global Clinical Trial Operations, Merck • Harpreet Singh, Director of Division of Oncology, U.S. FDA **Moderator:** • Craig Lipset, Co-Chair of Decentralized Trials & Research Alliance
12:40 PM – 1:00 PM EDT	**Discussion and wrap-up**	• Moderators and: • Barbara Bierer, Faculty Director, MRCT Center • Sarah White, Executive Director, MRCT Center

June 24, 2021

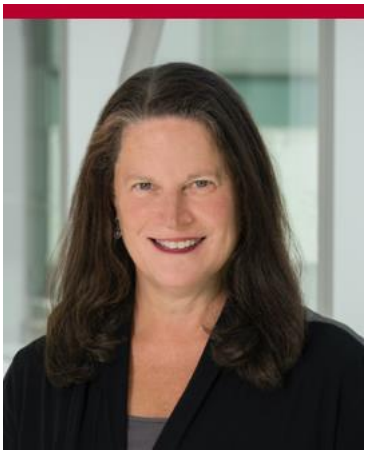
TIME	TOPIC	SPEAKERS
10:00 AM - 10:45 AM EDT	**Introduction Keynote speakers**	• Sarah White, Executive Director, MRCT Center

	Reimagining Clinical Trials: Learning from COVID-19 – Fergus Sweeney *Aligning global clinical trial requirements* – Ginny Beakes-Read	• Fergus Sweeney, Head, Clinical Studies and Manufacturing Taskforce, European Medicines Agency (EMA) • Ginny Beakes-Read, Executive Director, Global Regulatory and R&D Policy, Amgen
10:45 AM - 11:40 AM EDT	**First Panel –** Enabling regulatory flexibilities in a global context	• Taras Carpiac, Executive Director, Innovation & Process Improvement, Amgen • Lauren Hartsmith, Director of Regulatory Affairs, Advarra • Richard Moscicki, Chief Medical Officer and Executive Vice President of Science and Regulatory Advocacy, PhRMA • Névine Zariffa, Principal and Founder, NMD Group **Moderator:** • Barbara Bierer, Faculty Director, MRCT Center
11:40 AM – 11:50 AM	**BREAK**	
11:50 AM - 12:45 PM EDT	**Second Panel** – Regulatory cooperation and communication and issues of governance in a global pandemic	• M. Khair ElZarrad, Deputy Director, Office of Medical Policy at Center for Drug Evaluation and Research (CDER), U.S. FDA • Owen Fields, Vice President for Regulatory Strategy, Research and Development, Pfizer

		• Steven Kern, Deputy Director of Quantitative Sciences, Bill and Melinda Gates Foundation • Fergus Sweeney, Head, Clinical Studies and Manufacturing Taskforce, European Medicines Agency (EMA) **Moderator:** • Mark Barnes, Faculty Co-Director, MRCT Center; Partner, Ropes & Gray
12:45 PM – 1:00 PM EDT	**Discussion and wrap-up**	• Barbara Bierer, Faculty Director, MRCT Center • Mark Barnes, Faculty Co-Director, MRCT Center; Partner, Ropes & Gray

Appendix 2: Speaker Biographies

June 16, 2021



Barbara Bierer, MD, is the faculty director of the Multi-Regional Clinical Trials Center of Brigham and Women's Hospital and Harvard (MRCT Center); Professor of Medicine, Harvard Medical School and Brigham and Women's Hospital, Boston; and a hematologist/oncologist. She is the Director of the Regulatory Foundations, Ethics and the Law Program of the Harvard Clinical and Translational Science Center and the Director of Regulatory Policy, SMART IRB. Previously she served as senior vice president, research, at the Brigham and Women's Hospital for 11 years, and was the institutional official for human and animal research, for biosafety, and for research integrity. She initiated the Brigham Research Institute and the Innovation Hub (iHub), a focus for entrepreneurship and innovation. In addition, she was the Founding Director of the Center for Faculty Development and Diversity at the BWH.

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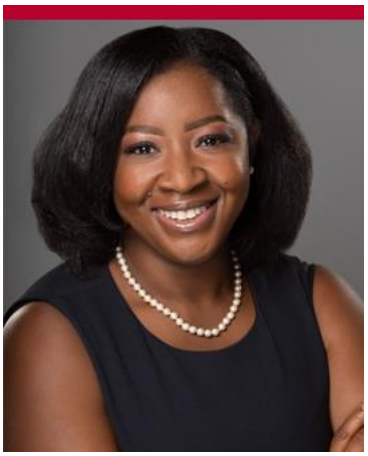
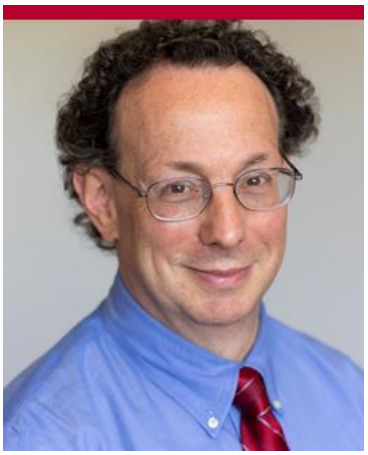
Dr. Bierer received a B.S. from Yale University and an M.D. from Harvard Medical School.

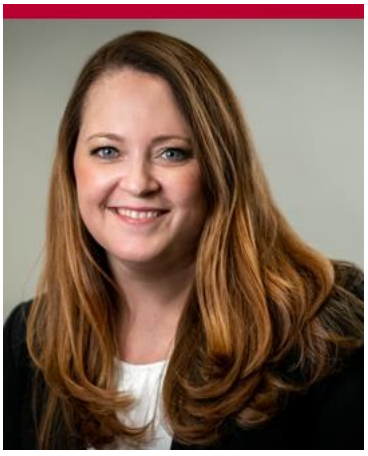


Esther Krofah is the executive director of FasterCures, a center of the Milken Institute and the Milken Institute Center for Public Health. She has deep experience in the government, nonprofit, and for-profit sectors, where she has led efforts to bring together diverse stakeholder groups to solve critical issues and achieve shared goals that improve the lives of patients. Most recently, Krofah was the director of public policy leading GlaxoSmithKline's engagement with the U.S. Department of Health and Human Services (HHS) and relevant Executive Branch agencies on broad healthcare policy issues, including leadership in improving vaccinations and care for people living with HIV. Prior to GSK, Krofah served as the deputy director of HHS' Office of Health Reform, where she led the development of policy positions for significant regulatory priorities, including the health insurance marketplaces. Prior to HHS, Krofah served as a program director at the National Governors Association (NGA) health-care division, working directly with governors' health policy advisors, state Medicaid directors, and state health commissioners on health insurance, health workforce, and Medicaid coverage issues. Before joining the NGA, Krofah worked in consulting at Deloitte Consulting LLP, where she worked with public sector and commercial clients, including assisting states

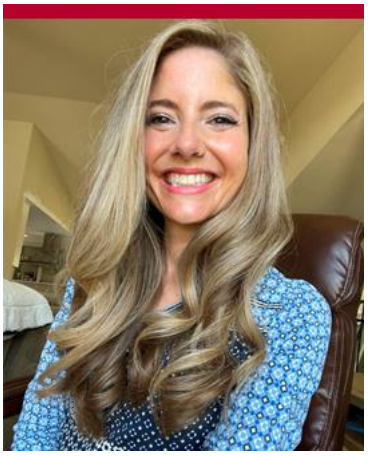
in developing state-based exchanges. Krofah received a BA from Duke University and a Master of Public Policy from the Harvard University John F. Kennedy School of Government.



Dr. Lindsey Baden is the Director of the Brigham and Women's Hospital (BWH)/Dana-Farber Cancer Institute (DFCI) Infectious Diseases Immunocompromised Host consultative services and the Division's Director of Clinical Research. Dr. Baden's research interests focus on early-stage vaccine development (including for HIV-1 and SARS-CoV-2) and the development of novel diagnostics and therapeutics for fungal and viral diseases that affect transplant and cancer patients disproportionately. He is the Program Director for the Clinical Trial Units of Harvard Catalyst at Harvard Medical School and Directs the Center for Clinical Investigation (CCI) at BWH.



Penny Carlson has nearly 25 years of experience in the pharmaceutical industry and is currently the Head of Global Development Support, which includes multiple clinical trial delivery functions. Prior to this, Penny held various roles of increasing responsibility across several disciplines and multiple therapeutic areas. She started her career working for a small Contract Research Organization supporting NIH sponsored Vaccine and Infectious Disease studies, followed by several years working for Pfizer in various data management roles. During her tenure at Pfizer, Penny moved into Clinical Operations and began managing studies in the Oncology therapeutic area, where she stayed for a number of years. In 2011 Penny joined Takeda (previously Millennium) initially as a Clinical Program Manager and was later responsible for multiple assets in the early development space. In more recent years, Penny has been the Clinical Operations Lead for the Gastroenterology Therapeutic Area and has supported a number of transformative initiatives and projects for Takeda. In addition to her years of traditional development operations experience, Penny also served as the Clinical Scientist for a European submission and multiple publications, and recently supported integration planning efforts prior to recent acquisitions.



Valen Keefer toes the line every day between survival and advocacy. At the age of 37, she is thriving thanks to two lifesaving transplants. Both were needed because of polycystic kidney disease (PKD). Valen was diagnosed with PKD at the age of 10, a genetic kidney disease which she inherited from her mother's side of the family and has deeply impacted and taken the lives of countless family members. Valen endured a challenging childhood full of hospital stays and cyst bleeds. After almost a year in the hospital as a teenager, both of her kidneys were removed, she was on dialysis, endured severe pancreatitis, received more than 70 blood transfusions and at the age of 19 received a life-saving kidney transplant. This second chance restored Valen's health and gifted her the opportunity to find her purpose in life, turn her health challenges into something meaningful and be the role model she wishes she had. In her early 30s, PKD affected her liver and she became very ill again. Thankfully, at the age of 35 Valen received a life-saving liver transplant and the ability to continue doing what she loves - helping others and living life to the fullest.

Despite life challenging her at nearly every turn, Valen is determined to help others who are fated to walk a similar path. She has taken her new lease on life and is intent on paying it back tenfold. As a passionate patient advocate since 2004, she works tirelessly to raise awareness of kidney disease, PKD and organ donation and to help educate and empower the 37 million US adults with chronic kidney disease, the 12.5 million people worldwide with PKD and the 114,000 waiting for a life-saving transplant.

Grounded in gratitude, she works directly with countless patients and has shared her journey at 100 events across North America with an authentic optimism that gives people hope and moves them to action. She's done many press interviews, coordinated educational and fundraising events and helped raise over $1,200,000 for polycystic kidney disease research. Valen has written 250 blogs (published by non-profits), painting a genuine picture of the challenges and joys of this journey. Through her collaborations with numerous organizations, she has inspired a combined total of 1.7 million social media followers with her story of hope and resilience that transforms people forever. She proves there is not just life with severe kidney disease, but potentially a great one.

Dr. Isaac R. Rodriguez-Chavez is a biomedical leader with expertise in Infectious Diseases, Viral Immunology, Viral Oncology, and Vaccinology. Currently, he is a Senior Vice President for Scientific & Clinical Affairs, leading the Strategy of the Global Center of Excellence for Decentralized Clinical Trials, PRA Health Sciences. Past positions in the last 33 years include FDA, CDER Senior Officer for Clinical Research Methodology, Regulatory Compliance and Policy Development modernizing clinical research through Decentralized Clinical Trials enabled by Digital Health Technologies; CEO/Founder, 4Biosolutions Biomedical Consulting Firm; Vice President, Research, Texas Biomedical Research Institute; Director of HIV Clinical Research Programs, NIH; Senior Clinical Scientist, Schering Plough Corp.; Scientist, Columbia University; Scientist, Polar Biotechnology Company and Venezuelan Institute for Scientific Research (IVIC). He issued the first U.S. Good Clinical Laboratory Practice (GCLP) Guidelines to improve the consistency of clinical laboratory endpoints supporting trials globally, published numerous scientific and technical articles, and has been an invited

speaker in 95 global conferences. He has a PhD in Virology and Immunology; a MS in Microbiology; a MHS in Clinical Research; and a B.S. in Biology. Dr. Rodriguez-Chavez is a Board Member of the Scientific Leadership of the Digital Medical Society (DiME). He is also a co-chair of the DiME's Research Committee, driving digital medicine globally. He is a regulatory Advisor and Vice-Chair of the Institute of Electrical and Electronics Engineers (IEEE) fostering initiatives on DCTs and DHTs. He is a Leadership Council member of the Decentralized Trials & Research Alliance (DTRA); a board member of the Hypertrophic Cardiomyopathy Association (HCMA); and an rare disease health equity board council member of the Global Genes. He is a global content editor for regulatory science at the DIA Global Forum Magazine. He is also an active member is fourteen professional associations, including the American Association of Immunologists, American Society for Virology, American Society of Microbiology, Society of Quality Assurance, Association of Clinical Research Professionals, New York Academy of Sciences, International AIDS Society, International Association for Dental Research, American Association for Dental Research, and Regulatory Affairs Professional Society.

Paul Kluetz, MD, is a medical oncologist and Deputy Director of the Oncology Center of Excellence (OCE) at the U.S. FDA. In addition to assisting in the strategic and operational oversight of the OCE, he has a broad interest in trial design and endpoint selection to expedite drug development and define clinical benefit in oncology trials. Some of his initiatives include creation of the OCE's patient-focused drug development program and expansion and direction of OCE's efforts to advance real-world evidence, decentralized trial designs and digital health technology. He is also active in regulatory review of Oncology products and oversees important oncology drug labeling initiatives. Dr. Kluetz remains clinically active, caring for patients and supervising medical residents at the Georgetown University Hospital.

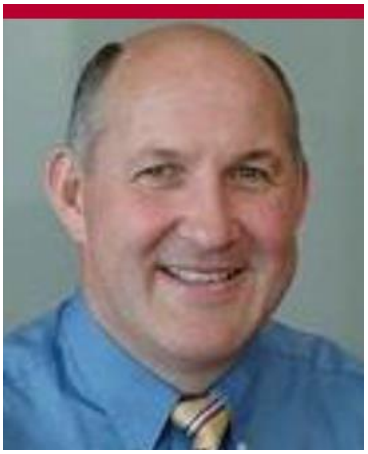
Nicholas Brooke is the Founder and Executive Director of The Synergist and CEO of Patient-Focused Medicines Development (PFMD.org). The Synergist is a collaboration platform incubator that brings key players together with the express aim of solving significant societal problems through collective action. Under Nicholas' leadership, The Synergist acts as a backbone, providing vision, strategy, stakeholder alignment and execution on multiple global, multi-stakeholder programs.

Nicholas is the Executive Director of Patient-Focused Medicines Development, a global collaborative platform dedicated to stimulating innovation in medicine development through systematic engagement with patients.

Nicholas Brooke is an economist by training and was previously Chief Executive Officer of an award-winning digital agency, providing cutting-edge digital strategy to global corporations across multiple sectors. Working with key players from across the public–private spectrum, The Synergist currently manages several collective programs including Motherhood Collective Impact, From Testing to Targeted Treatment, Patient-Focused Medicines Development and Safe Motherhood Week.

Andrea Ferris is President and CEO of LUNGevity Foundation. She became involved with lung cancer advocacy following her mother's death from the disease in 2008. After receiving a diagnosis of stage IV lung cancer in 2006, Andrea's mother underwent numerous treatments and clinical trials at several major academic institutions to no avail. Together with her father, Andrea was her mother's primary caregiver during this time. Determined to drive more money into lung cancer research, Andrea left the successful software company that she helped launch, to found Protect Your Lungs, an organization focused 100% on funding early detection research. In 2010, Andrea merged Protect Your Lungs with LUNGevity, a Chicago based organization, to form the nation's leading lung cancer focused non-profit.

Andrea's strong business background combined with her connections to the worlds of research and advocacy have enabled her to build one of the preeminent patient advocacy organization in the lung cancer space. LUNGevity funds translational research into both early detection and more effective treatments of lung cancer as well as a highly coveted Career Development Awards program. LUNGevity also fills unmet needs for people diagnosed with lung cancer by providing education, support and survivorship programs. Recognizing the need to build awareness and understanding about lung cancer, LUNGevity has built the largest grassroots network of events and advocates across the country.

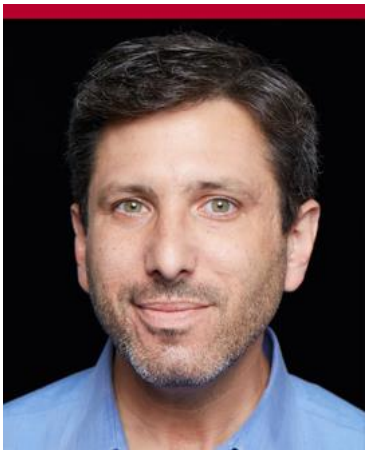


Andrew (Andy) Lee is Senior Vice President and Head, Global Clinical Trial Operations (GCTO). In this role, Andy leads and manages all operations related to the conduct of Merck's clinical trials, with particular focus on global in-patient clinical trials that are designed and executed to meet cost, speed and quality standards. Andy is also responsible for the design and study and data management of clinical protocols in all regions and countries, as well as the tools, systems and processes used in clinical trial executions. Andy joined Merck in September 2014 from Sanofi, where he served as Senior Vice President and Deputy Head of Clinical Sciences and Operations (CSO) and Head of the CSO Clinical Operations cluster. In addition to directing the CSO, Andy led the integration of Sanofi with Genzyme, where he had been Senior Vice President, Global Clinical Operations. Earlier in his career, he spent more than 16 years in a range of positions of increasing responsibility at Pfizer.

Andy holds leadership positions in several professional societies, including the role of Treasurer of TransCelerate Biopharma, Inc., a nonprofit organization that comprises the world's leading pharmaceutical and biotech companies. He received his M.S. in bioenergetics and physiology from Ball State University in Indiana, and two undergraduate degrees from Rhodes University in South Africa.

Harpreet Singh, M.D., is director of the Division of Oncology 2 in the Office of Oncologic Diseases, as well the Acting Associate Director for Cancer in Older Adults and Special Populations in the Oncology Center of Excellence at the U.S. Food and Drug Administration (FDA). Dr. Singh received her M.D. degree from the University of Southern California. She completed her Internal Medicine residency and Geriatrics fellowship at USC, followed by a Medical Oncology fellowship at the National Cancer Institute. As Director of the Division of Oncology 2, Dr. Singh oversees drug development for lung cancer, head and neck cancer, neurologic tumors, pediatric solid tumors, and rare cancers. Her scope of expertise includes precision medicine and targeted therapy, novel trial design, innovative regulatory initiatives designed to expedite drug approvals, and use of real-world data in regulatory decision making.

Dr. Singh is co-leading the FDA Oncology Center Excellence's project post Covidity effort, which aims to look at the impact of COVID-19 on patients with cancer. She also sits on a committee of academic investigators who are focusing on lung cancer and COVID-19. Dr. Singh maintains her clinical credentials at the National Cancer Institute.



Craig Lipset is an advisor, educator, advocate and innovator focused on novel solutions for clinical trials and medicine development. He is the founder of Clinical Innovation Partners, providing advisory and board leadership with pharma, tech and investors. Craig is Co-Chair for the Decentralized Trials & Research Alliance, Vice Chair of the MedStar Health Research Institute, Vice President of the Foundation for Sarcoidosis Research and on the Editorial Board for *Therapeutic Innovation & Regulatory Science.* Craig is Adjunct Assistant Professor in Health Informatics at Rutgers University, and Adjunct Instructor in the Center for Health + Technology at University of Rochester.

Craig was the Head of Clinical Innovation and Venture Partner at Pfizer, on the founding Operations Committee for TransCelerate Biopharma, and on the founding management teams for two successful startup ventures.

Sarah White, MPH, joined the MRCT Center as the Executive Director in January of 2018 and is responsible for developing, defining, and implementing the overall strategy and vision for the Center as well as oversee all management aspects of the MRCT Center functions. Sarah has almost 20 years of experience in human subjects' research including experience at both academic medical centers and industry. Prior to joining the MRCT Center, Sarah was the Director of the Human Research Quality Improvement Program (QI Program) at Partners' Healthcare in Boston, Massachusetts. In this capacity, she was responsible for strategic planning and oversight of the QI Program activities across the human research communities at Partners Healthcare, including Massachusetts General Hospital and Brigham and Women's Hospital. In addition, Sarah oversaw FDA Sponsor-Investigator support and the centralized support of clinical trials registration and disclosure. Sarah is the co-chair of the national Clinical Trials Registration

Taskforce, a large consortium of academic medical centers, hospitals and universities that identify best practices, develop tools, and serve as a communication forum associated with the requirements for clinical trials registration and results reporting that affect US academic health centers. Sarah also co-chaired of the Harvard Catalyst Quality Assurance/Quality Improvement Subcommittee from 2010 to 2018. Sarah received her undergraduate degree from Dartmouth College and her MPH from Boston University School of Public Health.

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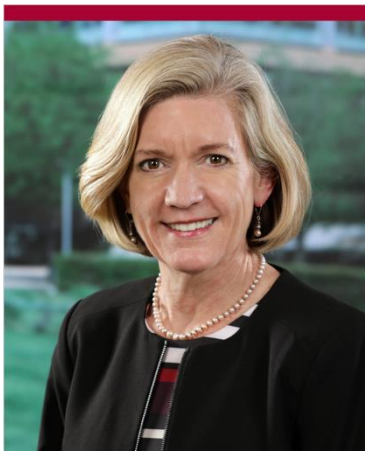
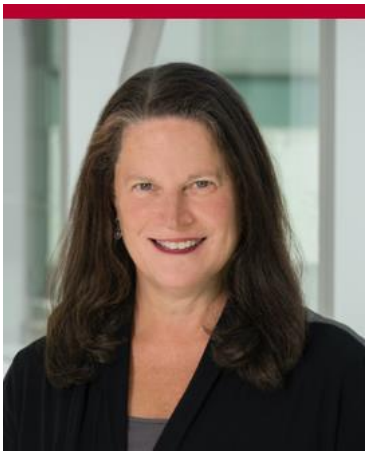
Fergus Sweeney is Head, Clinical Studies and Manufacturing Taskforce at the European Medicines Agency since March 2020, covering Clinical Studies (Clinical Trial Information System), Biological Health Threats and Vaccine Strategy and supports strategy development in manufacturing and personal data protection in health research on medicines. He joined the EMA Inspections Service in 1999 and became Head of Compliance and Inspections (2009) and Head of Division Inspections and Human Medicines Pharmacovigilance in 2013 (including Scientific Committee Services from 2016). He has a BA (Physiology 1979) a Dr de 3eme Cycle (cancer biology 1982), and PhD (Pharmacology 1986). Fergus worked in clinical research mainly in QA from 1982 to 1999.



Ginny Beakes-Read is Executive Director, Global Regulatory and R&D Policy at Amgen. She leads the GRR&D policy group, which works to shape the regulatory environment in ways that support innovative drug development and patient access to new therapies. The team works with Development, Commercial, Health Policy, Government Affairs, and other departments on a variety of regulatory and policy matters. Ginny joined Amgen from Eisai, where she led the Global Regulatory Policy team for 8 years. For her last 2 years at Eisai, Ginny was the Executive Director/Special Counsel, Regulatory Strategy and Law, where she was a member of the Global Regulatory Affairs and Legal Departments.

Ginny previously worked at Genentech, Inc., as Director, Regulatory Policy and Strategy, in the Washington, D.C. Office. Prior to her work at Genentech, Ginny was at FDA where she was the Director, Division of Regulatory Policy II, Office of Regulatory Policy in CDER for 8 years. In that position she was responsible for the development of regulations affecting CDER, and was involved with crafting policy positions in areas such as follow-on biologics. Before her tenure at FDA, Ginny was a US Army JAG, working as a prosecutor and appellate attorney. Ginny is also an RN and started her career as an intensive care nurse in the US Air Force. Ginny holds B.S.N. and J.D. degrees from the University of Virginia.



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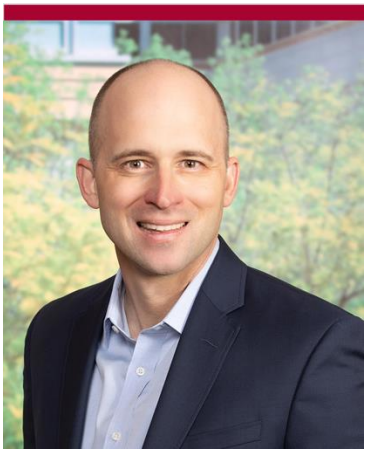
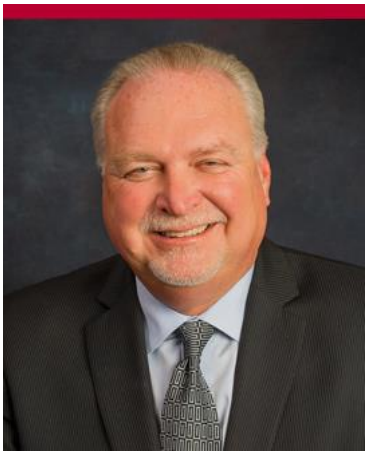


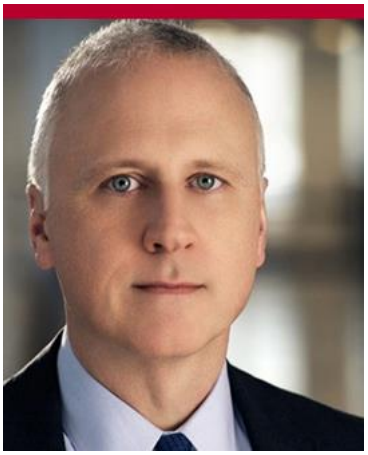
Taras Carpiac leads the Innovation & Process Improvement organization within Amgen Global Development Operations. In this role, he oversees transformation efforts in the clinical trial domain, including risk-based & statistical monitoring, decentralized trial execution, and patient-centered drug development. Prior to this role, Taras has held leadership roles within study operations, clinical data management, and information management. Taras is excited about the potential for new trial execution models to accelerate the pace at which high quality medicines can be brought to patients.

Lauren Hartsmith is Director of Regulatory Affairs at Advarra. She previously served as a Policy Analyst for the Department of Health and Human Services' Office for Human Research Protections (OHRP). In that position, she led scientific, regulatory, and legal experts to develop and revise policies and regulations. Lauren was a key analyst involved in all aspects of the revised Common Rule rulemaking process, where she developed reports analyzing and summarizing over 2,000 public comments submitted in response to proposed Common Rule revisions. Lauren has also conducted analyses and provided advice for the FDA's human subjects protection regulation. She holds a Juris Doctorate degree from Wake Forest University School of Law, where she was a recipient of the Kilpatrick Stockton and Wake Forest University Law Scholarships. She holds a bachelor's degree from Vassar College, where she majored in Geography.



Dr. Richard (Rich) A. Moscicki, MD, is the Executive Vice President for Science and Regulatory Advocacy and the Chief Medical Officer at Pharmaceutical Research and Manufacturers of America (PhRMA). Dr. Moscicki came to PhRMA in 2017 after serving as the Deputy Center Director for Science Operations for the U.S. Food and Drug Administration's (FDA) Center for Drug Evaluation and Research (CDER) since 2013. While at FDA, Dr. Moscicki brought executive direction of Center operations and leadership in overseeing the development, implementation, and direction of CDER's programs. Previous positions include serving as Chief Medical Officer at Genzyme Corporation from 1992 to 2011, where he was responsible for worldwide global regulatory and pharmacovigilance matters, as well as all aspects of clinical research and medical affairs for the company. He served as the senior vice president and head of Clinical Development at Sanofi-Genzyme from 2011-2013. Dr. Moscicki received his medical degree from Northwestern University Medical School. He is board certified in internal medicine, diagnostic and laboratory immunology, and allergy and immunology. He completed his residency in internal medicine, followed by a fellowship at Massachusetts General Hospital (MGH) in clinical immunology and immunopathology. He remained on staff at MGH and on the faculty of Harvard Medical School from 1979 until 2013.

Névine Zariffa, MMath – a highly accomplished thought leader in the fields of biostatistics and data science with extensive experience across all phases of drug development. Névine had a 25-year career in senior roles at GlaxoSmithKline and AstraZeneca where she also led the Enterprise Data & Analytics initiative. She has been a key contributor to development strategies for over 200 drug projects across oncology, cardiovascular, metabolic, respiratory, inflammation, and renal diseases. She served as a Board member of CDISC for 6 years, has been a reviewer for The Lancet and has over 30 peer reviewed publications to her name. She is currently a strategic consultant to select healthcare clients, several scientific data consortia (ICODA and ctMoniTR) and to the FDA's Office of the Commissioner on the application of real-world evidence to COVID19.



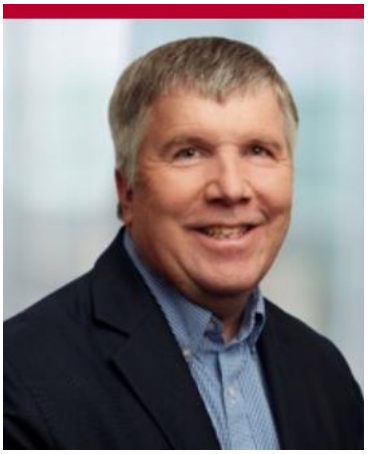
Mark Barnes is the faculty co-director of the Multi-Regional Clinical Trials Center of Brigham and Women's Hospital and Harvard (MRCT Center). Mark is also a Partner at Ropes & Gray LLP as well as a Lecturer at Yale School of Medicine and Visiting Lecturer at Yale Law School. Mark's law practice and his teaching at Yale focus on health care law and finance, human and animal research, stem cell and genetic research, research grants and contracts, research misconduct, and international research. Mark formerly served at Harvard as the Senior Associate Provost and University Senior Research Officer and started and directed Harvard's HIV/AIDS treatment programs in Nigeria, Tanzania and Botswana. He serves on the Ethics Working Group of the NIH's HIV Prevention Trials Network (HPTN). Mark has held senior appointed positions in the New York City and State departments of health. In 2019, he was named the "Legal Innovator of the Year" by the *Financial Times*.

M. Khair ElZarrad PhD, MPH., Dr. ElZarrad is the Deputy Director of the Office of Medical Policy (OMP) at FDA's Center for Drug Evaluation and Research (CDER), where he leads the development, coordination, and implementation of medical policy programs and strategic initiatives. Dr. ElZarrad currently leads multiple projects focused on exploring the potential utility of real-world evidence, innovative clinical trial designs, and the integration of technological advances in pharmaceutical development. Dr. ElZarrad is the rapporteur for the International Council for Harmonisation's ongoing work to revise the international Good Clinical Practice Guideline (ICH-E6(R2)). Prior to joining the FDA, he served as Acting Director of the Clinical and Healthcare Research Policy Division with the Office of Science Policy at the National Institutes of Health (NIH). At NIH he worked on policies related to human subject protections; the design, conduct, and oversight of clinical research; and enhancing quality assurance programs at pharmaceutical development and production facilities. He earned a doctoral degree in medical sciences with a focus on cancer metastases from the University of South Alabama, as well as a master's degree in public health from the Johns Hopkins Bloomberg School of Public Health.

Owen Fields received a B.S. in Biochemistry and a minor in mathematics from Wichita State University, and a Ph.D. from the Department of Molecular and Cellular Biology at Berkeley.

Following his graduate education, Owen served in the Policy Development Branch, Center for Food Safety, US FDA, where he helped develop the initial US policy towards agricultural/food biology, led the team that developed the review procedure that still applies to such products, and served as the lead reviewer on 3 of the first 8 products FDA approved in this area.

Following this he moved to Regulatory Affairs at Wyeth in 1995, where he worked on both late and early-stage products. Subsequently Owen became VP for Regulatory Strategy for Pfizer Research and Development and is now responsible for regulatory strategy for the Inflammation and Immunology therapy area at Pfizer.



Steven E. Kern, PhD is Deputy Director of Quantitative Sciences at the Bill and Melinda Gates Foundation. The Quantitative Sciences group is focused on quantitative analysis to support program strategies for therapeutic projects that the foundation funds across multiple disease domains.

Prior to this, he was Global Head of Pharmacology Modeling at Novartis Pharma AG based in Basel Switzerland where he led a team focused on providing model-based drug development support to therapeutics in many disease conditions across all stages of drug development. He joined Novartis in 2010 from the University of Utah in Salt Lake City, Utah where he was Associate Professor of Pharmaceutics, Anesthesiology, and Bioengineering, and served as co-investigator for their NIH funded Pediatric Pharmacology Research Unit. He has designed, conducted, and served as a principal investigator for clinical pharmacology studies in adults and children that spanned the population from preterm infants to elderly adults.

He has a bachelor's degree in Mechanical Engineering from Cornell University, a Master's degree in Bioengineering from Penn State University, and a doctoral degree in Bioengineering from the University of Utah. Dr. Kern has published over 70 papers in areas of pharmacokinetic and pharmacodynamic modeling, applying principles of control systems engineering to drug delivery, and clinical pharmacology.