

# Innovation in Cardiology: The ACC Innovation Program

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**ABSTRACT:** The last half century has seen extraordinary advances in the field of cardiology, including innovations in medications, diagnostic modalities, and therapeutics. Even so, cardiovascular disease remains the leading cause of morbidity and mortality globally, with suboptimal quality of care, inconsistent health outcomes, and unsustainable costs. It is clear that cardiovascular medicine must undergo a digital transformation to enhance the delivery of quality care and to improve outcomes. To meet this need, the American College of Cardiology developed an innovation program focused on the digital transformation of cardiovascular care, with the goal of improving heart health for individuals and populations.

## THE NEED FOR CARDIOVASCULAR CARE TRANSFORMATION

Perhaps no field of medicine has had more innovation over the last 65 years than cardiology. Major scientific insights, such as cardiovascular (CV) pathophysiology, coupled with pharmacologic and technologic advances have yielded breakthrough after breakthrough.<sup>1</sup> Despite the many advances, the full potential of CV science and medicine has not been realized, and population health is suboptimal. CV disease remains the leading cause of morbidity and mortality in the United States and worldwide. The global burden of CV risk factors—such as hypertension, diabetes, and obesity—is growing in both developed and developing countries.<sup>2-4</sup>

While inpatient and procedural cardiac care has become more effective and safer over decades, preventive and longitudinal care patterns vary widely. For example, fewer than half of patients with CV disease continue to take prescribed cardioprotective medications over time, which translates into approximately 125,000 preventable deaths per year just in the United States.<sup>5</sup> The continued rise in healthcare expenditures also threatens optimal CV care and the implementation of new innovations. Cardiovascular care costs are among the highest in health and medicine; in fact, the number of Americans with CV disease is projected to rise to approximately 45% of the total population over the next 15 years, and related costs are estimated to exceed \$1 trillion dollars.<sup>4</sup>

How can one reconcile the seeming paradox of major advances in cardiology with suboptimal quality of care, inconsistent health outcomes, and unsustainable costs? The clearest explanation is that the healthcare delivery system has not sufficiently evolved to keep up with advances in CV science and medicine. Indeed, the basic mode of healthcare delivery inside the walls of hospitals and clinics has been largely static over decades. The

delivery system is an impediment to adoption of innovation and needs transformation.

## DIGITAL TRANSFORMATION

Computing power, digital data, and transmission of digital data (via the internet, for example) continue to grow exponentially. Outside of health care, this has spurred so-called digital transformation, or the adoption of technologies to deliver services in a more effective and efficient way. Digital transformation has altered most sectors of the economy, from finance and entertainment to retail and transportation. In fact, according to Forbes magazine, 89% of all companies have adopted a digital-first business strategy or plan to do so and have already started a digital-first approach to operations and customer engagement.<sup>7</sup> There is widespread hope, as well as hype, that the digital transformation of health care can save billions of dollars while improving care delivery and outcomes.<sup>8,9</sup>

Dr. Kamal Jethwani, former senior director of Connected Health Innovation for Partners HealthCare, proposed that digital transformation in health care focus on virtual care, remote monitoring, and artificial intelligence (AI)-driven care.

- **Virtual care** leverages telehealth technology to provide remote clinical visits to improve access, efficiency, communication, and engagement.
- **Remote monitoring** uses data from digital health technologies (mobile, wearable and nonwearable biosensors, voice, etc.) to inform diagnostic and treatment decisions in the name of prevention, care management, and health optimization.
- **AI-driven care** applies analytic methods such as machine or deep learning to large digital datasets to improve risk

prediction and image interpretation and support diagnostic and treatment decisions.

Ideally, all three components work in concert to achieve meaningful digital transformation of healthcare delivery.

Writer William Gibson, who coined the term “cyberspace,” wrote, “The future is already here—it’s just not very evenly distributed.” Indeed, the technologies to achieve digital transformation for healthcare delivery already exist and are continuing to evolve. However, although hundreds of digital health start-ups as well as major technology companies have invested billions of dollars over the last decade to develop health and healthcare digital products, only a few have been integrated into healthcare delivery.

If the technologies exist and the potential is great, why hasn't it happened? There are numerous factors, including the inherent complexity of health care compared to other business sectors; misaligned financial incentives; too many technology “solutions” that are not designed to optimize care delivery or patient/family-clinician interactions; too much data and not enough actionable clinical information; variable evidence that digital technologies can improve care and outcomes; electronic health records that focus on billing yet hinder efficiency and block application programming interfaces; and overall lack of integration into clinical care. Even well-designed consumer digital health products may not integrate well into existing care delivery or evolving models of virtual care and remote patient monitoring.

All of this suggests the need for innovation in the way we approach digital transformation of healthcare delivery. This is the context that led to the development and launch of the American College of Cardiology (ACC) Innovation Program.

**THE ACC INNOVATION PROGRAM**

The mission of the ACC is to transform CV care and improve heart health. Given the many opportunities and challenges described above, the ACC Board of Trustees approved an innovation strategy in 2017.<sup>10</sup> The ACC Innovation Program ([www.acc.org/about-acc/innovation](http://www.acc.org/about-acc/innovation)) was launched with the goal of leading the digital transformation of cardiovascular healthcare delivery to improve heart health for individuals and populations.

Clearly the ACC cannot, by itself, effect the digital transformation of healthcare delivery. The question, instead, became “Can the ACC effectively facilitate such transformation?” From this challenge was born the key components of the ACC Innovation Program strategy (Table 1), which include engaging stakeholders across the healthcare spectrum, developing professional competencies around innovation for ACC members, surveilling evolving technologies, building strategic alliances with like-minded organizations, and collaborating with technology companies that focus on CV innovation—all with a focus on transforming the delivery of CV care.

STRATEGIC APPROACH	OBJECTIVE
<b>Multi-stakeholder engagement</b>	Facilitate transformation of cardiovascular (CV) care via direct collaboration with healthcare stakeholders ranging across patient/consumer advocates, clinicians, hospitals/health systems, technology companies, regulators/government, payers, pharmaceutical and device companies, healthcare innovation programs, etc.
<b>Strategic alliances</b>	Establish domestic and international strategic innovation collaborations with like-minded organizations, primarily focused on advancing the digital transformation of healthcare delivery. See current Strategic Collaborators at <a href="http://www.acc.org/about-acc/innovation">www.acc.org/about-acc/innovation</a> .
<b>Technology collaborations</b>	Develop novel collaborations with companies in the digital health and CV innovation spaces. See current Tech Collaborators at <a href="http://www.acc.org/about-acc/innovation">www.acc.org/about-acc/innovation</a> .
<b>Professional development</b>	Establish ACC as a “professional home” for members who are involved or interested in healthcare innovation, with a focus on entrepreneurship, analytics, digital health, and precision health. Learn more about the ACC Health Care Innovation Section at <a href="http://www.acc.org/innovation">www.acc.org/innovation</a> .

*Table 1.*  
The key components of the American College of Cardiology (ACC) Innovation Program strategy.

## ENGAGEMENT AND STRATEGIC ALLIANCES

An inaugural multi-stakeholder ACC Innovation Summit was held in the fall of 2016, leading to publication of the *2017 Roadmap for Innovation—ACC Health Policy Statement on Healthcare Transformation in the Era of Digital Health, Big Data, and Precision Health*.<sup>11</sup> Since then, the ACC has hosted annual summits on Health Policy Hurdles to Innovation (2017), Patient-Reported Outcomes (2018), Applied Artificial Intelligence (2019), and Virtual Care (2020).

In 2018, the ACC cohosted a Digital Health Think Tank with Stanford Digital Health and the Cardiovascular Research Foundation. It also launched the ACC–Yale–New Haven Hospital's Center for Outcomes Research and Evaluation Institute for Computational Health with a focus on applied machine learning and artificial intelligence analytics.

In January 2020, the ACC jointly hosted the “Disruptive Innovations in Health Care” program with the Consumer Technology Association at the Consumer Electronics Show.<sup>12</sup> The ACC also launched the Applied Health Innovation Collaborative in 2020 focusing on effective collaboration and implementation of digital technologies in clinical practice (not just a series of “pilots”), with a wide range of strategic partners.<sup>13</sup> The Applied Health Innovation Consortium conducted a successful summit on “Optimizing Virtual Care” in the Fall of 2020.

Finally, the ACC has established active global collaborations, often including joint Innovation Challenge competitions, with entities such as the Israel Innovation Institute, BioInnovate Ireland, the Chinese Cardiovascular Society, and Kings Health Partners in London, UK.

## TECHNOLOGY COLLABORATIONS

A primary focus of the ACC Innovation Program has been the development of novel collaborations with technology companies that support the ACC's Strategic Plan.<sup>14</sup> Some of these collaborations are project based, such as involvement in the Facebook Preventive Health project and the Apple Heart Study, the primary results of which were presented at the ACC Scientific Sessions in 2019. The ACC participated in the launch of the Preventive Health Project at the 2019 HLTH conference.

In highly selective instances, the ACC considers codevelopment of technologies provided there is scientific guidance, facilitation of clinical validation, and implementation in clinical practice. These collaborations focus on digital technologies with a high potential to impact patient and/or population health and often involve existing ACC assets (eg, clinical networks, education,

quality of care programs, advocacy) to facilitate meaningful implementation in clinical practice. As examples, the ACC Innovation Program is actively collaborating with (1) Cliexa, HealthPals, Heartbeat, and other digital health companies to develop and implement digital health platforms for virtual care and remote patient monitoring; (2) Carta Health, Clearly, and SpectraMD to use AI for clinical analytics, quality of care assessment, image interpretation, and novel prevention and treatment strategies; (3) HeartHero, which has developed a hand-held automated external defibrillator to address the public health crisis of sudden cardiac death; and (4) Butterfly Network, an AI-guided point-of-care ultrasound device, including collaboration on clinical research.<sup>15-19</sup>

## PROFESSIONAL DEVELOPMENT

Finally, in parallel with strategic and technology collaborations, the ACC has focused on professional development relevant to CV innovation and digital transformation. The ACC Health Care Innovation Section launched in 2018, and more than 2,000 members have joined to date. Innovation Section members span all career phases and clinical focus areas, with high engagement by fellows in training and early career members. Section members can opt in to any of the following work groups: Advanced Health Care Analytics, Digital Health and Devices, Entrepreneurship, and Precision Health and Virtual Care. As strategic and technology collaborations continue to develop, Innovation Section members can self-nominate for consideration for project- or initiative-specific workgroups.

Additionally, the Health Care Innovation Section oversees the “FutureHub,” which debuted in 2018 at the ACC Scientific Sessions. Held annually, the FutureHub highlights emerging digital technologies and interaction between clinicians and technologists/entrepreneurs. The FutureHub also features Innovation Challenge pitch events that have yielded multiple start-up company event winners and collaborative projects with the ACC. In 2019, the Innovation Section launched regional innovation hubs, working collaboratively with several ACC State Chapters. In 2020, the Innovation Section launched an Innovation Forum event series to further develop the community of ACC Innovation members and directly engage the technology sector with a focus on clinical evaluation and integration. The first Innovation Forum webinar, held in July 2020, focused on virtual care. Additional forums are planned through 2021 and are open to all ACC members.

## CONCLUSION

In less than 4 years, the ACC Innovation Program has executed dozens of projects, established numerous domestic and

international strategic alliances, developed a CV professional innovation “home” (the ACC Health Care Innovation Section), and launched novel technology collaborations including successful codevelopment and clinical integration. There is still a long way to go to successfully achieve the digital transformation of CV care. However, the ACC is committed to executing a strategy centered on clinical care delivery innovation that meaningfully improves heart health for individuals, populations, and the public.

#### KEY POINTS

- The American College of Cardiology (ACC) approved an innovation strategy in 2017 focused on advancing the digital transformation of health care.
- Primary foci for the ACC Innovation Program are virtual care, remote monitoring (eg, wearable and non-wearable biosensors), and artificial-intelligence supported care (eg, imaging, risk prediction, decision support).
- Key components of ACC Innovation activities include multi-stakeholder engagement, strategic alliances, technology collaborations, and professional development.
- In less than 4 years, ACC Innovation has executed dozens of projects, established numerous strategic alliances, created a cardiovascular professional innovation “home” (the ACC Health Care Innovation Section), and developed novel technology collaborations including successful co-development and clinical integration.

#### Conflict of Interest Disclosure:

Dr. Rumsfeld is the chief innovation officer and chief science officer for the American College of Cardiology. Dr. Shah is a consultant for and/or conducts research on behalf of the National Institutes of Health, American Heart Association, the National Heart, Lung and Blood Institute, Women as One, Doris Duke Charitable Foundation, and the American College of Cardiology.

#### Keywords:

American College of Cardiology, ACC Innovation Program, digital health, innovation, health care delivery, artificial intelligence

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