Precision medicine in an AI world

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The idea of precision medicine is a disruptive approach to healthcare, with care and wellness tailored to the individual genetic makeup, lifestyle and environmental factors of each person. It is an approach recognizing the uniqueness of each person, and that treatment should vary depending on an individual's specific characteristics. Since the mapping of the human genome 20 years ago in April 2003, genomic data has been used to determine predisposition to diseases and predict the efficacy of different forms of treatment, and to develop drugs targeting the basic biology of diseases. It is guiding the development of new drugs, therapies, and delivery mechanisms. By tailoring treatment to the specific needs of each patient, the promise of precision medicine is no less than to improve the quality of care, the efficacy of prevention, reduce the risk of adverse outcomes, and to improve the economy of healthcare delivery.

The growth of digital health technologies, and big data and AI in particular, are shaping the predictive, diagnostic and clinical aspects of precision medicine. A significant part of the future growth of precision medicine will come from emerging digital technologies and data-driven strategies. Some key trends and developments to keep watch on include:

- The **increasing developmental pace of AI technologies and computational methods** are accelerating the development of digital and precision medicine technologies. In many ways, precision medicine is only possible with the work that can be done by AI. The collection and synthesis of a vast amount of genomic, clinical, lifestyle, social and environmental data will provide unprecedented insights and opportunities not available to human researchers to develop a whole new level of precision. This will be especially true with drug research and development, where AI can be deployed to reduce the significant time and cost of bringing new treatments to market. And diagnostic equipment such as ultrasound and x-ray machines will see great benefits with the infusion of AI.
- A **growing trend in precision medicine will be a focus on preventive medicine, with a particular focus on mental health and well-being.** The impact on lifestyle, and changes to diet and exercise, with a growing emphasis on mental well-being, are areas of intervention primed for continued technological advancement. In the mental health field, for example, AI algorithms can create insights from range of sources, including social media, online forums, and wearable devices, to identify patterns that could be associated with specific mental health conditions.

- **Patient portals and other digital health applications and tools focusing on patient-provider experience** are creating platforms for patients to interact with their medical and health provides to access personalized health information. Connecting patients with their treatment providers (which itself will become a much broader concept) through digital technologies will help people connect with their genetic test results, understand the implications of findings, and provide opportunities for deep engagement with health care professionals should improve their health outcomes. Digital health tools that assist both the provider of care and the patient to make sense of that complexity and provide patients, family members, and health care professionals with a platform to contextualize genetic information could help improve the patient experience, support shared decision-making, and support patient-centred care based on their unique needs, preferences and values.
- **Regulatory frameworks for the development of precision medicine technologies and AI and digital technologies** cannot stifle innovation. The research and venture capital communities must come together with policymakers, and there must be harmonization across the globe. Certainly, the legal, ethical and social issues facing AI will be challenging, and there is a complicated landscape with layers of involvement by multiple levels of government and overlapping government agencies, regulated health professionals, health institutions. Nevertheless, the regulatory pathways that allow for innovation and commercialization at the intersection of technology and medicine.

Longstanding concerns about access to and equity of precision medicine technologies may become more pronounced with digital and precision health technologies. The high cost of accessing gene testing, for example, or the absence of some populations in health data, will be challenged with the trustworthiness and bias of AI systems for precision medicine technologies.

Short term funding challenges will persist with the collapse of Silicon Valley Bank and the worries of wider implications for start-up and early growth stage companies. Beyond this, however, the headwinds for precision medicine technologies look to clear up, and the intersection of digital health technologies and AI has the potential to allow precision medicine to live up to its promises.

For more information, please reach out to one of the key contacts listed below.

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