

디지털 의료기술을 적용한 정밀의료

Precision Medicine Requires Digital Medicine

Steven Steinhubl (Scripps Translational Science Institute, USA)

Precision medicine is difficult to define, partially because it is a dynamic definition – what is precise today will very likely be less precise in the future. For example, in a 1891 start-of-art lecture and subsequent manuscript entitled “The Early History of Instrumental Precision in Medicine” Dr. S. Weir Mitchell discussed the exciting potential enabled by the new levels of precision available to physicians of that time. Newly adopted technologies of that time allowed physicians to, for the first time, accurately measure previously estimated parameters like pulse rate, respiratory rate and body temperature.¹ We have come a long way since then, but much in the way a chronograph and thermometer enabled more precise diagnosis and treatment of people 130 years ago, the same is true today for our own generations’ newly available precision tools; genomics and digital technologies.

The United States’ National Institute for Health (NIH) recently defined precision medicine as an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment, and lifestyle for each person.² However, a much simpler description might be one offered by Enid Balint almost 50 years ago - “Understanding the patient as a unique human being.”³ To achieve the breadth and depths of understanding necessary to achieve these goals requires digital medicine.

Digital medicine encompasses a broad ecosystem of digital tools that when appropriately implemented can upgrade the practice of medicine to one that is high-definition and far more individualized. The tools most often considered when thinking of digital medicine are the wide range of ever growing biosensors that track our complex physiologic systems.⁴ While sensors, with smartphones as their hub, are an important component, the full spectrum of digital medicine technologies are needed to fully explore and then implement precision medicine. In particular, the digital capability to process the vast data generated via algorithms, cloud computing, and artificial intelligence. Returning individualized information to an individual

in a manner that is engaging and actionable for that person is also an additional important capability of digital communications that can be both dynamic and scalable.

Digital medicine contributes to our understanding and the advancement of precision medicine via 2 parallel pathways. First, the collection of large amounts of data from millions of individuals will lead to the redefining of the human phenotype. Second, through the unobtrusive and continuous monitoring of a wide range of ever-expanding characteristics unique to an individual wearer we can make the change from population-based medicine to individualized management based on always comparing you now to you at your healthiest.

The path forward for the implementation of digital medicine is not straightforward. It requires the development of completely new systems of care, which is often not possible within existing healthcare systems, especially those in the US.

References

1. Mitchell SW. The early history of instrumental precision in medicine: An address before the second Congress of American Physicians and Surgeons, September 23rd, 1891. Tuttle, Morehouse & Taylor, printers; 1892.
2. Hudson K, Lifton R, Patrick-Lake B. The precision medicine initiative cohort program- Building a Research Foundation for 21st Century Medicine. Precision Medicine Initiative (PMI) Working Group Report to the Advisory Committee to the Director, ed. 2015.
3. Balint E. The possibilities of patient-centered medicine. *The Journal of the Royal College of General Practitioners*. 1969; 17(82):269.
4. Steinhubl SR, Muse ED, Topol EJ. The emerging field of mobile health. *Science translational medicine*. 2015;7(283):283rv283.