Digital medicine

When genomics goes digital

"Alexa, what's my genetic risk for heart disease and should I be taking a statin?" Virtual assistants can guide us through CPR during emergencies and help manage diabetes, so a query into our personal genome is not far off. Genetic profiling is growing with projections that more than a billion people will have their genomes sequenced by 2025. But outside of prenatal and hereditary cancer screening, cancer treatment, and rare disease diagnosis, genetic data are infrequently used for routine preventive or therapeutic medical plans. Consumers typically connect with personal genomic data in isolation and there is poor or absent interoperability between our electronic health records and our genomics. Reviewing a patient's physiological and medical data in electronic and paper records with limited face-to-face time at each clinic visit can be daunting. The integration of genomic data adds a new level of complexity. To overcome these barriers and bring genomic insights into the process of shared decision making with physicians, new digital tools will take centre stage.

Advances in sequencing technologies and analysis platforms have led to a boom in genomic knowledge and helped identify DNA variants associated with susceptibility to common diseases such as atherosclerotic heart disease, diabetes, and cancer. Most disease associated common DNA variants can be assessed with genotyping. True, our understanding of all the genetic factors that influence common diseases is incomplete. Although not yet in broad clinical use, genetic risk scores (GRS) have been published for many common conditions and the cumulative data from GRS publications have positioned their potential use for assessing individual susceptibility before disease strikes.

A GRS is a summation of the individual genetic variants known to be associated with a specific disease but giving different weights to variants depending on the magnitude of their disease associations. As such, GRS provide complementary information beyond traditional clinical risk factors for various medical conditions. Many of the decisions patients make for taking certain medications, undergoing procedures, or even eating certain foods are borne out of evidence based on clinical variables alone and not granular, individual-level data. For example, in coronary artery disease (CAD), cigarette smoking status, blood pressure, glucose control, and cholesterol are used for risk determination and subsequently targets for optimisation. Indeed, these clinical risk factors have been built into commonly used calculators to tailor prevention strategies such as initiating statins, but uncertainty due to overestimation of risk is a concern. CAD GRS are a useful tool for addressing this uncertainty, by identifying those individuals most likely to benefit from statin initiation. Smartphone apps and web-based tools have the potential to bring in this added genetic risk information for a given disease and offer a new level of prediction to be used in concert with traditional risk calculators. In the future, using smartphones, both patients and physicians will have access to GRS information for multiple diseases in real time for use in clinical decision making.

The estimation of disease-specific GRS is only the first step. Our genes work in concert with our environmental exposures (both external and internal) to determine specific outcomes. We are still at an early stage of integrating each individual's multilayered data, which could include clinical and genomic data, environmental exposures, one's microbiome and immunome, and behavioural and social data. All these components are dynamic, complex, and interactive, engendering the need for deep learning AI to help provide personalised insights for each individual. It will take time before such data are meaningfully processed, but research on GRS use is already providing valuable information. Our group is conducting research into a heart-disease-related GRS with an app available at no cost for anyone who has had genotyping to help understand its impact.

One of the most tangible strengths of a GRS is that it can be calculated at the beginning of life and in the absence of traditional disease risk factors—many of which only become apparent in mid-life and beyond—to inform a lifetime risk of disease. Optimal disease prevention doesn't begin in mid-life. The digitisation of genetic risk will ultimately bring individualised disease prevention into play.

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For more on **Digital medicine** see **Comment** *Lancet* 2016; **388:** 740 and **Perspectives** *Lancet* 2018; **391:** 1013

For more on **Scripps heart-disease-related GRS research** see https://mygenerank.scripps.edu

Further reading

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