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Implementing genomics in a precision medicine practice

Stephen L Harlin
The Harlin Center for Genomic Medicine, USA

A tremendous opportunity exists for implementing genomics into clinical practice. However, there is little research on genomics-based practice protocols or clinical decision support systems (CDSS's) that incorporate genomic information technologies at the point-of-care. We developed a CDSS whose user interface combines raw DNA sequence variant data and gut microbial biomarkers to enable a high level, holistic interpretation of the holobiome. Our goal was to individualize therapeutic and preventive interventions, based on insights gleaned from two 'omics' data sources and advanced laboratory biomarkers for oxidative stress and inflammation. While several studies have shown that polygenic risk analysis accurately predicts the individual risk of developing a chronic disease, our model attempts to extend risk stratification to identify molecularly defined subsets of individuals. Specifically, our CDSS clusters polymorphisms in multiple genetic loci that contribute to the pathogenesis of many diseases: glucose and lipid dysregulation, endothelial dysfunction, mitochondrial stress, deficiencies in DNA repair capacity, circadian disruption, maladaptive emotion regulation and a dysbiotic gut microbiome. We believe that intelligent decision support tools are crucial to the integration of heterogeneous inputs from 'omics' technologies and evidence-based clinical regimens. Towards that end, we have designed an application that allows for easy, reliable and rapid assessment of genotype-phenotype relationships. The output is relevant and intelligible to both physicians and patients. In short, our vision of a genomic CDSS fully embraces the concept of the clinical holobiome. Finally, we present a descriptive case study of a 58-year old woman with a history of thrice recurrent bladder cancer. The presentation demonstrates how genetic loci, likely representing disease mechanistic pathways, can be paired with microbiota datasets and interpreted in the context of other known risk factors. This comprehensive approach provides new prospects for disease management and prevention.

Biography

Stephen L Harlin, during medical school, was selected for the Honors Research Program (Mayo Clinic) and inducted into the Alpha Omega Alpha Honor Society. She spent most of her career as a board-certified reconstructive plastic surgeon, continually involved in clinical research, teaching and electronic record development. She received the National Committee for Quality Assurance's (NCQA) highest recognition for development and integration of a workflow enabled electronic health record. In 2016, she became the first U.S. physician fully certified by the Benson-Henry Institute (BHI) at Massachusetts General Hospital (MGH) to implement BHI's intensive lifestyle intervention program. She actively contributes to BHI's research on the gut-brain axis. She is also an associate professor in Natural Sciences at New College of Florida (NCF). Moreover, for the past three years, she have practiced precision medicine while simultaneously developing clinical decision support software that integrates DNA sequence data and guts microbial community profiling.

sharlin@ncf.edu

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