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EDITORIAL

Special Issue on Health Behavior in the Information Age

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We are pleased to present this special issue on Health Behavior in the Information Age. Health behavior is a primary contributor to health outcomes at all levels (i.e., primary, secondary, tertiary, quaternary) of care. It has been estimated that 40% of the determinants of health are due to our behaviors, with the remaining determinants being related to genetics (30%), social circumstances (15%), environmental exposures (5%), and access to quality medical care (10%) [1]. As such, better understanding of health behaviors and methods for measuring and/or influencing them hold great potential for enhancing human health and well-being.

As health behavior largely takes place outside of healthcare settings, relatively few health behaviors are accurately or comprehensively assessed by standard, clinician-administered assessments or captured in electronic health records. For this reason, the published literature in the field of healthcare informatics primarily addresses topics that contribute to improving systems and methods for supporting clinical discovery and the delivery of care in healthcare settings, rather than supporting behavior change in settings or contexts where the behavior takes place. Moreover, if we want to shift the emphasis of our healthcare expenditures from "sick care" to "healthcare", there is a need for, and a desire from, patients to engage more in their own health and wellness. Therefore, it is imperative that advances in health informatics technologies place sufficient emphasis on patients as end-users, without inadvertently widening health disparities [2].

Although health behavior researchers have long been studying behaviors in non-clinical settings, they have, until recently, been limited by primarily analog forms of data collection. Computers initially made it easier for them to process the data they collected, and with the continued miniaturization and pervasiveness of computers, the actual collection of data has changed dramatically. Smartphones, wearable

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physiological and behavioral sensors, geotracking, etc. generate novel and potentially important data relevant to the enactment of behaviors in everyday life. More generally, as the world has become more instrumented and interconnected, the potential to implement systems and processes for collecting high-quality data about health behavior has arrived. This optimism, however, is also tempered by the recognition that until the nascent community of computer scientists and health behavioral scientists agree on what constitutes "high-quality" data and the appropriate methods to utilize it, truly impactful research may be challenging to achieve. In other words, it is imperative that insights generated through passive sensing and machine-learning are ultimately interpretable and meaningful from a behavioral and clinical perspective.

Nevertheless, there are exciting new opportunities that arise from the growing availability of data and computing power in this information age. For example, we observe that there is not only new data to be analyzed, but new ways to analyze the data we have always had. For this special issue, we have selected four papers that present excellent examples of the research and research opportunities in each of these high priority and important areas. Each of these papers, which we briefly summarize below, not only provides important insights into a specific topical domain but also raises issues—and, often, presents some preliminary solutions—that we hope inform and inspire the field more broadly.

New Data to Be Analyzed From a public health perspective, Kirchner et al. use data collected from GPS tracking devices to re-assess what we know about the relationship between the density of retail tobacco outlets in a neighborhood and the actual exposure of its residents to retail tobacco outlets. Our built environments play a role in influencing health behavior, and this research allows us to analyze the interaction between individuals and their environment at a level of detail that was not possible before on a large scale.

New Ways to Analyze Existing Data Motivational interviewing (MI) has been a longstanding and empirically supported approach for counseling individuals on behavior change. Hasan et al. borrow an approach that has been popularly used in speech recognition and bioinformatics (genetic) research and apply it to sequences of communications between a counselor and patients who are trying to lose weight. As the effectiveness of specific MI techniques can vary by patient context, this paper presents an attempt at devising an automated method for determining effective techniques for a given context; in doing so, this approach may facilitate MI counselors to discover and adopt more effective approaches across different contexts. Conceivably, such work may also pave the way for certain types of virtual counseling, which could be accessible to patients outside of a clinical setting.

Empowering Patients for Self-Care Due to the high rate of hospital re-admissions within 30 days of discharge, and the associated health and financial costs associated with re-admissions, the proper transition of care of patients from the hospital to home or community setting has received much attention within the past decade. One aspect of improving the quality of a patient's transition out of the hospital is by enhancing the education that patients receive upon discharge, which can inform and positively influence their behavior at home. Acharya et al. tackle the challenge

of generating personalized, patient-friendly care summaries at scale in an automated fashion for discharged patients. Notably, they consider both objective and subjective measures of an effective summary, the latter of which are often unchartered territory for more technically inclined researchers. In our opinion, greater attention to this topic, and the use of patient reported measures of communication effectiveness, would be a welcome trend.

Empowering Patients for Self-Experimentation Many individuals suffer from chronic conditions whose symptoms are difficult to manage (e.g., irritable bowel syndrome, chronic fatigue syndrome); these difficulties exist, in part, because symptoms depend on many different factors, and both symptoms and the influence of external factors vary widely from person to person (and, perhaps, within persons over time). Keeping detailed health diaries is not a new phenomenon (e.g., self-monitoring), although the information age has made the logging and analysis of relevant events more convenient, accessible, and more popular. Schroeder et al. discuss the value of using a Bayesian statistical approach to analyzing data that can be collected by individuals, about themselves, to help patients systematically explore hypotheses about how their behavior drives their symptoms. Ultimately, such approaches may help patients become more informed and better able to ideographically self-manage their illness.

We note that each of the papers in this issue involves co-authors from both the clinical and informatics disciplines, underscoring the value and potential utility of considering multiple perspectives when addressing challenges in health behavior. Although we well recognize the challenges of such interdisciplinary collaborations, we posit that unique insights and approaches can emerge from such work (such as that presented within the special issue). In this special issue, it was not possible to include all of the exciting new directions that are being explored. We encourage readers to consider the rich set of research opportunities available for addressing these, and related, important and interesting research questions at the intersection of technology, data science, and clinical health behavior change.

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