Presenter: Ryan Jeffery Shaw, PhD, RN

Title:
SPECIAL SESSION: Mobile Health Technologies and Precision Health

Type:
Oral

Keywords:
Data Science, Mobile Health and Sensing Technologies

Description/Overview:
Come see a demonstration on how emerging mobile health and sensing technologies are being used as tools for precision health. Participants will learn how data science is used to analyze real-time data in ongoing clinical trials, and hear about futuristic technologies on the horizon.

Final Number:
G 06
Slot:
G 06: Friday, 28 July 2017: 4:00 PM-4:30 PM

References:

1. Shaw, R. J., Bonnet, J. P., Modarai, F., George, A., & Shahsahebi, M. (2015). Mobile Health Technology for Personalized Primary Care Medicine. *The American journal of medicine*, *128*(6), 555-557.
2. World Bank. Information, Communication Technologies, & infoDev (Program). (2012). *Information and Communications for Development 2012: Maximizing Mobile*. World Bank Publications.
3. PricewaterhouseCoopers, E. I. U. (2012, June). Emerging mHealth: paths for growth. New York, NY: PwC.
4. Shaw, R. J., Steinberg, D. M., Bonnet, J., Modarai, F., George, A., Cunningham, T., ... & Bosworth, H. B. (2016). Mobile health devices: will patients actually use them?. *Journal of the American Medical Informatics Association*, ocv186.
5. Shaw, R. J., Pollak, K., Zullig, L. L., Bennett, G., Hawkins, K., & Lipkus, I. (2016). Feasibility and Smokers' Evaluation of Self-Generated Text Messages to Promote Quitting. *Nicotine & Tobacco Research*, *18*(5), 1206-1209.
6. Shaw, R. J., Bosworth, H. B., Silva, S. S., Lipkus, I. M., Davis, L. L., Ronald, S. S., & Johnson, C. M. (2013). Mobile health messages help sustain recent weight loss. *The American journal of medicine*, *126*(11), 1002-1009.
7. Shaw, R. J., McDuffie, J. R., Hendrix, C. C., Edie, A., Lindsey-Davis, L., & Williams Jr, J. W. (2013). Effects of nurse-managed protocols in the outpatient management of adults with chronic conditions.

Abstract:

Current care delivery models often revolve around a series of episodes, rather than functioning as a continuum. These single data points are collected where patients spend little lift time, and are compared with the patient's history and analyzed to make presumptive diagnoses and care recommendations. This neglects significant amounts of potentially meaningful data from patients' daily lives and results in less-informed treatment and scheduling of follow-up visits. This prevents clinicians from delivering precision healthcare that can predict changes in health status in real-time and prevent future illness before it occurs (1).

Advances in information technology are enabling the development and delivery of affordable health interventions beyond the traditional office visit and across populations. Over one billion users have mobile broadband and connect with mobile application marketplaces, and an estimated 75% of the world population has access to mobile communications (2)(3). Healthcare providers have an opportunity to use these interactive capabilities to connect with patients and enable personalized health interventions in real-time. By using technologies from cell phones to wearable sensors, providers can monitor patients and families outside of the traditional office visit and across inpatient and outpatient settings. The ability to objectively see a patient's biological, behavioral, environmental, and social environment in real-time can allow for high level of analytics such as predictive modeling to occur. This continuous stream of data has the potential to yield new insight into disease processes and can enhance our understanding of the longitudinal effect of care delivery, medications, and health behaviors – known as precision health.

Creating the ability to obtain continuous streams of data and to intervene in near real-time with patients and populations requires new software tools to developed, data science techniques that can analyze multiple streams of data, integration into electronic health record systems, and new of models of care delivery. Across several clinical research trials, our team developed a web-based software platform that assembles data from patients and their devices into a single aggregate secure database. This aggregation of data allows for real-time data analysis and in an automated feedback loop sends a response to patients, their social network, and to clinicians. This response can take a variety of forms including but not limited to the following: text and voice messaging feedback; physical prompts using wearables or sensors in a patient's environment; alerts to a smartphone or an electronic health record; and visualization of data to clinicians and patients that allow for a longitudinal view of data and predictive factors.

We demonstrate how this system is used to intervene with patients to self-manage diabetes, manage weight loss, promote smoking cessation, and monitor patients in a variety ways as a follow-up tool (4)(5)(6). We describe how these tools and their data can be integrated into health systems in a resourceful way. The aggregation of data in software and then analysis allow for the majority of feedback to patients and the health system. This automated system is resourceful and help patients manage during their everyday lives with limited need for clinician intervention and resources. The first level of intervention involves the software guiding patients to collect correct data and within specific parameters to take health-related actions. A second level of intervention occurs when the software alerts the health system to trends and changes in patients' conditions. Similar to a model in an inpatient telemetry floor, a technician intervenes as needed as the first step. If further clinical intervention is needed then a registered nurse is alerted to intervene (7). As care needs escalate, other providers are involved to adjust medications, change treatment, and to recommend in-person follow-up.

Challenges with integrating such a system into care delivery are not without its challenges. These include data quality, technical issues, data science challenges, integration into electronic health records, privacy, security, and regulations, among others. Finally, we discuss future directions and the next generation of mobile health tools for precision health. These tools include point-of-care diagnostics, environmental sensors, biomechanics, wearable tattoos, ingestibles, implantables, and the merging of genomics with mobile health.

As mobile technologies and access to the Internet become universal, healthcare systems will leverage capabilities that allow the transfer of data on a daily and hourly basis, analysis of this data, and near real-time intervention. More important, this will reflect the unique environment patients reside in,

taking into account the different exposures, stressors, and influences on their disease state (1) – known as precision health.

Learning Activity:

	LEARNING OBJECTIVES	EXPANDED CONTENT OUTLINE
	Audience members will learn about data science techniques that are being used to analyze real-time data from mobile technologies	A demonstration on software that is used to analyze and visualize time-intensive longitudinal health data from clinical trials will be given
	Audience members will learn about the development of software and how it is used to obtain and aggregate streams of continuous health data	A discussion on how streams of real-time health data from wearable sensors and sensors embedded in the environment are used in research and how these data will be applied in future healthcare delivery models will be given