Committee on Science, Space, and Technology, Subcommittee on Research and Technology,
US House of Representatives Hearing on:
"Smart Health: Empowering the Future of Mobile Apps"

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Subcommittee Chairwoman Comstock and members, thank you for reviewing this important topic in the new era of using personal technology to support health care. I am a professor of neurology at Johns Hopkins Medical Center and the co-inventor of EpiWatch with Dr. Nathan Crone, the first research app to use the Apple Watch. I would like to describe our app to make several points about issues in supporting innovation and safety in medical applications for mobile devices:

EpiWatch is a medical research app that collects physiological data from sensors on the Apple Watch during seizures from participants with epilepsy. This data is being used in research to create a seizure detector which will use changes in movements, heart rate and alertness to detect seizures and alert caregivers when their family members have seizures.

The app has several novel features:

> **a)** Participants enroll for the research using a novel electronic consenting process in which they review the aims of the research and required activities, and receive study screening and testing for comprehension of the research, all on their iPhones. Those agreeing to participate can sign the consent on their phones and receive a signed pdf consent form via email;
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> **b)** Participants' data is anonymized—physiologic data collected with Apple Watch sensors, health information from questionnaires, participants' seizure and pill taking logs—are sent to JHU in encrypted form and stored securely with registration information kept separate from research data;
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> **c)** The EpiWatch research uses a novel data management program integrated with the Apple Watch and iPhone operating systems called ResearchKit. ResearchKit supports electronic consenting and encrypted data transfer from mobile devices for research. Apple has no access to the participant registration or research data. ResearchKit requires research app software to be open-access and non-commercial.

The EpiWatch app is designed to collect participants' physiologic changes and responsiveness during seizures in order to collect research data for development of a seizure detector that alerts caregivers when patients might need help. EpiWatch also provides tools that patients with epilepsy can use to keep track of and manage their condition; however, it does not provide direct medical care. Participants submit information about their seizures and treatment and receive brief daily surveys asking if they have had seizures and have taken all their medications. Seizure tracking and survey data are logged in journals that are displayed graphically to participants as feedback on their seizure control and treatment adherence. Other support activities being implemented will screen for problems often associated with epilepsy, including depression and anxiety, drug side effects and quality of life. These activities are designed to

provide helpful feedback on each participant's condition and support additional research in epilepsy. Participants may also choose to share this information with their physician to help manage their epilepsy.

Advantages of research performed on mobile devices:

a) A large anonymized national study can be conducted rapidly that enrolls participants of all ages and demographics;

b) Research data collected on mobile devices can be quickly accumulated to permit rapid development of medical apps which can help patients and potentially save lives.

For example, 1 in 500 persons with epilepsy die each year with sudden unexpected death with epilepsy (SUDEP); we plan to implement risk screening in the EpiWatch app for SUDEP. Our research priority is to collect data for development of a seizure detector that accurately detects the most serious seizure type associated with SUDEP—tonic-clonic convulsions in sleep. The detector could alert caregivers to allow them to aid patients during these serious seizures by repositioning and stimulating them to reverse respiratory dysfunction. We hope the research data collected with EpiWatch will support development of a future version of the EpiWatch app that does not depend on ResearchKit and can be migrated to other devices.

Potential data confidentiality and safety issues with medical app development:

EpiWatch research was implemented with careful review by JHU data safety engineers, a research data safety committee and computer scientists at a medical research server support company. It is important that participant confidentiality be maintained while performing this type of minimal risk research and to prevent data confidentiality breaches. It is also important to the public that medical apps be effective and safe before being used to support patients and that false promises about medical apps not be made. A seizure detector that does not reliably detect seizures might, for example, provide false reassurance to patients and caregivers. Disclosures and cautions about the limitations of medical apps are important in providing medical app support in managing serious medical conditions.

Recommendations on regulation of medical apps: The Supreme Court recently narrowed the patentability of mobile apps, ruling in *Alice Corp. v. CLS Bank Int'l*, that the patent protection for mobile apps is not extended to abstract ideas or simple software representations of existing techniques. This seems appropriate: patents for medical apps should require an innovative application of a new technology representing ingenuity and invention. JHU submitted a provisional patent for EpiWatch based on its novel approach to seizure detection and alerting.

The FDA recently (February 2015) issued a preliminary guidance for regulation of mobile medical applications (http://www.fda.gov/downloads/MedicalDevices/.../UCM263366.pdf). In these nonbinding recommendations, non-significant medical apps are defined as applications that help patients monitor medical conditions, but do not provide medical interventions; non-significant medical apps do not currently require FDA review. Significant medical apps involving medical interventions may require FDA review of the safety and effectiveness of the medical application. The continued development of sophisticated medical apps, however, will require policy development and elaboration of the FDA guidance. Our EpiWatch research app, for example, does not provide medical interventions such as triggering administration of a drug during a prolonged seizure. It is unclear, however, whether seizure detection and alerting falls

into the definition of being a significant medical device when not implemented as part of research. Because of this uncertainty, for example, we did not implement alerting 911 with GPS location during prolonged seizures. This is a potentially lifesaving step, but we did not want to test the FDA guideline during a period of app research and development. Instead, participants are allowed to send a text message to a caregiver whenever the participant begins tracking one of their seizures. This is not as useful because it limits alerting to evolving seizures in which the participant is initially alert. Regulatory review is important to protect the public from unsafe devices, but it also needs to encourage medical app innovations. Regulatory review is also needed to help adjudicate liability associated with use of medical apps.

Medical apps for mobile devices are likely to be segregated into large and small tiers: 1) non-significant medical apps not requiring FDA review will be relatively inexpensive to develop and will probably compete in a broad marketplace based on user reviews and demonstration studies; 2) medically significant medical apps offering sophisticated functions will require much more expensive and time consuming testing and regulatory review. Hopefully, these test and review requirements will not limit medical app development to the major medical device field, as this could slow innovation and narrow the range of disorders supported by medical apps. These issues, such as how to fund significant medical apps for less common diseases, would be helped by direct NIH support of medical app development in each division. It would also be important to determine in which instances insurance could be billed in order to support the development and regulatory costs for significant medical apps.

Thank you for allowing me to testify on the exiting new medical field,

Regards,

Gregory Krauss, MD

The opinions expressed herein are my own and do not necessarily reflect the views of The Johns Hopkins University (or The Johns Hopkins Health System), as applicable