News from the NIH: using mobile and wireless technologies to improve health

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Mobile and wireless health (mHealth) technologies have developed at an exponential pace in recent years; however, the integration and translation of these cutting-edge technologies into rigorously evaluated health research and healthcare tools have lagged behind. Low-cost, real-time devices to assess disease processes, movement, images, behavior, social interactions, environmental toxins, hormones, and other physiological variables have made remarkable advances in the last decade because of increased computational sophistication and reductions in size and power requirements [1]. The engineering and computer science knowledge exists to develop technologies that will alter the collection of health-related data for basic and translational research, clinical practice, healthcare delivery, and public health in ways that were not imaginable a decade ago, but these applications must be subjected to the same rigorous biomedical and behavioral research standards to prevent ineffective or potential harmful applications from being used Unfortunately, the slow pace of our traditional research methods often fail to keep pace with the technology, resulting in publications of rigorous evaluations of potentially outdated technologies [2]. The gap between the mHealth product world and the health research community also represents a missed opportunity for scientists to include mHealth tools to strengthen and support their research efforts.

> **Implications**
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> **Research**: Provide information about relevant NIH activities.
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> **Practice**: Provide information about NIH activities in mHealth that can inform practice.
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> **Policy**: Provide information about NIH research, trainings and conferences that impact policy.

These efforts resulted in a new funding announcement, Smart and Connected Health, NSF-13-543, between NIH and the National Science Foundation (NSF). The purpose of this interagency program is to develop the next of generation health research, including mHealth research, through advances in the understanding of information science, technology, behavior, cognition, sensors, robotics, bioimaging, and engineering. Collaboration to establish better linkages among fundamental science, clinical practice and technology development, and deployment is encouraged. This announcement comes from the realization that a disruptive transformation in health will require well-coordinated, multidisciplinary approaches that draw from the social, behavioral, and economic sciences, engineering, medicine, biology, and computer and information sciences.

TRANS-NIH ACTIVITIES

To facilitate meeting these challenges, a number of National Institutes of Health (NIH) groups have been established to coordinate the activities of NIH in mobile and wireless health. The Wireless Medical Technologies Working Group is a trans-agency effort lead by the National Institute of Biomedical Imaging and Bioengineering (NIBIB) to learn about and coordinate the various activities of the range of federal agencies involved in mHealth. The NIH mHealth Inter-Institute Interest Group is a trans-NIH group established to educate NIH staff on mHealth advances in both the public and private sector, to coordinate trans-NIH activities, and to support NIH's interests in the planning of the annual mHealth Summit.

NIH SPECIFIC INSTITUTE ACTIVITIES

In addition to these trans-NIH and interagency working groups and activities, various NIH institutes are developing initiatives and restructuring their organizations to address the research challenges in the mobile health space. For example, the Division of Cancer Control and Population Sciences at the National Cancer Institute (NCI) recently created the Science of Research and Technology Branch. Among its mission and priorities is the development and application of innovative technologies and analytic tools to advance social and behavioral science in the context of cancer prevention and control (http://cancercontrol.cancer.gov/BRP/srtb/about.html). One of the initial efforts of this branch is support, with Office of Behavioral and Social Sciences Research, of

an upcoming special issue of Nicotine and Tobacco Research on New Methods for Advancing Research on Tobacco Dependence using Ecological Momentary Assessments (guest editors–Stephanie Lanza, Megan Piper, and Saul Shiffman) that will address analysis of intensive longitudinal data collected through mobile devices. A related branch at NCI, the Health Communications and Informatics branch, has supported a number of technology-related health behavior initiatives including the Centers of Excellence in Cancer Communication Research and the Small Business Innovation Research announcement focused on Innovative Health Information Technology for Broad Adoption by Healthcare Systems and Consumers initiative (http://grants.nih.gov/grants/guide/pa-files/PA-12-196.html). NCI's Health Information National Trends Survey (HINTS) has assessed access to health information via mobile devices (HINTS 3) and future cycles of HINTS 4 will include additional assessments of mobile and wireless health communication uses and attitudes, including security and privacy concerns (http://hints.cancer.gov/). NIBIB has recently added the Division of Health Information Technology to integrate research in areas of mHealth, informatics, clinical decision support science, and point-of-care diagnostics and therapeutics.

Conferences

Since its inception in 2009, the NIH has been an organizing partner of the mHealth Summit. The Summit, a collaboration between the public and private sectors to advance mobile and wireless health, has grown from approximately 800–4,500 attendees in its 4 years of existence. As an organizing partner, the NIH has been responsible for the research track and related research-oriented presentations to promote mHealth research among the diverse Summit participants and to expose researchers to the private sector technological innovations that can be leveraged for mobile health research. The cross-fertilization of public sector research and private sector technology and commercialization remains an important goal in NIH's continued participation in the mHealth Summit (www.mhealthsummit.org).

Training

Developing science in mHealth also requires building the research capacity. The NIH, in collaboration with the technology industry, has been involved in mHealth trainings to address the capacity of the research field to accommodate the demands of these new technologies. Ideally, research in mHealth should draw from medical and clinical expertise, behavioral and social sciences research (which will provide the science to guide intervention development and behavior change), user interface design, sensing technology, computer science and statistical inference, all of which will help realize mHealth technology's potential to improve health outcomes. To address these issues, the NIH has conducted training institutes in mHealth for the last 2 years (http://obssr.od.nih.gov/training_and_education/mhealth/index.aspx). The institutes bring together leaders in mobile technology and behavioral sciences to provide cross-training to early career investigators with interest in mHealth. Core faculty included experts from behavioral and social sciences, medicine, engineering and computer science, as well as program staff from NSF, the Food and Drug Administration, and NIH. The highly competitive application process yielded participants with diverse expertise. The training curriculum covered the current state of the science in mobile technology and engineering, behavior change theory and clinical applications, and highlighted the intersection among these areas for research related to health. The participants' immersive experience in the basic and applied science of mHealth allowed them to improve their own mHealth design and research, while building research capacity as a whole in this important new field to improve health. These trainings should begin to address the capacity issues which have been identified by the field and add to the growing body of quality mHealth researchers. Researchers interested in the trainings should consider joining the NIH mHealth listserv to get up to date information on available offerings (http://obssr.od.nih.gov/scientific_areas/methodology/mhealth/index.aspx).

CONCLUSION

This column highlights recent efforts at the NIH to enhance mHealth technology research. Reviews of the field highlight the growing need for high quality mobile health research both domestically and abroad. The field is growing at an unprecedented rate, with the technology often outpacing the research. For mHealth to be effective and sustainable, it requires a solid, interdisciplinary scientific approach that pairs the need for the rapid change associated with technological progress with a rigorous evaluation approach that informs rapid iterations of the programs. For mHealth to achieve its potential to improve health research, healthcare, and the overall health of the population, incorporation and advancement of research methods into these programs is essential.