New Frontiers of Digital Health Research

UNC-HSL Digital Health Symposium
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RTI International is an independent, nonprofit research institute dedicated to improving the human condition. We combine scientific rigor and technical expertise in social and laboratory sciences, engineering, and international development to deliver solutions to the critical needs of clients worldwide.
427 devices are available from 266 different vendors.

217 registered clinical trials are using Fitbit devices for data collection.

Over 500 papers have been published on Fitbit devices since 2012.
Wearable devices are fundamentally changing primary data collection, enabling low-cost, distributed, passive, longitudinal monitoring of human performance, health behaviors, and other indicators.
### Wearable Device Data Elements

<table>
<thead>
<tr>
<th><strong>Self-report</strong></th>
<th><strong>Basic Dataset</strong></th>
<th><strong>Expanded Dataset</strong></th>
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<tbody>
<tr>
<td>- Height</td>
<td>- Steps</td>
<td>- Heart rate</td>
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<tr>
<td>- Weight</td>
<td>- Distance traveled</td>
<td>- Fitness score</td>
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<tr>
<td>- Age</td>
<td>- Floors climbed</td>
<td>- Workout routes and pace</td>
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<tr>
<td>- Gender</td>
<td>- Calories burned</td>
<td>- NN interval</td>
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<td></td>
<td>- Active minutes</td>
<td>- RR interval</td>
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<td>- Sedentary minutes</td>
<td>- Respiratory rate</td>
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<td></td>
<td>- Specific exercises / activities</td>
<td>- Tidal volume</td>
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<tr>
<td></td>
<td>- Sleep time</td>
<td>- Minute ventilation</td>
</tr>
<tr>
<td></td>
<td>- Sleep quality</td>
<td>- Abdominal / thoracic respirations</td>
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Integrating Signals and Human Response

Consumer wearable devices

Systematic review; app reviews; open access datasets

Remote access and consumer wearable data extraction

Smartphone-based spatial data collection and analysis

Research-grade devices

Ecological momentary assessment (EMA) via ResearchKit

Psychophysiological signal acquisition and analysis

High-fidelity, nonlaboratory sleep assessment
Selected Publications on Wearables

- Systematic Review on Validity and Reliability (2015)
- Fitbit Activity Index versus CDC BRFSS (2017)
- Establishing Linkages Between Survey and Sensor Data (2017)
Collaborative Healthcare Using Patient-Generated Data

Standardizing and Evaluating Consumer Wearable Device Measurement

by RTI International & the University of North Carolina at Chapel Hill
Aim 1: Determine rates of smartphone and consumer wearable device adoption within the Add Health cohort.

Aim 2: Invite cohort members identified in Aim 1 to make a one-time donation of historical data collected using personally owned wearable devices.

Aim 3: Prepare a harmonized dataset

Aim 4: Conduct preliminary analysis of wearables data, including device types, duration and consistency of tracking, and physical activity outcomes.
The Healthy Behavior Data Challenge explores the potential of innovative data sources and alternative methodologies for public health surveillance.

Our approach emphasizes how consumer wearable data can be used to augment BRFSS measures with a focus on physical activity, sedentary behaviors, and sleep.

RTI was a Phase I winner and submitted a Phase II dataset to CDC on January 31, 2018.
Law enforcement officers experience a wide-variety of stresses. Using research-grade wearable biometric sensors to explore stress responses in high resolution as a result of daily policing activities.
UAV Follow Me + physio tracking (E4) + 5G + GPS + thermal / IR imaging
delivering the promise of science
for global good

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