Mobile Technologies

RTI International develops pioneering mobile computing applications for field surveys, personal health interventions, education assessments, teaching and learning, disease surveillance, and other needs. Our mobile apps support a wide range of tablets, smartphones, and other mobile devices, and run on a variety of mobile operating systems.

Survey Data Collection

RTI Mobile Field Surveys (RTI Mobile FS). Powered by a robust open source survey engine at its core, RTI Mobile FS is one of RTI’s most heavily used mobile technologies. The platform combines traditional survey capabilities, like complex instrumentation, audio computer-assisted self-interviewing (ACASI), and computer audio-recorded interviewing (CARI), with pragmatic implementations of mobile technology to enhance data quality. RTI Mobile FS is firmly integrated with RTI’s case management and data quality infrastructure, giving projects access to management tools that enhance data quality and streamline staff efficiencies. Currently, RTI Mobile FS is in large-scale production domestically and internationally.

RTI Mobile FS features include the following:

- Passive GPS capture during survey administration
- CARI
- ACASI
- Geotagged photo capture
- Deep integration with survey data quality infrastructure
- Geofenced sampled dwelling units
- Range and validity checking
- Enumeration
- Support for multiple languages and complex Unicode fonts (Vietnamese, Arabic, Mandarin)
- Complex data capture logic and sequences
- Sample selection in real time
- Case management and status recording
- Data file and input statements for use in statistical software.

An interviewer in Malaysia uses Mobile FS to collect information for the Global Adult Tobacco Survey.
Health Monitoring and Intervention

Personal Health Intervention Tool. RTI’s Personal Health Intervention Tool (PHIT) combines several layers of technology to create a powerful tool for health assessments and interventions. PHIT is both an innovative research tool—effectively a personal health pocket laboratory—and a health aid. It collects self-reported data through survey-style assessments or personal diaries. It can capture physiologic data from a user through networked wireless sensors to track measurements such as heart rate or sleep disturbances. PHIT also can analyze this data through a powerful logic engine to identify potential problems. Finally, using a variety of media, it delivers educational content, reminders, and self-help interventions when indicated.

PHIT is currently used in studies to prevent post-traumatic stress disorder (PTSD) and other problems among military personnel. Potential applications include collecting data on environmental exposures, increasing compliance and promoting safety in clinical trials for drugs or medical devices, and assisting with detection and treatment of a range of chronic diseases.

PHIT features include the following:

- Tools for survey, diary, and other self-reported data
- Library of standardized health and psychometric assessments
- Library of self-help interventions, for issues such as stress, sleep problems, and alcohol use
- Bluetooth networking for streaming data from sensors (e.g., pulse monitor for heart rate and actigraphy monitor for activity level or sleep quality)
- Data incorporation from geolocation, acceleration, compass, and camera
- Logic engine to suggest and schedule interventions based on collected data
- Self-help methodologies ranging from didactic text to video to interactive gaming.

ARTEMIS. Short Message Service (SMS) technology can play a useful role in both data collection and delivery of content to mobile phone users. ARTEMIS employs SMS as a web service built for researchers investigating the use of text messaging to support health behavior change, including risk reduction, disease prevention, and chronic disease management. RTI specialists support intervention design and implementation across a range of areas—from message development through analysis of data gathered from participants via SMS.

ARTEMIS is a network service built on top of the Adobe ColdFusion application server and Microsoft SQL Server database engine.

The platform’s core components include the following:

- Responsive, user-friendly dashboard
- Messaging communications module, which sends messages via SMS gateway directly to all major mobile carriers
- Message campaign manager, which allows running multiple simultaneous interventions
- Scheduling and logging features for customization and reporting
- Support for multiple research profiles that enable messaging to be tailored for individual subjects.
- Pin-protected messaging
- Varying levels of security, including operations within RTI’s Enhanced Security Network (certified as FIPS-Moderate)
- HIPAA compliance.

The Health Resources and Services Administration (HRSA) uses ARTEMIS in the UCARE4Life Message Library, which is designed to improve retention in care and HIV medication adherence among youth with HIV infection. The National Institute on Drug Abuse sponsors a study, Improving Adherence to Smoking Cessation Medication among People Living with HIV/AIDS, which implements ARTEMIS to send text messages to improve compliance with medication regimens.

With PHIT’s biofeedback training module, users can learn mindfulness-based stress reduction. This acceptance-oriented technique emphasizes attention to the present moment. There is evidence it can help users reduce stress and depression and cope with pain.
Mobile Apps for Low-Resource Settings

**Coconut.** The versatile Coconut open-source software platform can be used to create data collection and data management applications for mobile devices and desktop and laptop computers. Engineered to meet the challenge of intermittent Internet access, it stores data locally. When a network connection is available, data are synchronized automatically with a remote database. Changes to any application also can be distributed to users seamlessly during synchronization.

Features include the following:

- Role-based security (username and password)
- Support for multiple languages
- Integrated form designer
- Real-time reporting for monitoring and managing the data collection process
- Data sharing using private servers or cloud storage
- Scalability from one mobile device to thousands.

Coconut is used as part of a malaria surveillance system in Zanzibar (see Project Highlights). In the Philippines, midwives working in rural areas use a Coconut app to manage patient data and synchronize data with a centralized electronic medical record system, bypassing paper forms.

**Tangerine.** An open-source application for mobile devices, Tangerine is designed primarily to record students’ responses in oral early grade reading and mathematics assessments. It is also used to capture interview responses from students, teachers, and principals. Tangerine shares technology with Coconut (above). Tangerine has many advanced features specific to educational assessments, including group import and upload, subtest randomization, test resuming, and custom validation for open text questions.

The software simplifies preparation and implementation of field work, eliminates costly and time-consuming manual data entry, and reduces measurement and data entry errors, while providing rapid turnaround of results. In one of several current implementations, Tangerine plays a pivotal role in an Early Grade Reading Assessment (EGRA) in the Philippines.

**Project Highlights**

**Professional Services for Pediatric Guidelines for Cardiovascular Health (National Heart, Lung, and Blood Institute, 2009–2014).** For this project, RTI tailored the PHIT platform to implement a clinical decision support tool for pediatric cardiovascular risk reduction. Physicians enter a range of patient data—including family history, medical history, height, weight, blood pressure, and other measures—on their mobile devices to evaluate pediatric cardiovascular disease risk factors. Evidence-based logic is then applied to interpret risk factor results, and the physician receives guideline-based recommendations for patient education and care.

**Global Adult Tobacco Survey (GATS) (CDC Foundation, 2007–2013).** Under the Bloomberg Initiative to Reduce Tobacco Use, the GATS project has implemented RTI’s GSS software on a global scale. The GATS GSS has been used to collect data in over 150,000 household surveys in 30 languages across 24 countries. The system allows in-country staff to design and implement country-specific questionnaires, port the software to a handheld device, aggregate all field data into a single file, and integrate data with the sample file to create an analysis file.

**PHIT for Duty: A Personal Health Intervention Tool for Psychological Health and Traumatic Brain Injury (U.S. Army, 2011–2015).** PHIT for Duty is an mHealth app that RTI is evaluating for prevention of chronic psychological health issues and PTSD. PHIT is a field-deployable, self-help device to build resilience in healthy troops and to support prevention in high-risk personnel. The PHIT for Duty platform includes a smartphone and nonintrusive physiological and behavioral sensors. PHIT for Duty apps integrate a suite of health assessments (e.g., depression, anxiety, alcohol use) with a powerful logic engine that recommends, tailors, and presents self-help interventions such as relaxation exercises.
Develop and Implement UCARE4Life Message Library (HRSA, 2012–2014). HRSA is using RTI’s ARTEMIS system to support the UCARE4LIFE program to improve retention in care and HIV medication adherence among youth. The project’s aims are to develop, test, and maintain a message library that addresses HIV self-management and to conduct and evaluate a pilot study that delivers text messages to racially and ethnically diverse youth who are HIV-positive.

BreathEasy: A Personal Health Record Application for Improving Health Status among Adults with Asthma and Depression (Robert Wood Johnson Foundation, 2009–2012). This Project HealthDesign-funded study supported the user-centered design of a native smartphone application for adults with asthma and depression, integration with a clinician web portal, pilot implementation, and evaluation. A custom SMS-adjunct intervention was developed to improve participant engagement and promote compliance with data collection.

Coconut Surveillance (USAID, 2010–2015). RTI has worked with Zanzibar’s Malaria Control Program to develop a mobile app that interfaces with the Malaria Early Epidemic Detection System (MEEDS). Coconut Surveillance extends the MEEDS system by alerting district malaria officers to new case reports and guiding them through an active case detection protocol. The tool facilitates data collection at the reporting facility and the household. Built-in GPS features precisely record the location of each household.