

# 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 the apps 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—such as complex instrumentation, audio computer-assisted self-interviewing (ACASI), and computer audio-recorded interviewing (CARI)—with pragmatic implementations of mobile technology. RTI Mobile FS is firmly integrated with RTI’s case management and data quality infrastructure, giving projects access to effective management tools. Currently, RTI Mobile FS is in large-scale production domestically and internationally.



*Interviewers in Malaysia use RTI Mobile FS to collect information for the Global Adult Tobacco Survey.*

## RTI Mobile FS Features

- Active and/or passive GPS capture during survey administration
- ACASI, CARI, and other traditional survey capabilities
- Geotagged photo capture
- Geofenced sampled dwelling units
- Deep integration with survey data quality infrastructure
- Azimuth capture (using magnetometer)
- 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.

## 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 pocket-sized health laboratory—and a health aid. Based on a given study's needs, PHIT can collect self-reported data through survey-style assessments or personal diaries; the tool can also gather physiologic data through networked wireless sensors to track measurements such as heart rate or sleep disturbances. PHIT also analyzes these data through a powerful logic engine to identify potential problems and uses a variety of media to deliver educational content, reminders, and self-help interventions when indicated.

PHIT is being used in a variety of areas including psychological health, clinical decision support, and patient education. It is also ideal for 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 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



*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.*

- Logic engine to suggest and schedule interventions based on collected data
- Self-help methodologies ranging from didactic text to video to interactive gaming.

**ARTEMIS®.** RTI created the ARTEMIS application platform to take advantage of the uniquely effective possibilities of short message service (SMS—i.e., texting) as a research tool.

Mass adoption of mobile technology has made SMS ubiquitous. Near-universal usage and immediacy make the medium an especially valuable means for interacting with participants and study staff members. SMS messages are far more likely to gain the recipient's attention than other forms of communications. Two-way communications can be used to enable quick interactive sessions with minimal intrusion.

SMS allows RTI to build applications using content delivery, data collection, and notification features. The net result can be a greater level of interaction, with innovative features enabled by new models of interaction—including chat bot interactions—and heightened convenience for staff members and participants.

RTI researchers have used ARTEMIS to investigate the efficacy of text messaging to support a wide variety of applications. Chief among these applications is health behavior change—including risk reduction, disease prevention, chronic disease management, and medication adherence. Staff communications specialists design effective interventions across a range of areas, from message development through analysis of data gathered from participants via SMS. Survey programs have deployed automated enrollment features and seen increased response rates because of SMS reminder campaigns.

ARTEMIS'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 that allows multiple interventions to run simultaneously
- Scheduling and logging features for customization and reporting
- Support for multiple research profiles that allows messaging to be tailored for individual subjects
- Messaging protected by a personal identification number (PIN)

- Data security levels, including operations within RTI's FIPS-Moderate environment
- HIPAA compliance.

### Mobile Apps for Low-Resource Settings

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

Coconut's features include the following:

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

Coconut is used for malaria case surveillance and response in Zanzibar (see Project Highlights). In Zimbabwe, mobile nurse counselors use Coconut to manage medical records.

**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), but has many advanced features specific to educational assessments, including group import and upload, subtest randomization, test resuming, and custom validation for open-text questions.



*Tangerine for Early Grade Reading Assessment is being used to collect data at 20 international sites, ranging from Haiti to the Philippines.*

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 in the Philippines.

### Data Management Tools

**ResearchNet.** RTI's ResearchNet is a cloud-enabled, flexible backend for computer assisted self-interview systems. This platform provides a secure mechanism for managing enrollment, processing consent, and collecting survey data on native iOS with Apple's ResearchKit or on native Android using ResearchStack. ResearchNet comprises three software components: a software development kit (SDK) for building applications, an SDK for iOS, and a simple dashboard for monitoring study progress.

**Data Extraction for Wearables and More.** The market for activity trackers and smartwatches is approaching \$4 billion, and there currently are more than 150 registered clinical trials using Fitbit devices to collect data. RTI has partnered with Validic, a small business based in Durham, North Carolina, to enable the extraction of patient-generated data from digital health applications, devices, and wearables. The RTI-Validic integration enables investigators to obtain data from both study-assigned and personally owned wearable devices. RTI's Participant-Generated Health Data portal supports consenting, onboarding, and authorizing access to more than 200 different connected devices, including Fitbit, Jawbone, Garmin, Misfit, Withings, a range of personal medical devices (e.g., glucometers and blood pressure monitors), and smartphone apps (e.g., Runkeeper, Moves, dailymile, and MyFitnessPal).

### Project Highlights

#### National Panel of Tobacco Consumer Studies

**(2012–2017).** To inform regulatory efforts granted under the 2009 Tobacco Control Act, the U.S. Food and Drug Administration (FDA)'s Center for Tobacco Products seeks to better understand what tobacco users know or how they feel about FDA regulatory actions. RTI Mobile FS is used to administer five instruments in a nationwide survey to explore such topics as how people react to tobacco warning statements or marketing restrictions, the type of tobacco products people use, preferred brands, where products are purchased, and how often coupons or in-store promotions are used.



*District Surveillance Malaria Officers in Zanzibar administer rapid diagnostic malaria tests and use a tablet running Coconut to record results.*

**Global Adult Tobacco Survey (GATS) (Centers for Disease Control and Prevention Foundation, 2007–present).** Under the Bloomberg Initiative to Reduce Tobacco Use, the GATS project has implemented RTI's General Social Survey (GSS) software on a global scale. The GATS GSS has been used to collect data in over 400,000 household surveys in more than 50 languages across 28 countries. The system allows in-country staff members 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 (PHIT) for Psychological Health and Traumatic Brain Injury (U.S. Army, 2011–2015).** PHIT for Duty is an mHealth app that RTI developed 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.

**Increasing Adherence to Smoking Cessation Medication to Improve Cessation Outcomes among HIV+ Patients (2012–present).** As mortality due to AIDS-related causes has decreased, the proportion of deaths due to non-AIDS defining illnesses, including cardiovascular disease and lung cancer, has been on the rise. This suggests that targeting modifiable risk factors, such as cigarette smoking, could potentially improve the long-term survival of persons living with HIV/AIDS. The purpose of this National Institute on Drug Abuse-funded R34 grant is to determine the feasibility and acceptability of a theory-driven, SMS-based smoking cessation intervention that enhances existing behavioral approaches by testing the impact of text message adherence reminders to take cessation medication.

**Coconut Surveillance (U.S. Agency for International Development, 2010–2015).** RTI worked with Zanzibar's Malaria Elimination Program to develop a mobile app that interfaces with the Malaria Early Epidemic Detection System (MEEDS). Coconut Surveillance extended the MEEDS system by alerting district malaria officers to new case reports and guiding them through a reactive 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. Program managers monitor case response in real time and use built-in analytics to help target interventions.

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#### More Information

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