Supplement

Scale-Up of the Accrual to Clinical Trials (ACT) Network across the Clinical and Translational Science Award Consortium: A Mixed-Methods Evaluation of the First 18 Months

Table of Contents

Approach to Disseminating ACT

The PCORI Dissemination and Implementation Framework and the Diffusion of Innovation Theory provided a theoretical foundation for the strategic launch of the ACT Network at CTSA hubs. For its launch, the ACT dissemination team developed and used a comprehensive dissemination approach informed by four principles.

The team's dissemination principles were to be: (1) customer-centered –you (the CTSA hub), are the expert on local needs; (2) customer-friendly – support nationally with core materials and resources, adapt locally; (3) customer-responsive – evolve over time in response to site needs and feedback; and (4) advancing the science –use data analytics and evaluation to inform on-going dissemination efforts and as well as scale-up and spread of other NCATS-supported innovation.

Organization and Governance of ACT

The following three sections describe key aspects of the ACT Network's governance and organizational structure.

ACT Network: National Team Organizational Structure

As shown in Online Supplement Figure 1, the ACT governance structure includes required reporting to the National Center for Advancing Translational Science through the ACT Principle Investigator Group (PI Group). The ACT Principle Investigator group is made up of the four principle investigators who are listed on the National Center for Advancing Translational Science grant (Steven Reis, University of Pittsburgh; Gary Firestein, UCSD; Robert Toto, UTSW; and Lee Nadler, Harvard). The ACT Executive Committee reports to the ACT Principle Investigator Group and provides oversight for the project. Reporting to the ACT Executive Committee are the following five work groups: (1) Governance; (2) Regulatory; (3) Technology; (4) Data Harmonization; and (5) Dissemination and Evaluation.

ACT Dissemination Team: Dissemination Advisory Board

The ACT Dissemination Team established a Dissemination Advisory Board. The purpose of the advisory board was to gather insights, experiences, and suggestions that would advance the dissemination of the ACT Network to clinical investigators in the CTSA consortium. Online Supplement Appendix A lists the Advisory Board members along with a description of their area of expertise.

ACT Network: CTSA Hub Roles and Responsibilities

Online Supplement Appendix B is a component of the ACT Governance Document. It outlines the roles and responsibilities of CTSA hubs. In general, in accordance with the ACT Governing Document, each CTSA hub is expected to:

- Stay current on software versioning as guided by ACT Network Operations

- Ensure integrity of data use by regularly monitoring local query activity
- Adhere to expected uptime policies and work through issues in a timely manner
- Refresh data on at least a monthly basis

Logistics of Disseminating ACT

To launch the ACT Network, the ACT Dissemination Team used methods common to launching a new product. This involved logistical activities that ranged from conceptual to managerial. The following three sections describe aspects of these logistical activities.

Conceptualizing the 'Jobs' of the ACT Network

The ACT dissemination team conceptualized how the ACT Network fit within the clinical research ecosystem in order to: (1) establish a common understanding of its purpose and value; and (2) to then strategically communicate its purpose and value. Online Supplement Figure 2 depicts the jobs to be done within the clinical research cycle and which of these jobs the ACT Network fulfills.

Managing the Launch Process

Management of the ACT Network launch process included the development and use of two different checklists. The first – the ACT Technology Checklist (Online Supplement Appendix C) – was used to ascertain that sites were ready to disseminate the ACT Network (which meant that they had completed (or were near completing) the technical implementation of it). The second checklist –the ACT Launch Toolkit Customization Checklist (Online Supplement Appendix D) – gathered information about each CTSA hub to customize the launch of ACT at their institution. For instance, it inquired about sites' preferred custom URL for their ACT landing page as well as their preferred local ACT contacts.

The ACT Dissemination Team also developed a multistep process to manage the launch of the ACT Network at each CTSA hub. Phase A sites include the first 21 sites to join ACT's live (production) network; these sites joined the production network (marking the end of the technical implementation stage) on December 31, 2017 and kicked off launch planning in early 2018. Phase B sites represent 27 sites who joined the production network on a staggered basis starting in fall 2018, with each site starting launch planning shortly before or after reaching this milestone. The multistep process was modified for Phase B sites based on continuous process improvement feedback from the CTSA hubs in Phase A.

Online Supplement Figure 3 describes the original launch processes used for "Phase A" sites as well as the improved processes used for "Phase B" sites. As describe in the figure, the three key changes to the launch processes for Phase B sites were: (1) adding additional pre-launch items to the technical readiness checklist; (2) removing the original "Step 2" which summarized the kickoff conference call and included a planning call; and (3) adding in a new step for "Step 4" to formalize internal communication about the ACT Network within CTSA hubs.

Conceptualizing the ACT Local Launch Toolkit

The ACT Dissemination Team conceptualized how Diffusion of Innovation Theory informed strategically communicating about the ACT Network in its launch. This involved developing an ACT Local Launch toolkit with materials that ranged from video tutorials and co-branded local landing webpages to customizable print and digital communications. Online Supplement Appendix E summarizes the materials included in the ACT Local Launch Toolkit and provides a practical description of how these materials related to the Diffusion of Innovation Theory.

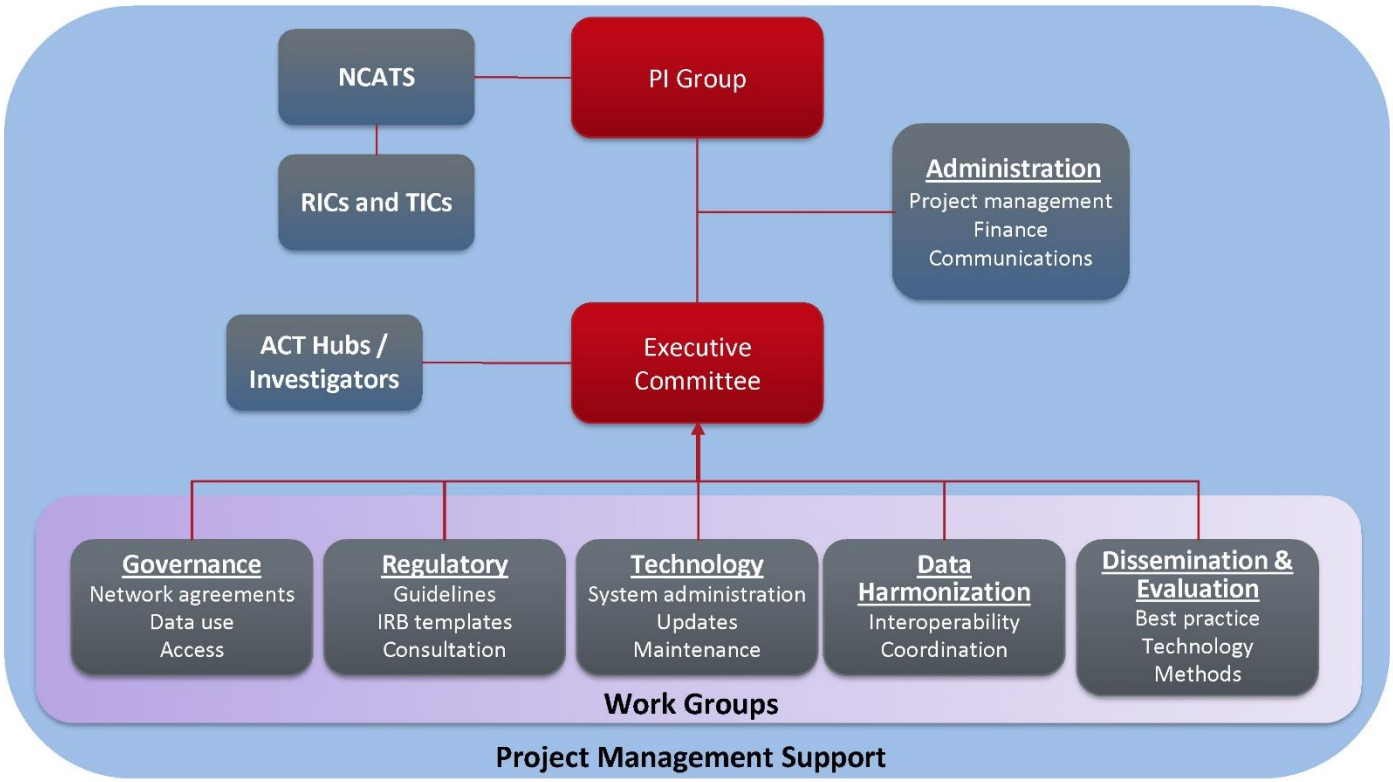
Time-Based Analysis of Early Adoption Stages

Online Supplement Figure 4 presents the time-based analysis of the governance agreement and technical readiness processes. Figure 4A shows the Kaplan-Meier curve for the time from initiating to completing the governance agreement. The median time to complete the governance agreement was 49 days (IQR: 23-134 days).

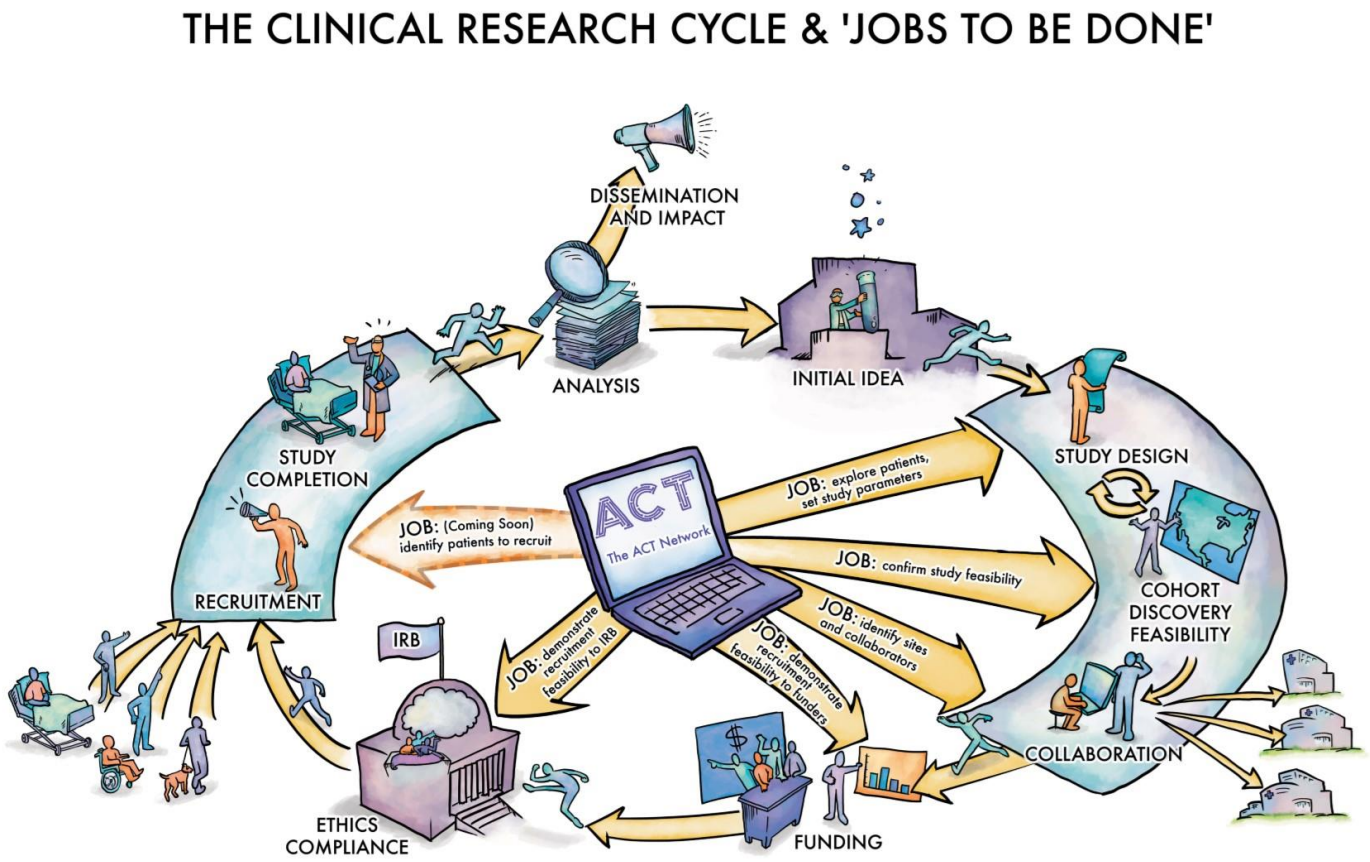
The time-based analyses for the technical readiness process was stratified by Phase A and Phase B sites. Figure 4B shows the Kaplan-Meier curve for the time from initiating to completing the technical readiness process among Phase A sites where the median time to finalize technical readiness was 1,217 days (IQR: 1,126 – 1,217). Figure 4C shows the Kaplan-Meier curve for the time from initiating to completing the technical readiness process among Phase B sites. For Phase B sites the median time to finalize technical readiness was 477 days (IQR = 260 – 488).

Online Supplement Figures and Appendices

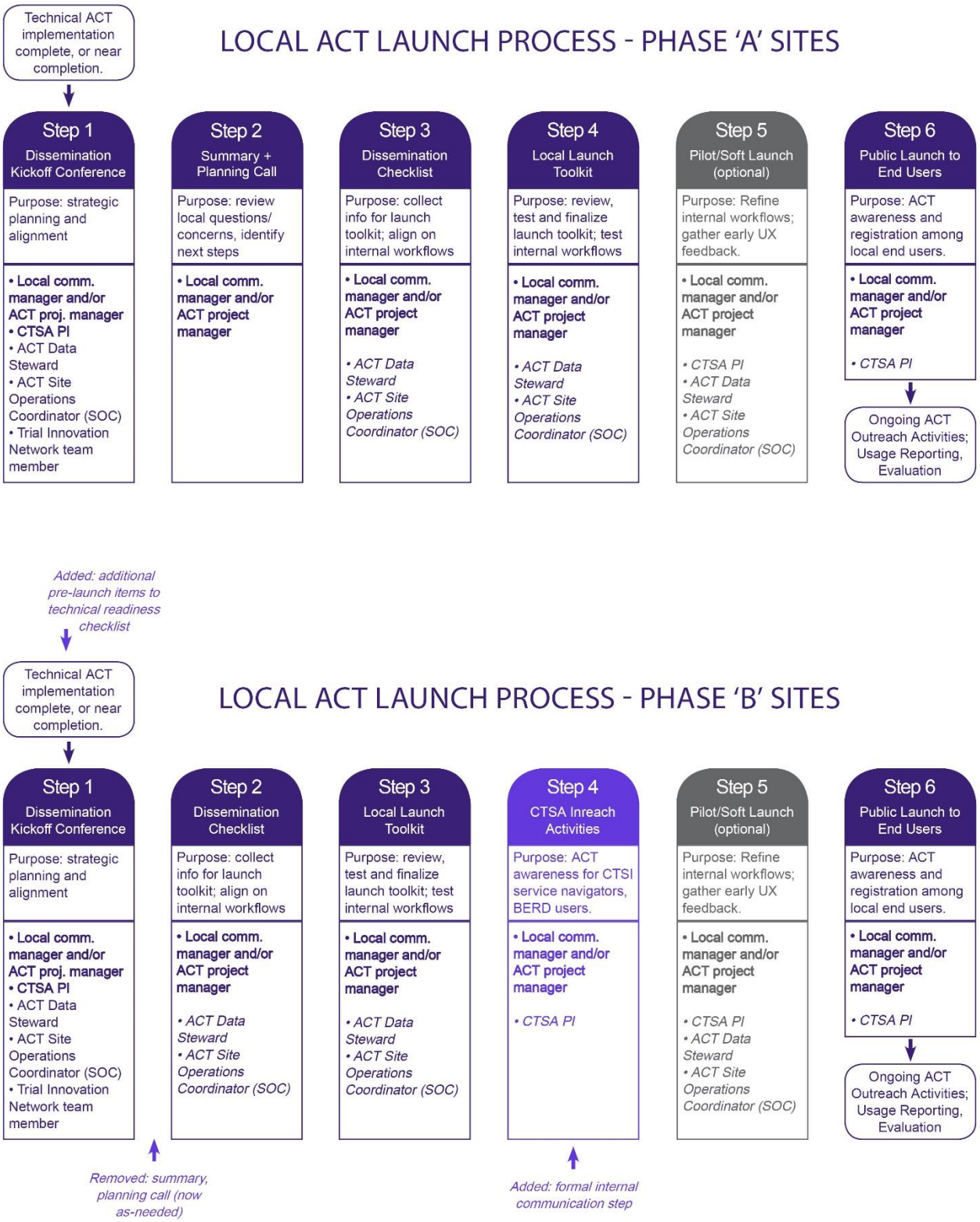
Online Supplement Figure 1: ACT Governance Structure



Online Supplement Figure 2: Clinical Research Cycle & 'Jobs to Be Done'

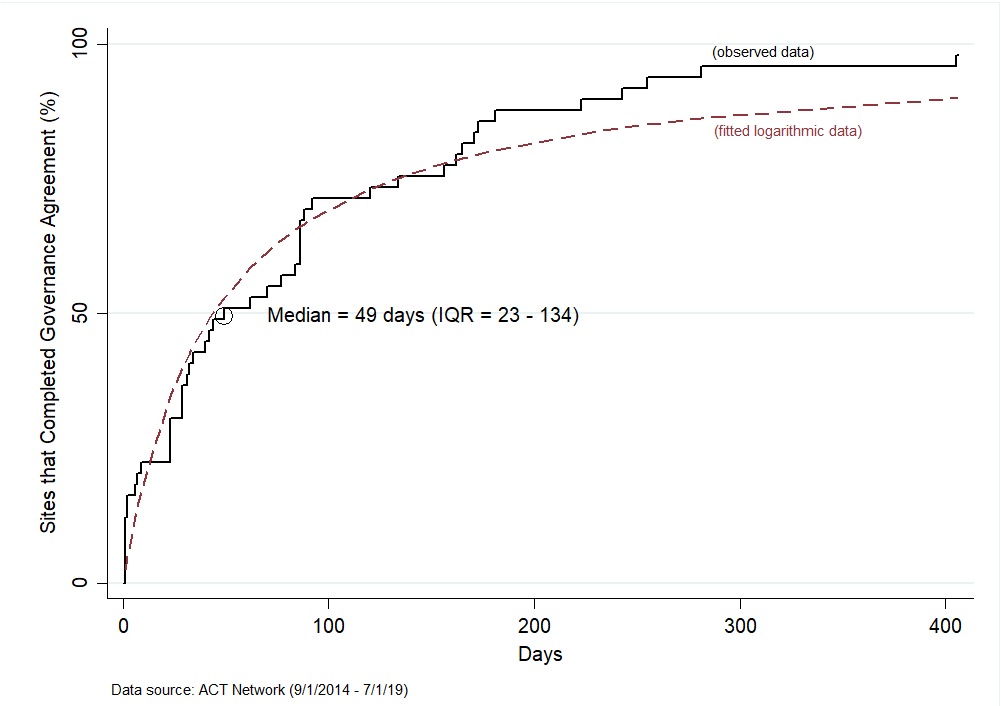


Online Supplement Figure 3: Steps to Launch ACT

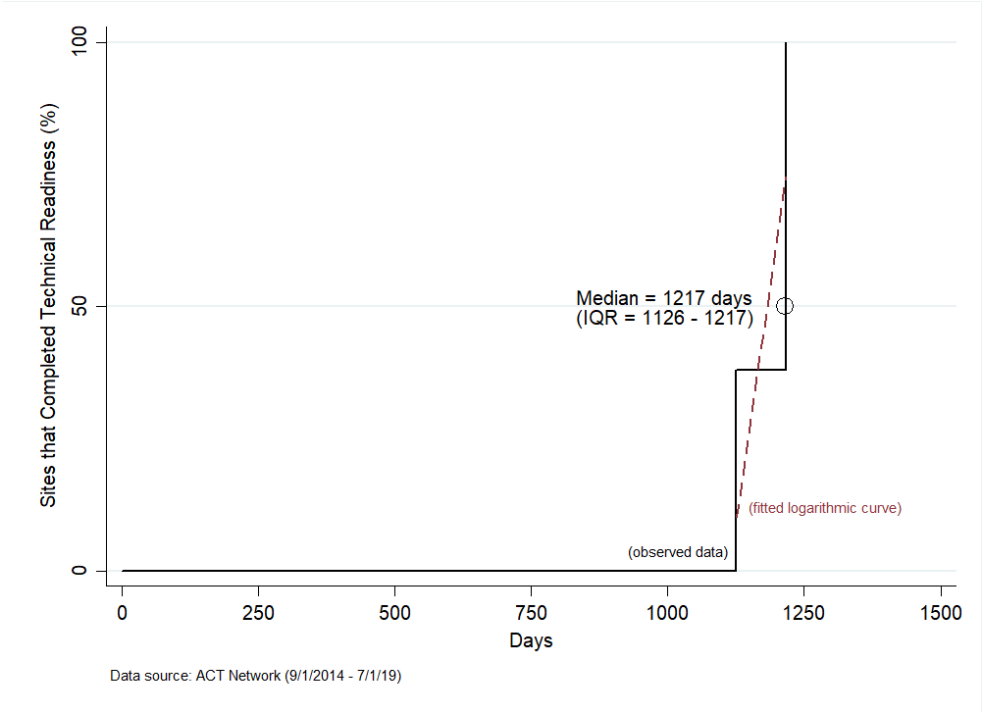


Online Supplement Figure 4: Time-Based Analysis of Early Adoption Stages

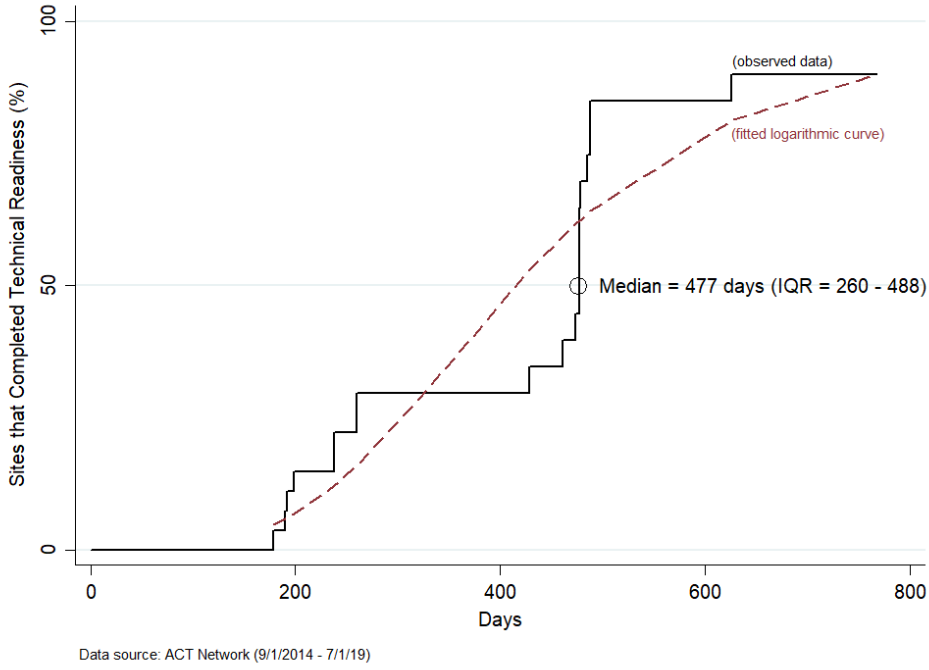
A. Time from the date governance agreement process was initiated to the date the governance agreement was signed. (N= 48 CTSAs)



B. Phase A sites: Time from the date governance agreement process was initiated to the date the governance agreement was signed. (N= 21 CTSAs)



C. Phase B sites: Time from the date the technical readiness process was initiated to the date the technical readiness process was completed. (N= 27 CTSAs)



Online Supplement Appendix A: Dissemination Advisory Board Membership & Expertise

Purpose: to share insights, experiences and suggestions to assist in the development of a dissemination strategy to bring the ACT Network to clinical investigators in the CTSA consortium, along with other members of the Dissemination Advisory Board.

Members:

- Anne Coughlan, PhD, Polk Bros. Chair in Retailing, Professor of Marketing, Kellogg School of Business, Northwestern University - Nationally-recognized expert on the strategic development and use of complex distribution channels to bring products to end users (and author of A Field Guide to Channel Strategy).
- Jim Dearing, PhD, Professor and Chair, Department of Communications, Michigan State University - Nationally-recognized NIH-funded expert on diffusion of innovations, including adoption and implementation of new evidence-based practices, programs and technologies in a healthcare setting.
- Deborah Goeken, MPH, Vice-President, Colorado Health Institute (retired) - Expert in strategic communications and messaging in health and health care; former managing director of the Rocky Mountain News, a Pulitzer Prize winning publication.
- Wayne Guerra, MD, MBA, Co-founder/CMO, iTriage, CU Entrepreneur-in-Resident - Serial healthcare entrepreneur experienced in consumer-facing mobile and digital health technology, including business model creation, product development, and customer acquisition/retention.
- Jerry Shelton, R.Ph., Retired executive, Merck & Co, Inc. - Expert in domestic and international product launch and marketing management in the pharmaceutical industry.

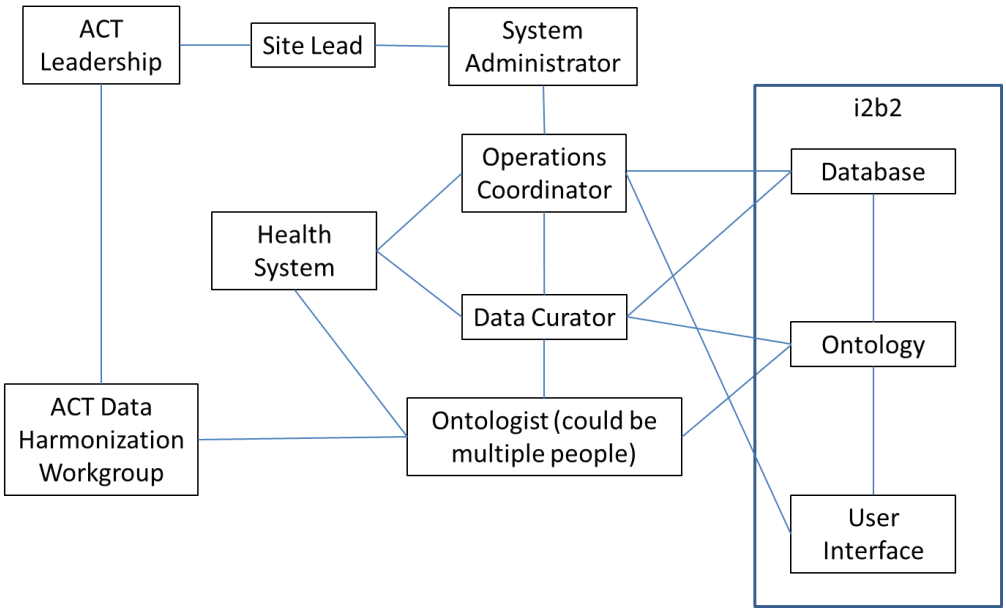
Online Supplement Appendix B: CTSA Hub Roles and Responsibilities

Function	Responsibilities	Recommended Qualifications	Interaction Points	Duration of Role
Site Lead	Overall responsibility for site's activities in the ACT network.	Institutional approval to be PI of subcontract.	ACT Leadership. Oversees other roles.	Throughout project.
System Administrator (application and infrastructure)	**Application** -Installation, implementation, maintenance of SHRINE and i2b2 systems -Ability to provide deep level troubleshooting when needed -Communicate with project sponsors, leadership, other local technical resources, end users on an as needed basis **Infrastructure** -Well rounded knowledge of servers, operating systems -Familiarity with local (institutional) network operations, local IT policy, and experience with top-tier infrastructure and front-line service support	**Basic Qualifications** -BA / BS in Computer Science / Engineering or related field -Have at least 3+ years of system / network administration **Additional Qualifications** -Knowledge of Linux / Unix systems -Scripting (bash, python, etc.) -Database Administration (SQL, Postgres, Oracle, etc.) -Networking skills (firewalls, proxies, certificate / encryption methods, port configuration) -Web services (Apache Tomcat, Axis, WildFly, JDK)	-Works closely with SOC, other local technology contacts	-Focused effort in the early stages of joining the ACT Network to implement i2b2, SHRINE -Continued role in regular health and maintenance once on ACT production network
Site Operations Coordinator (SOC)	-Institution's main, day-to-day, point of contact for network operations, administration -Report status of routine network activities (software upgrades, data refresh activities) -Assist in compiling audit information for Data Steward -Assist in creating and deactivating users in accordance with local and network policy -Serve as point of contact for local end users	-Familiarity with project management concepts -Experience with Atlassian JIRA -Attention to detail -Good communication skills	-Works closely with System Administrator, Data Steward, Research Data Curator	-Necessary for duration of ACT network participation
Research Data Curator	-Ensuring accuracy and compliance of research data available to the ACT network -Perform data mappings as needed -Provide feedback on local data availability to assist in development of ACT ontology -Respond / troubleshoot data anomalies discovered on the network	-Prior experience with i2b2, SHRINE, ontologies, ETL and data mapping -Have at least 2+ years of database administration -Knowledge of scripting methods (SQL, Python, etc.) -Familiarity with local EHR and research data handling processes -Familiarity with scientific research topics highly valuable	-Works closely with SOC	-Necessary for duration of ACT network participation

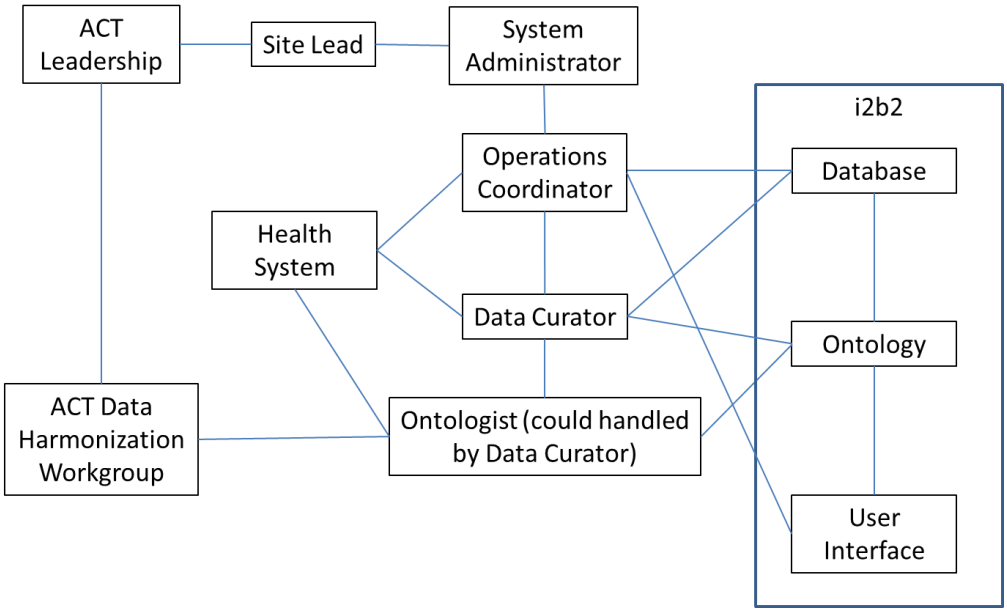
Data Steward (User Liaison)	-Serve as contact for users (researchers) with questions or problems using the network -Monitors research network behavior per the Terms of Query Access -Ensures appropriate use of the network -Serves as point of contact for other institution Data Stewards, as necessary	-Experience with biomedical research topics -Bachelor's or Master's degree in a related field is desired -Good communication skills -Attention to detail	-Works closely with the System Administrator and/or Site Operations Coordinator	-Onboarded prior to local dissemination of ACT to end users -Regular role throughout participation in ACT network
Dissemination Lead	-Conducts ACT related communication and outreach activities to local CTSA investigators	-Good communication skills -Ability to facilitate rollout of ACT to local end users	-ACT Dissemination & Evaluation Work Group	-Immediately following the technical implementation of ACT, if not before, and continue through participation in the network
Ontologist (if available)	-Mapping local terminologies to standards -Collaboration on ACT ontology development and participation in the ACT Data Harmonization Work Group	-Understanding of ontology principles -Patient care and/or health systems domain knowledge	-Research Data Coordinator -ACT Data Harmonization Workgroup	-Immediate and for duration of project -This is an optional role; mapping tasks could be carried initially as a team effort (with extra resources) and then handled by research data curator in maintenance mode

ACT Functions Interaction Points

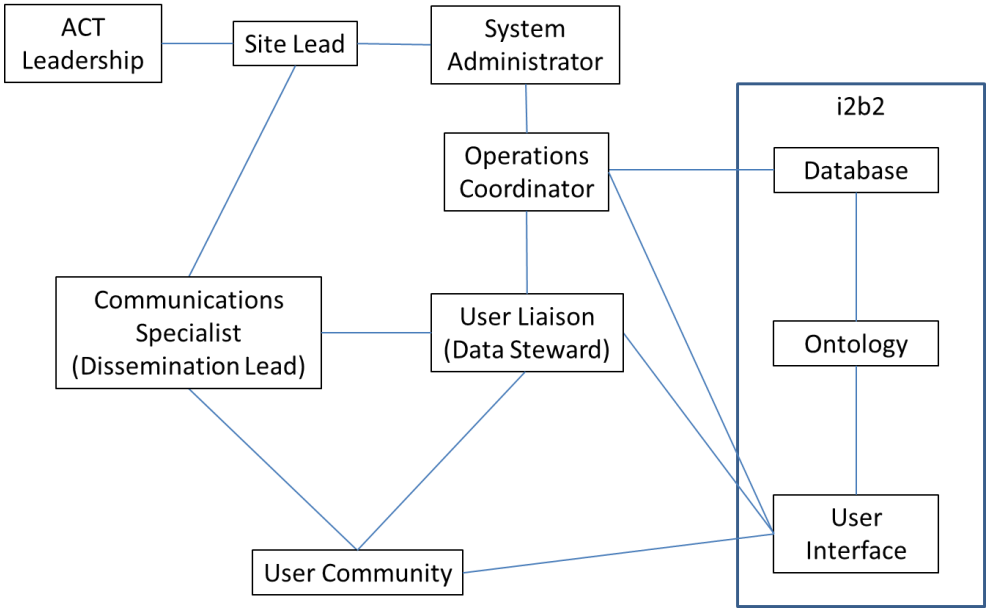
Onboarding



Maintenance



System Use



Online Supplement Appendix C: ACT Technology Checklist

Purpose. Prior to releasing ACT to local end users, the institution must confirm the following:

Connectivity and Software	Required Result	Needed By:
Confirm appropriate i2b2 version	1.7.09C	Site
Confirm appropriate SHRINE version	1.22.8	Site
Confirm appropriate ontology version	V1	Site
Able to query the network?	Yes; results received from staging sites	Site
Able to be queried by other nodes on the network?	Yes; results returned by site when checked from the hub	Network Ops (Sam)
Successful pass on smoke test (just prior to production onboarding)	Yes; results returned meeting parameters of smoke test	Network Ops (Sam)
Acknowledgement of maintenance window	Tuesdays, 4pm ET - Wednesdays, 7am ET	Site
Confirm expectations for response to network queries	Timely resolution of identified issues	Site
Confirm SHRINE webclient url for end user access		Site

Data Load	Required Result	Who confirms?
Completion and approval of data characterization	Completion of ACT Data Characterization survey and completed follow up after review of responses	Michele, Philip

Local Policy and Practice	Required Result	Who confirms?
All local functions named and emails provided (DS, sys admin, etc)	SOC, Data Steward contacts identified	Elaina
Confirm JIRA access for one user	Active ACT JIRA account	Travis / Elaina

Online Supplement Appendix D: ACT Launch Toolkit Customization Checklist

Institution:	
Target launch time frame:	
ACT designated project manager:	**CTSA communications/outreach manager:**
Other key ACT contacts who should receive information about new ACT sites, functionality improvements, etc.?	

Website customization:

1. **Preferred custom url for your ACT landing page (hosted by ACT):**

   www.ACTNetwork.us/_____

2. **Preferred local highlight/button color (optional):**

   Provide color as HEX value (#ffffff)

3. **Logo** – please attach your CTSI logo as a transparent PNG, in colors suitable for use on a black background.

4. **'Use ACT' url, for local ACT users:**

   URL where registered ACT users at your institution can log into ACT and run queries.

5. **Process for ACT registration requests (please choose one option):**

Option 1: use existing local access request form.

Provide url: _____

Option 2: use access request form provided by ACT.

Provide email address to receive ACT registration requests:
_____

6. Local ACT contacts – the categories below are suggestions; feel free to adapt to suit local roles and preferences. The website can accommodate up to 6 local contacts.

ACT access, lost passwords, technical support:

Name:
Title:
Email:
Phone:

This is likely your ACT Site Operations Coordinator (SOC).

Questions about data security, network usage, etc.:

Name:
Title:
Email:
Phone:

This is likely your ACT Data Steward.

Help running queries and interpreting results:

Name:
Title:
Email:
Phone:

This might be your informatics core, data navigator, etc.

Inquiries from external investigators seeking collaborators at your institution:

Name:
Title:
Email:
Phone:

This might be your Trial Innovation Network (TIN) liaison team.

7. Introductory text – default content is below; add additional information as desired:

The ACT Network is a real-time platform allowing researchers to explore and validate feasibility for clinical studies across the NCATS Clinical and Translational Science Award (CTSA) consortium, from their desktops. ACT helps researchers design and complete clinical studies, and is secure, HIPAA-compliant and IRB-approved.

ACT was developed collaboratively by members of NCATS' Clinical and Translational Science Award (CTSA) consortium, with funding from the NIH National Center for Advancing Translational Sciences.

8. Local IRB/data security endorsement – suggested language below; customize as desired:

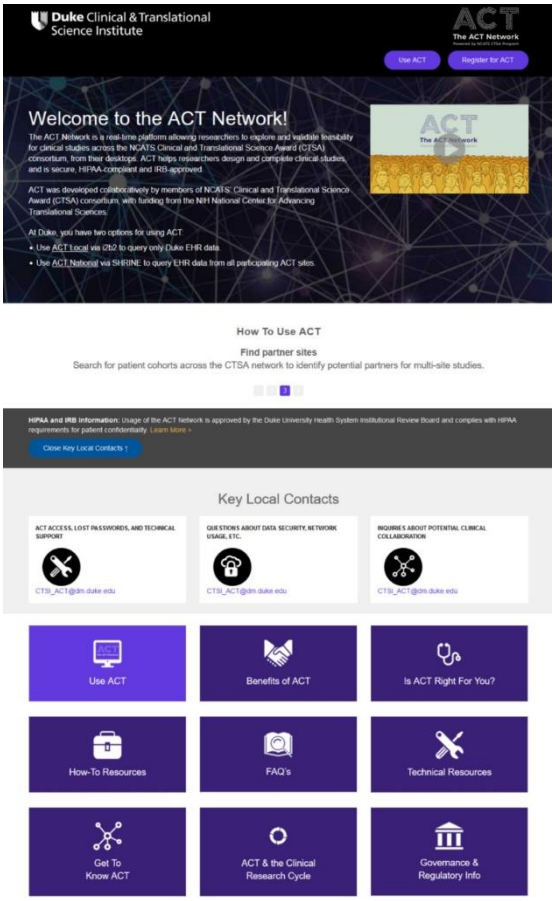
HIPAA and IRB Information: Usage of the ACT Network is approved by the [name of local IRB] and complies with HIPAA requirements for patient confidentiality.

Online Supplement Appendix E: ACT Launch Toolkit

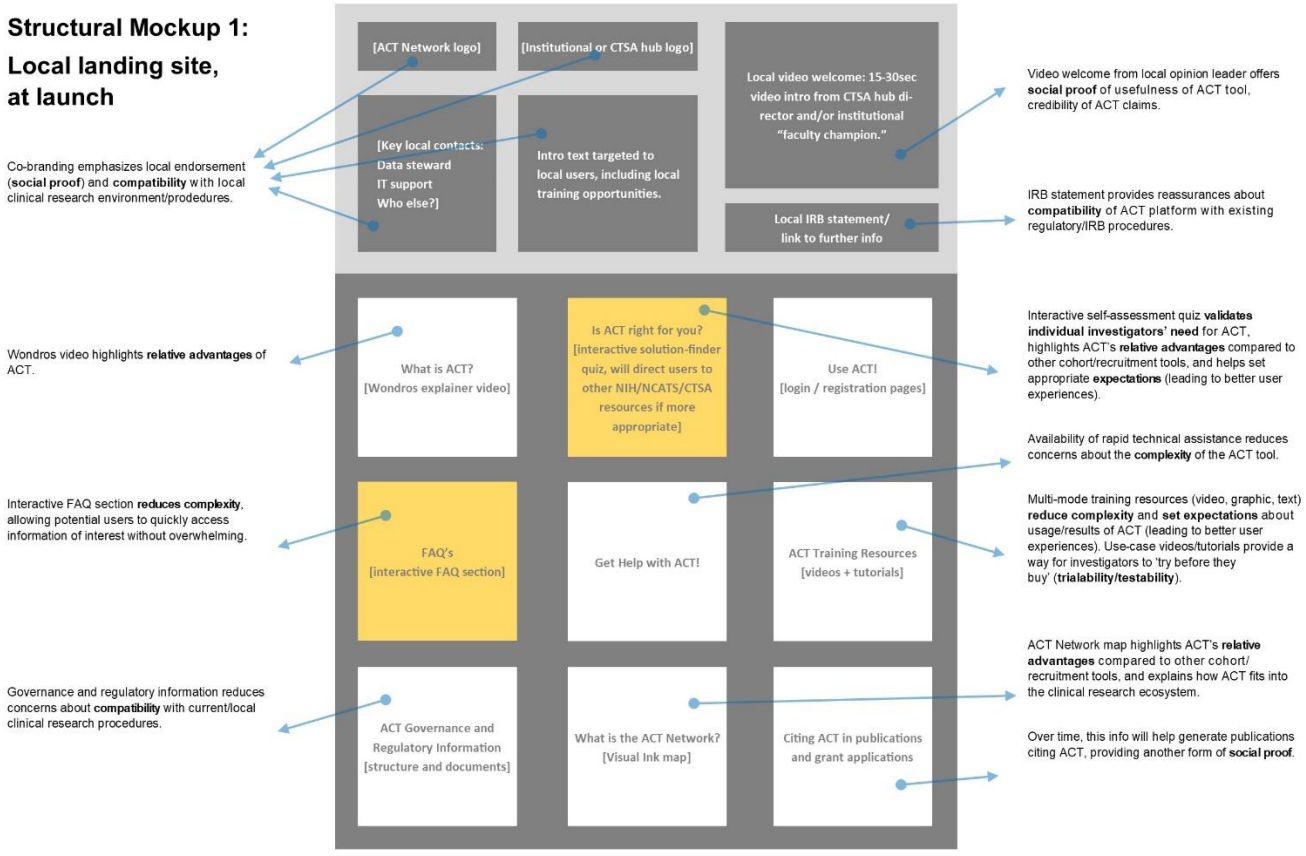
Co-branded Local Landing Pages

At the core of the ACT local launch toolkit is a customized, co-branded website created for each CTSA hub partner by the ACT dissemination team, and maintained by ACT. These websites share a unified site architecture and mostly common content maintained and updated by the dissemination team, including interactive educational modules, FAQ's, governance info, etc. Additionally, each local landing page includes customized elements: the CTSA hub partner's logo and user support contacts, local IRB and data security language, other custom text, and site-specific routing of end users for registration and ACT access.

By providing these custom websites to CTSA hub partners, the ACT dissemination team is able to easily refresh and manage shared content about ACT (>90% of web content across ACT websites), while substantially reduce the web maintenance burden for CTSA hub partners, and ensuring that all end users have access to accurate and up-to-date information and educational resources about ACT. See sample screenshot at right, and annotated mockup below for details about the strategic approach and goals.

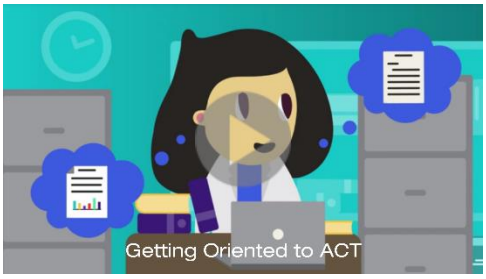


Links: view the [national ACT website] and [local custom ACT landing pages].



ACT Local Launch Toolkit: Video Tutorials

The ACT dissemination team produced a series of 4 animated tutorial videos to help novice users (as well as those experienced with similar clinical informatics tools) get started using the ACT web client. While local CTSA hub partners still provide hands-on user support and troubleshooting, these videos provide a quick-start resource to alleviate the user support burden on CTSA informatics and clinical data navigator staff, and make it easier for end users to quickly start running queries in ACT and explore the tool's capabilities. The videos were embedded on all ACT websites (national website, local CTSA customized ACT landing pages).



Getting Oriented to ACT

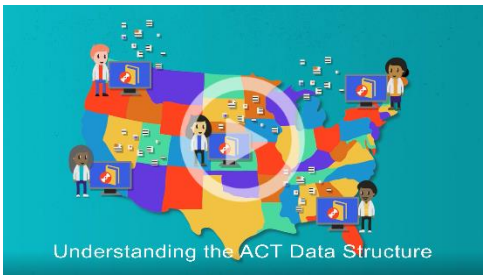
3min - This video is part 1 of a 3-part quick-start series, and presents the key elements of the ACT web client, and how to register and use ACT for the first time.

Running ACT Queries

2min - Part 2 of the quick-start series details a step-by-step process for running queries in the ACT web client, with included video capture demonstrating this process within the real ACT web client.

Interpreting and Using ACT Query Results

2.5min - In part 3 of the quick-start series, this video provides more information about the data included in ACT, and ways this data can be used to explore cohorts, validate feasibility, and identify potential sites for collaboration.



Understanding the ACT Data Structure

3.5min - This video, for experienced users of clinical informatics tools, offers an overview of how data is structured and managed in the ACT Network.

Link: **see all ACT videos on the ACT Network Vimeo channel.**

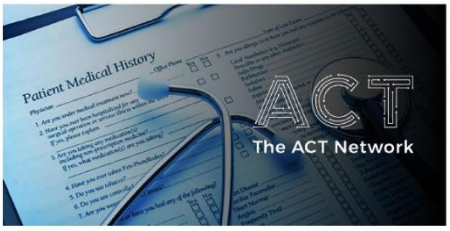
ACT Local Launch Toolkit: Templates and Sample Language

The ACT dissemination team created a collection of images, editable co-branded templates and sample wording for adaptation by CTSA hub partners in their local outreach about ACT. These resources reduce the work required to launch ACT locally, and also reduce the complexity of the local launch process by providing accurate, accessible messaging about what ACT is, how it works, and what end users can do with ACT. These resources were provided to all sites during the initial launch planning process, and sites were encouraged to use and adapt the materials in whatever way they preferred; the ACT dissemination team also offered assistance in customizing the templates when requested, to help reduce the burden of local launch especially for CTSA hubs without communications staff. A sampling of items from the local launch toolkit is included below; use the link below to view all items in the toolkit.

Link: [see the full local launch toolkit via Dropbox.]

Sample tweets, with included images:

We are excited to announce that we've partnered with @The_ACT_Network to bring real-time, open access cohort exploration and discovery to our researchers, to help accelerate clinical studies that can bring new treatments to patients: [custom url]



Did you know? Our researchers can run HIPAA-compliant searches on data from 100M patient records across the country to accelerate clinical trials using @The_ACT_Network - [custom url]

Editable co-branded flyer temples:

Sample emails and web messages:

All,

I am pleased to announce the launch of the ACT Network at [institution or CTSA hub name].

The ACT Network is a real-time, open-access platform allowing researchers throughout the CTSA consortium to explore and validate feasibility for clinical studies using electronic health record data. ACT is NIH-funded and HIPAA-compliant.

ACT was developed collaboratively by CTSA hubs (with funding from NCATS) to help investigators more efficiently develop and validate parameters for clinical studies. The ACT Network currently contains over **125M patient records.**

Using ACT, investigators can:

- Explore patient populations in depth, in real time, from their desktop
- Confirm study feasibility by iteratively testing and refining inclusion and exclusion criteria.
- Demonstrate study feasibility in funding proposals and IRB submissions.
- Identify potential partners for multi-site studies by searching for patients across the CTSA network

The ACT Network currently contains de-identified data from **42 CTSAs across the country**, expanding to 57 CTSAs in 2020 (almost 100% of the CTSA consortium).

The ACT Network is **open access** and available to all [CTSA members, researchers at [institution], or whatever is accurate] at **no cost**. To request access and learn more about **ACT**, go to [custom url].

As part of the implementation process, the ACT platform (and its governing agreements) have been reviewed for HIPAA compliance and approved by [insert local IRB] – no additional IRB approval is needed for researchers wishing to use ACT. (To learn more about how ACT protects patient confidentiality, click here.)

I've attached a one-page document to help summarize how ACT can be used in a variety of clinical research settings, and encourage you to visit [custom url] to learn more and request access.

Warmly,

[CTSA PI signature]

Hi,

Your request to access the ACT Network at [institution or CTSA hub name] has been approved! Please find your login credentials below:

[username]
[password – is this temporary? If so, need to add note about updating the password]

To help you get started, please bookmark [custom url for local ACT landing page] and use this as your landing page for the ACT Network. This page provides tutorial and help resources, FAQ's, and other information about using the ACT Network. You can also click the purple "Use ACT" button at the top right of this page to go directly to the [institution name] ACT web client to log in. **To access ACT, [insert specific info about physical location, firewall, etc.].**

We recommend that you view the quick-start tutorial resources on the ACT landing page, which are also available at the links below:

Getting Oriented to ACT

Running ACT Queries

Interpreting and Using ACT Query Results

Key contacts for getting help with ACT:

[contact info] – lost passwords, trouble accessing ACT
[contact info] – help using or troubleshooting ACT
[contact info] – request support from the [CTSA hub name] bioinformatics core

Thank you,

[contact info]

1. CTSA Hub Newsletter (internal audience)

ACT Network Launches at [Institution]

We're excited that a new cohort discovery tool, the ACT Network, is available to researchers at [institution]. The ACT Network is a real-time, open-access platform allowing researchers to explore and validate feasibility for clinical studies using aggregated electronic health record data from over 125M patients nationwide. ACT is HIPAA-compliant and pre-approved by [institutional review board], so using ACT does not require study-specific IRB approval. Improving upon other data networks, it offers open-access to a national network of leading academic medical research centers and generates aggregate patient count data from an investigator's real-time, iterative searches. We also anticipate that it will allow investigators to check the feasibility of their clinical protocols and to identify potential partner sites for multi-site studies. ACT is provided to [institution] researchers at no charge, but registration is required. For more information about the ACT Network and how to start using it, please visit [custom url].

2. CTSA Website News Announcement (front page and/or news section)

ACT Network Launches at [Institution]

[Institution] is pleased to announce that it has partnered with the ACT Network to bring real-time cohort exploration and discovery to its researchers. ACT was developed by members of the CTSA consortium to enable cohort discovery using a web interface in a HIPAA-compliant manner, without requiring study-specific IRB approval. It offers open-access to a national network of leading academic medical research centers and generates aggregate patient count data from an investigator's real-time, iterative searches. Using ACT, [institution] researchers can explore patient populations, confirm and demonstrate study feasibility, and identify potential partners for multi-site studies. For more information about the ACT Network at [institution], please visit [custom url].

3. CTSA Website ACT Description (internal web pages where ACT is linked)

The ACT Network is a real-time, open access platform allowing researchers to explore and validate feasibility for clinical studies. ACT is available to all [CTSA members, researchers at [institution], or whatever is accurate]. ACT is provided to [institution] researchers at no charge, but registration is required. Access ACT: [custom url].