Interplay With a Sampling of Other Strategic Plans, Priorities & Initiatives (Appendix A)

Note: This content was developed in 2020. The LHS/Knowledge Ecosystem landscape has evolved since then but integrating ACTS Roadmap execution with the myriad other pertinent activities remains critical.

There are many national and international efforts (Figure 8. Sampling of Non-AHRQ Initiatives Addressing the Knowledge Ecosystem With Which Roadmap Execution Coordinates) focused on the LHS cycle and its many components (e.g., data interoperability, knowledge interoperability, health IT use and optimization, improving high-priority care processes and outcomes, etc.). The ACTS Roadmap augments, enhances, and integrates these as appropriate to achieve shared goals. The recommendations in the American College of Physicians (ACP) *Annals of Internal Medicine Supplement: Vision for U.S. Health Care* (119) also resonate with goals of the ACTS Future Vision: to provide patients, families, caregivers, care teams with understandable, actionable, evidence-based quality, cost information to inform shared decision making; redesign Heath IT to enhance patient-physician relationship and improve care; and enable coordinated, team-based care. ACTS Roadmap provides a detailed path for delivering on these recommendations.

Roadmap

- Full LHS Cycle
- Make Data & Knowledge Interoperable
- Produce Evidence and Guidance
- Make Guidance Computable
- Disseminate Evidence and Guidance
- Measure and Improve Care Quality

Full LHS Cycle

DHA

DHA leads the Military Health System (MHS), which provides care for uniformed service members, military retirees, and family members (120) while promoting medical research and innovation (121). Through its MHS GENESIS modernization efforts (122), DHA shares medical data between the military health services and VA, which promotes the advancement of national, patient-centric EHR interoperability and a focus on quality, safety, and patient outcomes (123).

VHA

As part of its VA business systems transformation effort to modernize its legacy systems and processes detailed in its 2018–2024 Strategic Plan (124), VA is making massive investments in an interoperable EHR that will connect VA to "DOD, private doctors, and private pharmacies to create a continuum of care and organize" healthcare around the Veteran's needs.
In addition, VHA's Evidence-based Clinical Practice Program (125) works to improve the overall health of Veterans and those who use DOD healthcare facilities by increasing the adoption of evidence-based practices and reducing variations in care throughout VA and military healthcare systems (e.g., overuse, underuse, different use, and waste of healthcare practices and services with varying outcomes). VA uses clinical practice guidelines as recommendations to doctors and nurses to improve care, reduce variations in practice, and share best practices in care nationwide.

Make Data & Knowledge Interoperable

U.S. Core Data for Interoperability (USCDI)

USCDI (126) is a standardized set of health data classes and data elements that are essential for nationwide, interoperable HIE, including "clinical notes," allergies, and medications among other important clinical data, to help improve the flow of electronic health information and ensure that the information can be effectively understood when it is received, in addition to essential demographic data to support patient matching across care settings.

21st Century Cures Act

The 21st Century Cures Act (127) (128) supports MyHealthEData with two final rules that require public and private entities privately and securely share FAIR health information between patients and other parties via FHIR-enabled API access to—and interoperability of—information about patients and providers.
"The two rules, issued by ONC and Centers for Medicare & Medicaid Services (CMS), implement interoperability and patient access provisions of the 21st Century Cures Act (Cures Act) and support the MyHealthEData (129) initiative, which is designed to empower patients around a common aim—giving every American access to their medical information so they can make better healthcare decisions. Together, these final rules mark the most extensive healthcare data sharing policies the Federal Government has implemented, requiring both public and private entities to share health information between patients and other parties while keeping that information private and secure…" The Cures ACT final rule synergies with ACTS Roadmap in two ways. First, FHIR-enabled API access to—and interoperability of information about—patients and providers is an important leap forward in informing and improving care decisions, as the rules note. However, to fully unleash the power of this FAIR **patient data** there needs to be FAIR **guidance and tools** to help patients, care teams, and others **understand and act on** this information to achieve desired goals. Second, the ACTS Roadmap approaches (e.g., DKPs, knowledge ecosystem, reference architecture and PPP) build on FHIR/API-enabled **data** FAIRness, computability, and usefulness to address **evidence, knowledge, guidance, and CDS** FAIRness, computability, and usefulness needed to fully optimize healthcare decisions, delivery, and outcomes.

ONC's Cures Act Final Rule

The ONC Cures Act Final Rule (130):

- Updates certification requirements for health IT developers
- Establishes new provisions to ensure that providers using certified health IT have the ability to communicate about health IT usability, user experience, interoperability, and security
- Requires EHRs to provide the clinical data necessary, including core data classes and elements, to promote new business models of care
- And advances common data through USCDI, which includes "clinical notes," allergies, and medications among other important clinical data, to improve the flow of electronic health information, ensure that the information can be understood when received, and includes essential demographic data to support patient matching across care settings

FHIR-enabled API access to—and interoperability of information about—patients and providers is an important leap forward in informing and improving care decisions, as the rules note. However, to fully unleash the power of this FAIR *patient data* there needs to be FAIR *guidance and tools* to help patients, care teams and others *understand and act on* this information to achieve desired goals. The ACTS Roadmap approaches (e.g., DKPs, knowledge ecosystem, reference architecture and PPP) build on FHIR/API-enabled **data** FAIRness, computability, and usefulness to address **evidence, knowledge, guidance, and CDS** FAIRness, computability, and usefulness needed to fully optimize healthcare decisions, delivery, and outcomes.

ONC's Accelerating APIs for Scientific Discovery Project

ONC's Accelerating APIs for Scientific Discovery project (131) accelerates the understanding and use of standardized APIs and healthcare apps in support of the ONC Cures Act Final Rule with the first of four planned reports that explore the current landscape of API-based HIE in a rapidly evolving electronic health data ecosystem, *Accelerating API and App Connectivity: Consumer Perspectives*, which found

- Data must be interoperable, detailed, accurate, and timely
- The healthcare app must reduce the time consumers spend obtaining their data and achieving their objective
- And healthcare apps must mitigate privacy and security concerns while realizing the potential of expanded consumer control over their health data and expanding the type and scale of data available to researchers and clinicians

The CMS Interoperability & Patient Access Final Rule

The CMS Interoperability and Patient Access Final Rule (132):

- Adopts HL7 Fast FHIR Release 4.0.1 as the foundational standard to support data exchange via secure APIs
- Requires payers to implement and maintain a secure, standards-based API that allows patients to use third-party applications of their choice to easily access:
    - Their claims and encounter information, including cost
    - A defined subset of their clinical information
    - And publicly available provider directory information
- Allows third-party application developers to create services that help patients find providers for care and treatment, as well as help clinicians find other providers for care coordination, in the most user-friendly and intuitive ways possible
- And requires hospitals to send electronic patient event notifications of a patient's admission, discharge, and/or transfer to another healthcare facility or to another community provider or practitioner, which improves care coordination by allowing a receiving provider, facility, or practitioner to reach out to the patient and deliver appropriate follow-up care in a timely manner

CMS Strategic Initiatives

CMS 16 Strategic Initiatives (133) share several important ACTS synergies.
Figure A-1. CMS Strategic Initiatives (133)
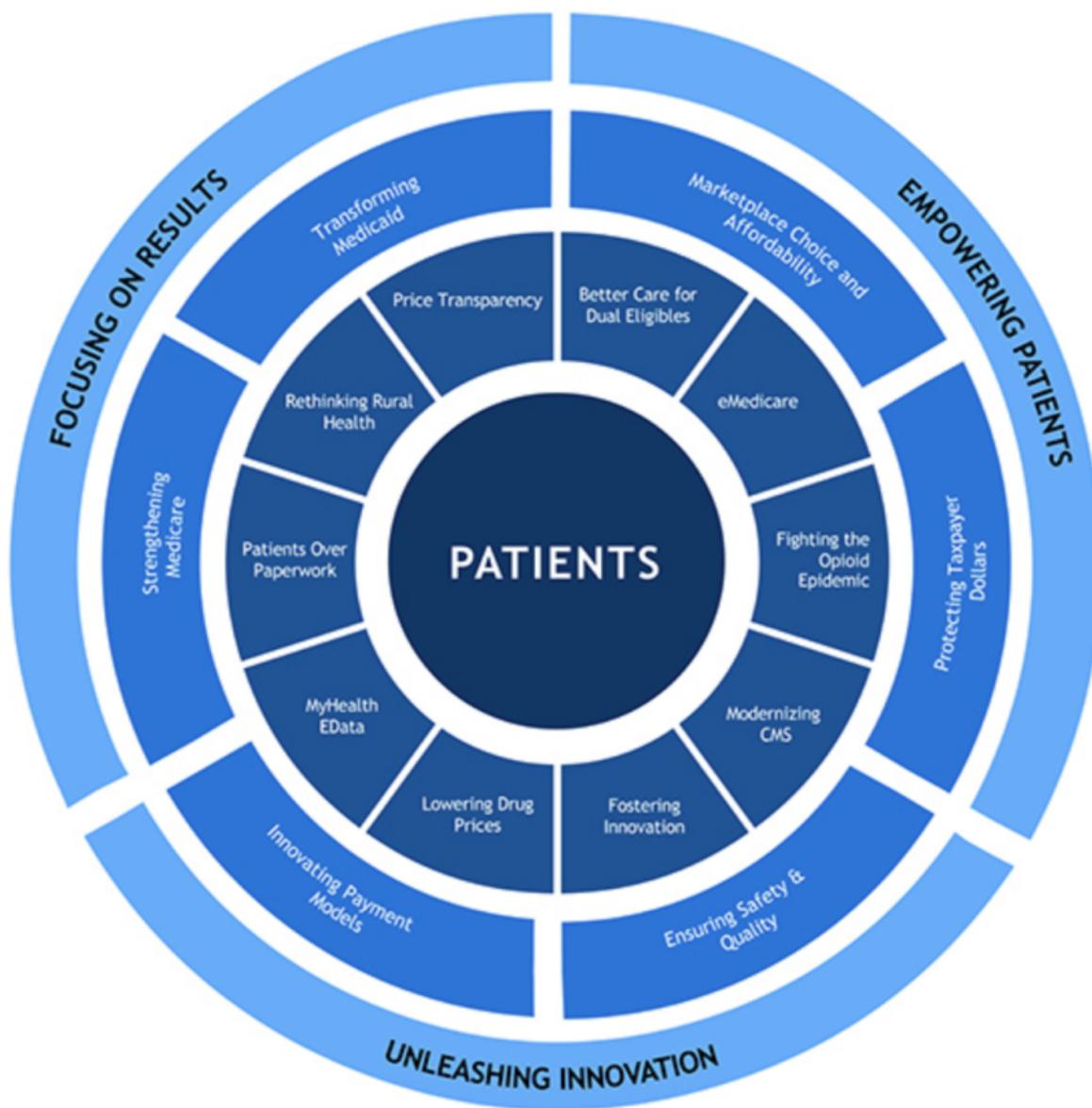
Ensuring Safety & Quality

To ensure safety and quality (134), CMS is "moving quality programs to measure value more robustly and give consumers access to that information in a way that is understandable and actionable." They are incorporating the voices of both beneficiaries and providers as they unleash innovative tools, provide better public information, and modernize quality payment and improvement programs to meet the needs of beneficiaries for generations to come.

Strengthening Medicare

CMS is unleashing innovations and modernizing our policies to support technology to strengthen Medicare (135). For the first time, Medicare is paying for virtual check-ins, meaning, patients can connect with doctors by phone or video chat, similar to how telehealth works." Hospital improvement innovation networks (HIINs) working with 4,000 acute care hospitals across the nation have generated a 13 percent reduction in the number of hospital acquired conditions between 2014 and 2017, based on preliminary 2017 data. This translates into 20,500 lives saved from harms avoided and a savings of $7.7 billion to the healthcare system (136).

Innovative Payment Models

CMS is testing innovative payment models focused on local delivery of healthcare, where patients and providers determine the best care plan, and providers are accountable for patients' outcomes (137).

COVID19 Interoperability Alliance

The COVID19 Interoperability Alliance (138) is a collaborative effort between healthcare industry stakeholders to provide a collection of value sets for clinical, demographic, and administrative concepts relating to the COVID19 pandemic, free of charge, to anyone in the healthcare community who can leverage them to identify, understand, and monitor COVID19 information patterns.

COVID19 Knowledge Accelerator (COKA)

COKA Deeply integrated with ACTS Roadmap development (139) (140)is a suite of early-stage tools to exchange limited information about studies between systems and standardize and make systematic review details, guidance, and guidance rationale more computable.

European Union (EU) Fair4Health

EU Fair4Health (141) supports the "FAIRification" of data, stressing data quality (certification), interoperability, and reproducibility of research.

FHIR for FAIR Connectathon & IG

The FHIR for FAIR Connectathon and IG (142) engages the HL7 FHIR community on the implementation of the FAIR principles and the assessment of the FAIR indicators by collecting and discussing implementation experiences, known challenges, and proposed solutions.

FHIR-Based Knowledge Representation Specifications

FHIR-based knowledge-related specifications (e.g., as outlined in Figure 21. FHIR-Based Knowledge Representation Specifications (84)) are inputs to the reference architecture, playbooks and related Roadmap deliverables.

HHS Assistant Secretary for Planning and Evaluation (ASPE)–AHRQ–NIH NIDDK eCare Plan

The HHS ASPE eCare Plan (143) is building data capacity to conduct pragmatic, patient centered outcomes research by developing an interoperable electronic (eCare) plan.

HHS Secretary Priorities

The HHS Secretary's Priorities (144) maximize the promise of health IT through interoperability and with regard to combating the opioids crisis and promoting value-based care. The ACTS Roadmap likewise supports HHS Secretary current priorities.

Opioids Crisis

The opioids crisis target anchors the proposed pilot of ACTS knowledge ecosystem and future vision to address HHS' five-point strategy (e.g., addiction prevention/Rx, pain management). The ACTS Roadmap builds on the AHRQ-funded OAP (56) which can likewise be leveraged in executing the proposed pilot.

Value-Based Care

With regard to the value-based care target, the ACTS Roadmap centers on the HHS goal of "Maximizing the promise of health IT, including through promoting interoperability" by addressing *knowledge/guidance interoperability* through new public/private collaborations currently lacking and via a Roadmap-recommended effort to develop a widely adopted reference architecture that promotes knowledge interoperability. It also addresses the goal of "boosting transparency around price and quality" within B.3, Care Delivery Perspective of the ACTS Future Vision.

HHS Strategy on Reducing Burden Relating to the Use of Health IT & EHRs

The HHS' *Strategy on Reducing Burden Relating to the Use of Health IT and EHRs* (145) outlines three goals to reduce clinician burden: reduce the effort and time required to record health information in EHRs, reduce the effort and time required to meet regulatory reporting requirements, and improve the functionality and intuitiveness of EHRs.

HL7 CPG-on-FHIR

HL7 CPG-on-FHIR (86) provides a means of creating a computable representation of a narrative clinical guideline that is faithful to guideline intent and supports the derivation of downstream capabilities such as cognitive and decision support, quality measures, case reporting, and documentation templates that direct clinical documentation in support of determining guideline compliance.

HL7 Evidence-Based Medicine (EBM) Knowledge Assets Project (EBMonFHIR)

HL7 EBMonFHIR (146) provides interoperability (standards for data exchange) for those producing, analyzing, synthesizing, disseminating, and implementing clinical research (evidence) and recommendations for clinical care (clinical practice guidelines).

HL7 FHIR Accelerators

The HL7 FHIR Accelerators (73) assist communities and collaborative groups across the global healthcare spectrum in the creation and adoption of high-quality FHIR IGs or other standard artifacts to move toward the realization of global health data interoperability.

The Argonaut Project

The Argonaut Project (147) is developing a first-generation FHIR-based API and core data services specification to enable expanded information sharing for EHRs and other health information technology based on Internet standards and architectural patterns and styles.

The Creating Access to Real-time Information Now Through Consumer-Directed Exchange (CARIN) Alliance

The CARIN Alliance (148) is rapidly advancing patients and caregivers' ability to easily get, use, and share their digital health information when, where, and how they want to achieve their goals by promoting the digital access to their health information via non-proprietary APIs and moving toward *"a future where any consumer can choose any application to retrieve both their complete health record and their complete coverage information from any provider or plan in the country."*

Common Oncology Data Elements eXtensions (CodeX)

CodeX (149) is addressing the need to obtain high-quality, computable data for cancer care and research by expanding the core Minimal Common Oncology Data Elements (mCODE™) FHIR IG standard to address new use cases and accelerate opportunities to create an LHS based on interoperable data and improved patient care.

Da Vinci Project

The Da Vinci Project (150) is discouraging the development and deployment of unique solutions between trading partners (e.g., a payer and provider) and promoting interoperability across value-based care stakeholders and to guide the development and deployment of interoperable solutions on a national scale with common Standards (FHIR), IGs, and Reference implementations to achieve better care at lower cost.

Gravity Project

The Gravity Project (151) is expanding available social determinants of health (SDOH) core data for interoperability and accelerate standards-based information exchange by using HL7 FHIR by identifying coded data elements and associated value sets to represent SDOH data documented in EHRs across four clinical activities: screening, diagnosis, planning, and interventions focused on three specific social risk domains: food insecurity, housing instability and quality, and transportation access.

Vulcan

Vulcan (152) is bringing together stakeholders across the translational and clinical research community to bridge existing gaps between clinical care and clinical research, strategically connect industry collaboratives, maximize collective resources, and deliver integrated tools and resources.

Logica HSPC Interoperability Roadmap

Logica HSPC Interoperability Roadmap (97) (153) is a roadmap that addresses:

- Inherent limitations within the HIT marketplace to provide seamless solutions
- Inconsistencies among widely adopted HIT standards
- Insufficient richness in the expression of clinical detail, curtailing the ability to provide for computer-assisted CDS
- Competing technology stacks, resulting in additional challenges when integrating systems or sharing between health systems
- And a lack of a common health platform, limiting third-party innovation, written by a provider-led, not-for-profit community dedicated to advancing open platforms, systems, standards, and content

MyHealthEData

Led by the Trump Administration's White House Office of American Innovation with participation from HHS (CMS, ONC, NIH) and VA, the MyHealthEData (129) initiative gives every American control of their medical data by providing patients electronic access to their medical records and the ability to share their data with whomever they want.
In support of MyHealthEData, CMS (154) is "ensuring patients have unencumbered access to their health information, in a format that is practical, usable, and easily shared. This empowers patients to use of their digital and personal health data so they can make good healthcare decisions." CMS created Blue Button 2.0 to give beneficiaries the ability to securely connect their data to apps and other tools developed by innovative companies. CMS is also enabling and empowering patients to share their health information securely and electronically with any provider, application, or researcher they choose, and that information will be in a standards-based format that is commonly accepted and used across the healthcare system while also ensuring privacy and security. They also initiated the "Data at the Point of Care" API Pilot to make a patient's Medicare A, B, and/or D claims data available to the clinician directly in their workflow to support treatment decisions. CMS also announced the top 25 innovators of the AI Health Outcomes Challenge, providing an opportunity for innovators to demonstrate how AI tools, such as deep learning and neural networks, can be used to predict unplanned hospital and skilled nursing facility admissions and adverse events.

- Price transparency (155):
    - Empowered consumers will drive cost and quality by demanding that our healthcare system evolve to compete for patients and deliver better results
    - Putting patients in the driver's seat means integrating quality and price information, so consumers can see the whole picture, empowering them to seek out high-value care among providers competing on both cost and quality
- Better care for dually eligible beneficiaries (156):
    - Many dually eligible beneficiaries have complex healthcare issues to manage, including MCCs, and often have unmet social needs that can lead to poor health outcomes
- Fighting the opioid crisis (157):
    - The CMS Opioid Strategy focuses on three key areas to empower patients with the information they need to make the best healthcare decisions for themselves and their families through:
        - **Prevention:** Preventing and reducing opioid use disorder (OUD) by promoting safe opioid prescribing and encouraging non-opioid pain treatments
        - **Treatment:** Increasing access to evidence-based treatment for OUD

- **Data:** Leveraging data to target prevention and treatment efforts

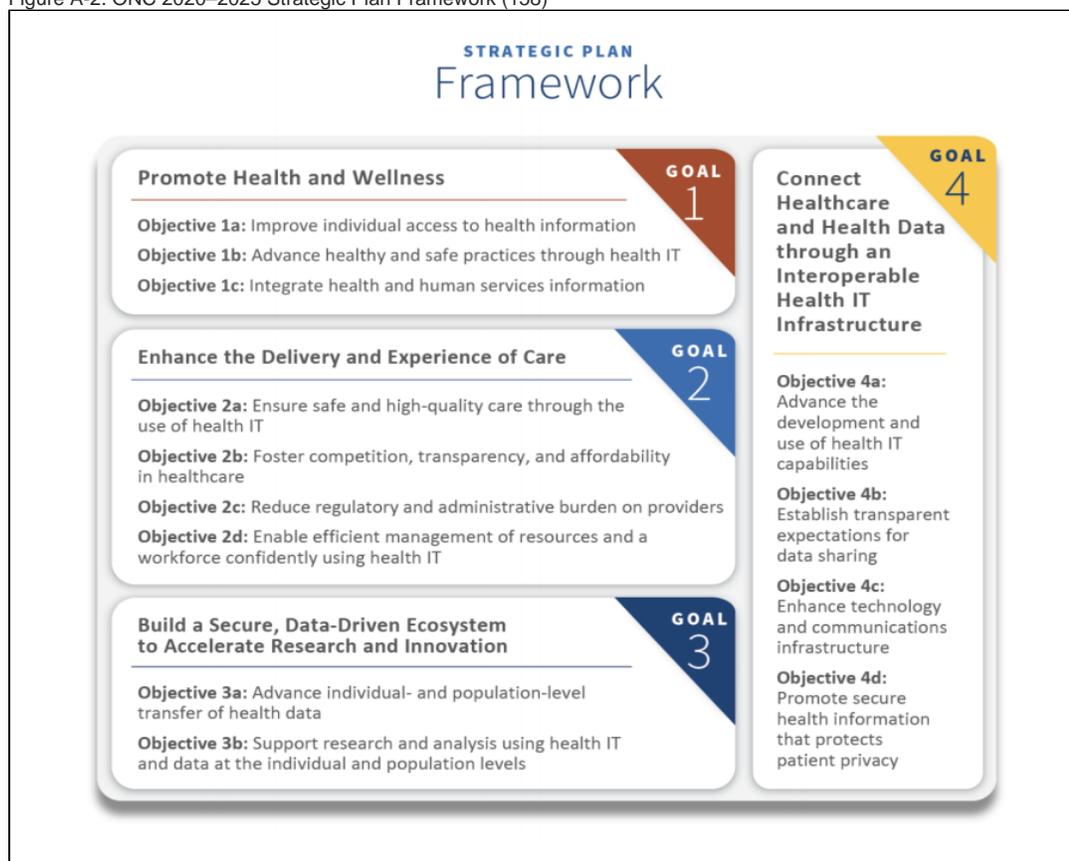## ONC 2020–2025 Federal Health IT Strategic Plan

ONC's 2020–2025 Federal Health IT Strategic Plan (158) promotes data access, interoperability, and seamless exchange and integration of health information between platforms, using shared data standards and common terminologies, which equips patients, caregivers, and healthcare providers with complete and accurate health records, so they can establish comprehensive and tailored care plans, make informed decisions about care, and engage in preventive care.

Developed in collaboration with over 25 Federal organizations, the ONC 2020–2025 Federal Health IT Strategic Plan guides Federal health IT activities. The principles, framework, challenges, opportunities, goals, objectives, and strategies it outlines resonate strongly with and complement the ACTS Roadmap. The data access and interoperability promoted by this plan are key to the virtuous LHS cycle described in the ACTS Roadmap, which, in turn provides more detailed strategies to achieve the knowledge/evidence-related objectives in the Strategic Plan. For example, Goal 2: "Enhance the Delivery and Experience of Care," Objective 2a: "Ensure safe and high-quality care through the use of health IT" ensures evidence-based care primarily through this one strategy, "Optimize care delivery by applying advanced capabilities like machine learning, evidence-based CDS, and smart dashboards and alerts." Another example, Goal 4: "Connect Healthcare and Health Data through an Interoperable Health IT Infrastructure" allows the seamless exchange and integration of health information between platforms using shared data standards and common terminologies, which equips patients, caregivers, and healthcare providers with complete and accurate health records, so they can establish comprehensive and tailored care plans, make informed decisions about care, and engage in preventive care. The ACTS Roadmap provides a stakeholder-driven future vision for what these goals should look like and how achieve them.

The plan's goals are deliberately outcomes-driven, with objectives and strategies focused on using health IT as a catalyst to empower patients, lower costs, deliver high-quality care, and improve health for individuals, families, and communities. ONC and its Federal partners have taken and will continue to take steps to ensure that stakeholders in the healthcare sector benefit from the electronic access, exchange, and use of health information." Strategic plan strategies that are highly synergistic with the ACTS Roadmap include:

- 1b: support care plan adherence and healthy choices
- 1c: integrate social determinant information into CDS
- 2a: optimize and extend care beyond traditional settings with smart dashboards, CDS, remote monitoring/telehealth) and monitoring outcomes with eCQMs
- 2c: reduce provider burden with evidence-based workflow tools
- 3a: support appropriate use of health and human services data (e.g., "to close the LHS loop")
- 3b: build the evidence base on the use of health IT to improve quality
- 4a: promote a digital economy, support provider adoption and use of health IT, adopt and advance nationally endorsed standards, and implement specifications

Figure A-2. ONC 2020–2025 Strategic Plan Framework (158)

STRATEGIC PLAN
Framework

Promote Health and Wellness — GOAL 1

Objective 1a: Improve individual access to health information
Objective 1b: Advance healthy and safe practices through health IT
Objective 1c: Integrate health and human services information

Enhance the Delivery and Experience of Care — GOAL 2

Objective 2a: Ensure safe and high-quality care through the use of health IT
Objective 2b: Foster competition, transparency, and affordability in healthcare
Objective 2c: Reduce regulatory and administrative burden on providers
Objective 2d: Enable efficient management of resources and a workforce confidently using health IT

Build a Secure, Data-Driven Ecosystem to Accelerate Research and Innovation — GOAL 3

Objective 3a: Advance individual- and population-level transfer of health data
Objective 3b: Support research and analysis using health IT and data at the individual and population levels

GOAL 4 — Connect Healthcare and Health Data through an Interoperable Health IT Infrastructure

Objective 4a: Advance the development and use of health IT capabilities

Objective 4b: Establish transparent expectations for data sharing

Objective 4c: Enhance technology and communications infrastructure

Objective 4d: Promote secure health information that protects patient privacy

The principles, framework, challenges, opportunities, goals, objectives, and strategies outlined in the Strategic Plan, and summarized in the Health IT Buzz blog (159), resonate strongly with and complement well the ACTS Roadmap. For example, data access and interoperability promoted by this Plan is key to the virtuous LHS cycle described in the ACTS Roadmap, which, in turn provides more detailed strategies for achieving the knowledge /evidence-related objectives in the Strategic Plan.

For example, Goal 2: "Enhance the Delivery and Experience of Care, Objective 2a: Ensure safe and high-quality care through the use of health IT" addresses ensuring evidence-based care primarily through this one strategy, "Optimize care delivery by applying advanced capabilities like machine learning, evidence-based CDS, and smart dashboards and alerts." **The ACTS Roadmap provides a stakeholder-driven future vision for what this should look like and how achieve it.** The same goes for Goal 4: "Connect Healthcare and Health Data through an Interoperable Health IT Infrastructure." When patients, caregivers, and healthcare providers are equipped with complete and accurate health records, they can establish comprehensive and tailored care plans, make informed decisions about care, and engage in preventive care. An interoperable health IT infrastructure facilitates this by allowing the seamless exchange and integration of health information between platforms using shared data standards and common terminologies.

ONC hosted a virtual CDS workshop in September 2020 (160). This is one of many examples of things ONC is doing that is highly synergistic with actions that will be required to execute this Roadmap.

ONC–ASPE–PCORTF Data Infrastructure Projects

ONC led or collaborated on 10 projects funded PCORTF and managed by the ASPE that informed policy, standards, and services specific to the adoption and implementation of a PCOR data infrastructure (161):

1. **Synthetic Health Data Generation to Accelerate PCOR (2019–ongoing)** will enhance the ability of software to produce high-quality synthetic data for opioid, pediatric, and complex care use cases
2. **Training Data for Machine Learning to Enhance PCOR Data Infrastructure (2019–ongoing)** will conduct foundational work to support future applications of machine learning and AI to health, healthcare, and PCOR
3. **Common Data Model Harmonization (ended in 2019)** developed mappings to support harmonization and advance the interoperability of the data within four common data models (CDMs): Sentinel, PCORnet, Observational Health Data Sciences and Informatics, and Informatics for Integrating Biology and the Bedside
4. **Coordinated Registry Network for Women's Health Technologies (ended in 2019)** developed and tested a standards-based approach to establishing a coordinated registry network (CRN) that is focused on women's health technologies, including tools to facilitate data collection within registries
5. **Data Access Framework (ended in 2017)** published standards that facilitate the ability to access and extract data from within an organization's health IT systems, from an external organization's health IT systems, or from health IT systems across multiple organizations
6. **PGHD (ended in 2018)** identified best practices, gaps, and opportunities for progress in the collection and use of PGHD for research and care delivery
7. **Patient Matching, Aggregating, and Linking (ended in 2019)** addressed some of the obstacles of linking patient data across research, claims, and clinical data sets
8. **Patient-Reported Outcomes (PROs) through Health IT (ended in 2019)** developed and tested the standardized integration of structured PROs data in EHRs and other health IT solutions to support interoperable exchange of this information

9. **Privacy and Security Framework for PCOR (ended in 2019)** developed tools and resources to address the complex privacy- and security-related legal and policy considerations that arise when using electronic health data for PCOR
10. **Structured Data Capture (ended in 2016)** published standards that enable an EHR to retrieve, display, and fill a structured form or template, and store or submit the completed form

ONC Federal Health IT Coordinating Council FHIR & USCDI Workgroups

The ONC Federal Health IT Coordinating Council FHIR and USCDI workgroups (162) are assessing Federal Government use of FHIR and providing internal guidance for development, implementation, and use of FHIR that covers a majority of Federal use cases.

ONC Interoperability Proving Ground

The Interoperability Proving Ground is an "open, community platform where you can share, learn, and be inspired by interoperability projects occurring in the United States (and around the world)" (163).

University of Michigan Knowledge Grid

University of Michigan Knowledge Grid (164) is a four-part platform—comprised of knowledge objects (i.e., modularized, externalized computer-processable knowledge), a digital library (i.e., digital repository for storing and managing knowledge objects), activators (i.e., systems for deploying knowledge objects to process health data), and services (i.e., mechanisms for using the deployed knowledge objects)—that allows users to take actionable knowledge, make it machine-ready, and manage it; deploy the added knowledge as services to generate health advice; and apply the health advice to real-world decisions for better outcomes.

University of Michigan MCBK

MCBK[15] (71) is an international community from academia, the sciences, and government working together to ensure that computable biomedical knowledge is FAIR.

Produce Evidence and Guidance

CDC

The CDC publishes guidance to mitigate the biggest health problems that cause the most death and disability for Americans and educate the public health workforce about new and emerging health threats (165), including COVID-19 (166) and the opioids (167).

National Health IT Priorities for Research

The *National Health IT Priorities for Research: A Policy and Development Agenda* (168) supports alignment between the clinical and research ecosystems. Priorities 1–8 address data management activities related to closing the action-to-data-to-evidence portion of the LHS cycle that the ACTS Roadmap seeks to deliver and outline specific work to be done to realize these Roadmap goals. Priority 9, "Accelerate integration of knowledge at the point of care," speaks directly to the evidence-to-knowledge-to-action portion of the LHS cycle. The ACTS Roadmap provides detailed steps—and broad stakeholder engagement—to address each of these priorities.

NIH

NIH produces and aggregates a vast amount of healthcare evidence (169) and guidance (170), including specialized guidance for health emergencies such as COVID-19 (171). NLM's many databases, including PubMed and PubMed Central, Bookshelf, MedlinePlus, and ClinicalTrials.gov support the health services research community. NLM's Unified Medical Language System and clinical vocabulary and data standards resources are used by individuals in clinical research and health practice in the United States and globally (172).

NIH HSR Request for Information (RFI)

NIH HSR RFI (172) is seeking input on future resource and program directions in support of information related to health services research, practice guidelines, and health technology, including technology assessment.

NLM Strategic Plan 2017–2027

The *NLM Strategic Plan 2017–2027 (A Platform for Biomedical Discovery and Data-Powered Health)* (173) and corresponding RFI (174) enhances research, development, training, and information services to make more biomedical data FAIR, invent the tools and services to turn data and information into knowledge and insight, and develop the workforce capable of doing so. "NLM will enhance its efforts to collect, organize, and disseminate well-understood (literature) and non-traditional research objects, notably, but not only, data. ...NLM will lead this process by creating, collecting, and curating digital research objects such as articles, data sets, analytic strategies, and visualization tools, as well as executable objects such as workflows, analytic pipelines, simulations, and predictive models. Systems will be designed around the FAIR principles..." "NLM will link its expanding collections into an ecosystem that ensures digital research objects are FAIR." (175)
The ACTS Roadmap describes one important context for where/how NLM programs and resources are applied. That is within a knowledge ecosystem cycle that supports LHSs in achieving the Quintuple Aim. This knowledge ecosystem closely relates to and overlaps with the ecosystem mentioned in the NLM strategic plan. AHRQ and many other organizations (including NLM per its strategic plan) are exploring enhancements to their DKPs to make their offerings more FAIR (through standards-based content computability) and useful in ways that better meet user needs and deliver a robust knowledge ecosystem that supports desired outcomes.
The ACTS COVID19 Guidance to Action Collaborative/Learning Community (55) is bringing together diverse stakeholders to advance the knowledge ecosystem (e.g., as outlined in the diagrams on this Learning Community page (176)) as it relates to the COVID19 pandemic. NLM's collections that it

seeks to make more FAIR—including the resources it provides to support health services research stakeholders—play a critical role in this ecosystem. NLM could consider the details of the knowledge ecosystem, LHS, and Quintuple Aim (e.g., as outlined in the ACTS Roadmap and COVID Collaborative)—and related efforts to achieve these goals—as important context for the ecosystem NLM aims to deliver/support. That is, consider these efforts as use cases in addressing the core of NLM's service model as it relates meeting the biomedical information needs of all who participate in this work. In the immediate term, ensure that all NLM's pertinent COVID19 offerings and efforts are fully used in ACTS Collaborative efforts to enhance and leverage the pertinent knowledge ecosystem components and, likewise, leverage this engagement to support efforts to build out a next generation NLM digital ecosystem.

NLM could also play a key role in any stakeholder-driven steps to execute this Roadmap (e.g., related to the COVID Collaborative and other efforts that might arise after the Roadmap deliverable is submitted) to ensure synergies between NLM's evolving digital platform is synergistic with those of others with which it must seamlessly interoperate (i.e., exchange standards-based, computable information) to fully achieve shared goals.

Make Guidance Computable

CDC Adapting Clinical Guidelines for the Digital Age (CDC-ACG)

CDC-ACG (177) is a strategy to get CDC's evidence-based CDS guidance quickly, accurately, and consistently into patient care.

COVID19 Healthcare Coalition's (C19HCC) Digital Guideline Working Group

The C19HCC[15] (178) is a private-sector-led response that brings together healthcare organizations, technology firms, nonprofits, academia, and startups to preserve the healthcare delivery system and help protect U.S. populations. Together, we're working to provide data-driven, real-time insights that improve outcomes. The Digital Guideline Workgroup (179) developed and has begun using a knowledge elicitation tool for producing computable clinical practice guidelines. Synergies are being cultivated between this tool and the tool requirements project (see E.3.2, Evidence /Guidance Computability Tools Requirements Pilot).

HL7 CPG-on-FHIR

HL7 CPG-on-FHIR (86) provides a means of creating a computable representation of a narrative clinical guideline that is faithful to guideline intent and supports the derivation of downstream capabilities such as cognitive and decision support, quality measures, case reporting, and documentation templates that direct clinical documentation in support of determining guideline compliance.

OMG BPM+

OMG BPM+ (Business Process Model and Notation \[BPMN\], Case Management Model and Notation \[CMMN\], and Decision Model and Notation \[DMN\]) (180) is a cross-discipline group of professional organizations, clinical societies, and healthcare providers working together to develop and pilot standards-driven healthcare process automation techniques to fully realize the benefits of Healthcare IT by applying business process modeling standards to clinical best practices, care pathways, and workflows directly at the point of care.

Project Gemini

Project Gemini (181) is a joint initiative of HL7 and Integrating the Healthcare Enterprise International (IHE) to advance interoperability. The goal is to identify and pursue pilot projects that focus the people, resources, and processes of both organizations to accelerate the implementation of FHIR to address high-value use cases. Pilot project activities may include coordinated development, testing and demonstration of standards specifications, including FHIR Resources and IGs and IHE Profiles. One of its pilot implementation projects is focused on Computable Care Guidelines (CCG).

Disseminate Evidence and Guidance

COVID19 Evidence Network to support Decision-making (COVID-END)

COVID-END (74) is a time-limited network that brings together more than 50 of the world's leading evidence-synthesis, technology-assessment, and guideline-development groups, covering the full spectrum of the pandemic response, from public-health measures and clinical management to health-system arrangements and economic and social responses, in the full spectrum of contexts where the pandemic response is playing out, including low-, middle- and high-income countries.

Graphite Health

Graphite Health (182) is a non-profit with a mission to establish a trusted digital ecosystem of standardized medical information—comprised of a plug-and-play interoperable data platform and an open, innovative, and secure application marketplace governed by the Digital Hippocratic Oath (DHO)—that provides real-time data aggregation, analytics, AI, and augmented decision support tools. Created for and by its health system members, Graphite will drive the advancement of healthcare for all patients by:

- Creating a jointly supported, system-aligned digital development capability populated of top-tier operational leaders, engineers, data scientists, and innovators to exceed the capabilities achievable by any single health system effort
- Constructing a democratized public utility infrastructure that enables the standardization of medical information while maintaining informational fidelity with an operation platform that enables plug-and-play interoperability by creating a common language for healthcare
- Building a marketplace, GRAPHITEHEALTH 2, that efficiently connects the buyers (healthcare systems) and sellers (software developers) via our standardized infrastructure, resulting in a marketplace that is an open, innovative, and secure location governed by the DHO
- Enabling the realization of value via better care and cost efficiencies, which is made possible by digitally empowering our providers and employees with real-time data aggregation, analytics, AI, and augmented decision support tools available via symbiotic marketplace–platform interaction

Logica HSPC Marketplace

The Logica HSPC Marketplace (183) is an open-source, operational implementation of the Marketplace REST specification jointly developed with HL7 for vendor-neutral exchange of executable, standardized healthcare services and knowledge.

NIH U24 Funding Opportunity Announcement (FOA) PAR-20-097 Biomedical Knowledgebases

NIH's U24 FOA PAR-20-097 Biomedical Knowledgebases (184) supports biomedical knowledgebases that extract, accumulate, organize, annotate, and link growing bodies of information related to core datasets, while supporting efficient and effective data curation methods that scale to the needs of the community and include semiautomated methods.

NIH FOA PAR-20-089 Biomedical Data Repositories

NIH's FOA PAR-20-089 Biomedical Data Repositories (185) supports biomedical data repositories that ingest, archive, preserve, manage, distribute, and make accessible the data related to a particular system or systems, while supporting data curation methods that improve the efficiency and accessibility of data ingestion, management, use, and reuse by the user communities (could support data and knowledge gathering related to the core topics that the Roadmap addresses, such as hypertension (part of the National Heart, Lung, and Blood Institute's \[NHLBI\] mission) and COVID /pandemic (part of the National Institute of Allergy and Infectious Diseases' \[NIAID\] mission).

Implement Guidance

HHS 2018–2022 Strategic Plan

HHS' 2018–2022 Strategic Plan (186) has several strategic objectives that align with this Roadmap:

- Strategic Objective 1.2: Expand safe, high-quality healthcare options
  - Support research and innovation to strengthen evidence-based recommendations
  - Address quality gaps and safety risks for healthcare-associated conditions
  - Translate knowledge and evidence into practical tools, training, and other resources to accelerate progress to improve quality and patient safety
- Strategic Objective 2.1: Empower people to make informed choices for healthier living
  - Encourage providers to communicate effectively with patients, families, and caregivers by offering tools and resources to assist discussions centered around care and healthier living
  - Develop tools and resources that improve health department and healthcare setting efficiency in providing education, training, and quality assurance for screening, treatment, services, and prevention messages
  - Improve early detection and treatment of people with multiple chronic conditions, such as heart disease, asthma, diabetes, kidney disease, cancer, chronic pain, and dementia
  - Improve human immunodeficiency virus (HIV) viral suppression and prevention by increasing engagement and re-engagement activities for screening, treatment, care, and support services
- Strategic Objective 2.4: Prepare for and respond to public health emergencies
  - Provide subject expertise and tools to ... health systems and facilities ... to strengthen their capabilities to provide continuous, safe, and effective healthcare.
- Strategic Objective 4.4: Leverage translational research, dissemination and implementation science, and evaluation investments to support adoption of evidence-informed practices speaks directly to a centerpiece of what the ACTS Roadmap seeks to accomplish:
  - Assess evidence-based practices and service delivery system improvements to increase access to services and improve outcomes for disproportionately affected populations
  - Support research conducted in a variety of settings and populations, to improve the quality and utility of evidence generated from HHS investments and the impact of those investments on a broad range of outcomes
  - Evaluate multifaceted strategies to apply evidence-based interventions to reach disproportionately affected populations and reduce health disparities
  - Increase dissemination and implementation of evidence-based practices and provide training and technical assistance to stakeholders to improve outcomes
  - Systematically review current evidence on the effectiveness of programs and policy, and disseminate findings in easily accessible formats to practitioners and decision-makers
  - Disseminate patient-centered outcome research findings to health professionals and organizations that deliver healthcare
  - Encourage the use of learning agendas—PDF or other tools to prioritize critical questions that generate evidence to guide decision making and continuous learning, including short- and long-term questions that build a portfolio of evidence about what works for whom
  - Foster a culture of learning through opportunities for coordination and collaboration within and across HHS and with external partners
  - Identify improvements to existing evidence-based programs and policies to share broadly with local communities for public health impact
  - Promote the use of common evidence standards, principles and practices for evaluation, and policies that support rigorous, relevant, transparent, independent, and ethical evidence-building activities
  - Engage healthcare, public health, and human service system research networks to study and support local adaptation or customization of evidence-based practices
  - Develop and disseminate tools and provide technical assistance that supports adoption and implementation of evidence-based practices to improve access to high-quality public health, healthcare, and human services
  - Support knowledge translation capacity and practice to ensure that knowledge generated by grantees and others working in the field is used or adopted by its intended users
  - Promote innovative approaches to translating research into interventions that improve health and well-being, by modernizing processes and removing obstacles to bring more effective practices to more people more quickly
  - Leverage cutting-edge science to support product development strategies, regulatory evaluation, and implementation science by establishing platforms for interaction with academic institutions, other Government agencies and their investments, and industry
- Strategic Objective 5.3: Optimize information technology investments to improve process efficiency and enable innovation to advance program mission goals
  - Build multiuse and interconnected systems that are intuitive, usable, and accessible

- Capitalize on and leverage best practices from divisions within HHS and the private sector to develop enterprise-wide information technology solutions, while minimizing custom application development, maximizing collaboration, and reducing cost
- Improve system interoperability to allow efficient data sharing

Healthy People 2030

The HHS Office of Disease Prevention and Health Promotion Healthy People 2030 initiative (187) is a program that sets data-driven national objectives to improve health and well-being over the next decade.

Measure and Improve Care Quality

NCQA

NCQA "measures performance to inform health care quality improvement." (188) In its efforts to build a more equitable, sustainable, and responsible healthcare system, NCQA seeks to refine and develop quality measurement to help stakeholders drive toward health equity and address SDOH; reduce burden and improve care by moving to a digital quality measurement system that captures quality data during care delivery and provides results and decision support much more rapidly; and validate data to ensure accurate payments in value-based models (189).

MedMorph

As part of CDC's efforts to "build and connect the digital public health data superhighway" to facilitate the seamless and timely flow of EHR data, MedMorph is an project to create a reliable, scalable, and interoperable method to get EHR data for multiple public health and research scenarios (use cases) through development of a reference architecture and demonstrated implementation that will reduce the burden on healthcare providers and help provide the standards and methods to receive and send data from EHRs for a variety of public health and research purposes. (62)

National Health Quality (NHQ) Roadmap

Executive Order 13877, *Improving Price and Quality Transparency in American Healthcare to Put Patients First* (190), directed the Secretaries of HHS, DOD, and VA to publish a health quality roadmap detailing a strategy to establish, adopt, and publish common quality measurements; align inpatient and outpatient measures; and eliminate low-value or counterproductive measures.
The NHQ Roadmap is driving change through governance and oversight, data collection and reporting, and aligned measures in Federal quality programs. Figure 1 (page 11) of the NHQ roadmap (191) summarizes the planned actions and general timing for milestones. When implemented, the NHQ Roadmap will "accelerate change and advance the Administration's goals of improving transparency, reducing provider burden, allowing informed consumer decision-making, and ultimately improving the health of all Americans."

NHQ Roadmap Synergies with ACTS Roadmap

Measuring care delivery performance effectively/efficiently to drive better outcomes is a key focus of the NHQ Roadmap and using that information to drive the virtuous data to evidence to knowledge/tools to action to data cycle is a key focus of the ACTS Roadmap approach to improving outcomes. These are complementary aspects of enabling organizational and national LHSs to achieve the Quintuple Aim via high-functioning and integrated knowledge and data ecosystems. The NHQ Roadmap ensures that the Quality Measurement Enterprise (QME) part of the cycle works well and the ACTS Roadmap will help ensure that this better functioning QME achieves its quality goals by similarly strengthening the other parts of the LHS /Quality cycle.
These excerpts exemplify specific NHQ Roadmap items that resonate with the work outlined in the ACTS Roadmap to provide a robust knowledge ecosystem that provides much more successful approaches for translating quality measurement results into evidence, guidance, and action than those currently in use.
The NHQ Roadmap contains the principal for reform (192): "Quality Information is Available and Meaningful." The QME should produce accurate, timely, and actionable information with sufficient clinical detail on healthcare quality for:

- Patients selecting providers and **making choices about their healthcare**
- Providers **identifying opportunities for improvement in providing care**
- Payers and policymakers seeking to **align financial incentives with health quality goals**

The sections that follow describe the NHQ Roadmap's opportunities for change (193).

Governance & Oversight

"HHS, DOD, and VA will, in conjunction with private-sector stakeholders, establish an enduring, integrated, and transparent governance and oversight structure to oversee the administration of Government healthcare quality programs, quality measures and standards, core data sets, and quality data collection." (193)
The ACTS Roadmap calls for a similar PPP to support evolution of the knowledge ecosystem of which the QME is a key part. These initiatives can be integrated and coordinated to achieve overlapping goals. The governance called for in the ACTS Roadmap can be seeded as an extension of these NHQ Roadmap governance/oversight efforts.

Data Collection & Reporting

"...Federal data are housed in isolated datasets on systems limited in their ability to share and receive information." "…Leveraging the governance body described above, the Federal Government will reevaluate its approach to data collection and reporting, with the goal of empowering the intended users of the data—patients, providers, policymakers, and payers—with access to timely and transparent information about the quality of care..."(193)

Similar considerations to the first quote about isolated data sets apply to Federal assets providing _guidance_ (e.g., from AHRQ, CDC, NLM, VA, DOD, etc.) to patients, care and quality teams, and policy makers about how to optimize _care delivery_ and _QI decisions_ and actions—leveraging quality measurement data. The knowledge ecosystem and related efforts proposed in the ACTS Roadmap are focused sharply on these data to evidence to guidance to action steps, and the NHQ Roadmap efforts described in the second quote could be applied to reevaluating these guidance

silos as well, and empowering the users of both the data and the knowledge, applying the "what happened?" (measurement) and "what should happen \[based on best evidence\]?" (guidance) information together to realize healthcare quality goals.

Quality Measures in Federal Programs

"Leveraging the governance body described above, the Federal Government will undertake a systematic review of its quality reporting and value-based payment programs, to identify opportunities to reduce burden, promote efficiency and effectiveness, and accelerate the shift to value..." (193)
As in the point above, there is an opportunity to accompany this action-oriented analysis of Federal quality *reporting* and *incentive* programs with the companion assessment on evidence and guidance development, dissemination, and implementations in ways that better tie together the 'what happened,' 'what should happen,' 'help make the right things happen' components of achieving quality goals.
The NHQ Roadmap's Call to Action/Planned Actions (194) resonate with several of the core ACTS Roadmap recommendations regarding coordinating Federal efforts with each other and with other related public and private efforts. For example, specific NHQ Roadmap action items listed under oversight and governance, data collection and reporting, quality measures and reporting, and other considerations (e.g., related to patient-reported outcome measurements) mirror ACTS Roadmap recommendations regarding the *entire* quality ecosystem / life cycle (176)—*including* the *quality measurement* efforts that are the focus of the NHQ Roadmap.

NIH National Center for Advancing Translational Sciences (NCATS) National COVID Cohort Collaborative (N3C)

The NIH NCATS N3C (195) is a centralized national data resource—the NCATS N3C Data Enclave—that the research community can use to study COVID19 and identify potential treatments as the pandemic evolves. Specifically, N3C will enable the rapid collection and analysis of clinical, laboratory, and diagnostic data from hospitals and healthcare plans.