Strategic Options for the Modernization of the

Indian Health Service Health Information Technology

Final Report
October 2019

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Vision Statements

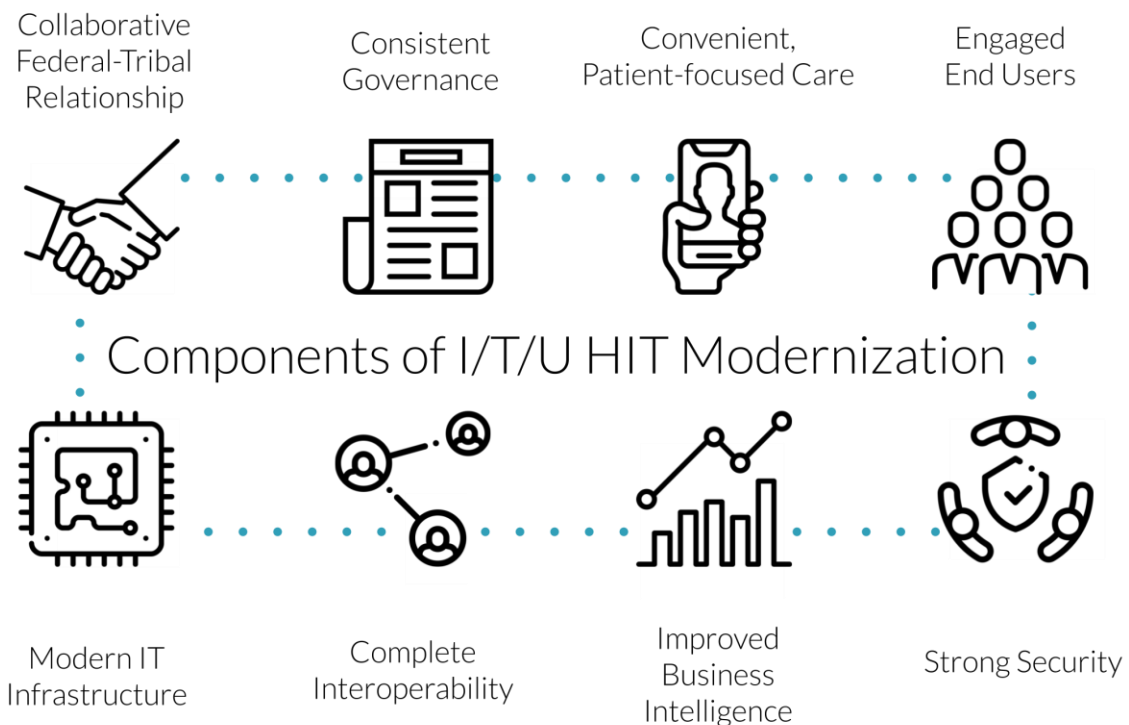**IHS HIT Modernization Project Vision**

Support the Indian Health Service (IHS) mission to raise the physical, mental, social, and spiritual health of American Indians and Alaska Natives (AI/AN) to the highest level[1] through modern, innovative, and practical health information technology.

IHS Vision

Healthy communities and quality healthcare systems through strong partnerships and culturally responsive practices.[1]

IHS Office of Information Technology (OIT) Vision

To meet customer needs by providing excellent, reliable, interoperable health information services that protect privacy while connecting patients, providers, and payers, enabling improved patient outcomes and controlled costs in support of the IHS mission.[2]

Components of I/T/U HIT Modernization

Collaborative Federal-Tribal Relationship · Consistent Governance · Convenient, Patient-focused Care · Engaged End Users · Modern IT Infrastructure · Complete Interoperability · Improved Business Intelligence · Strong Security
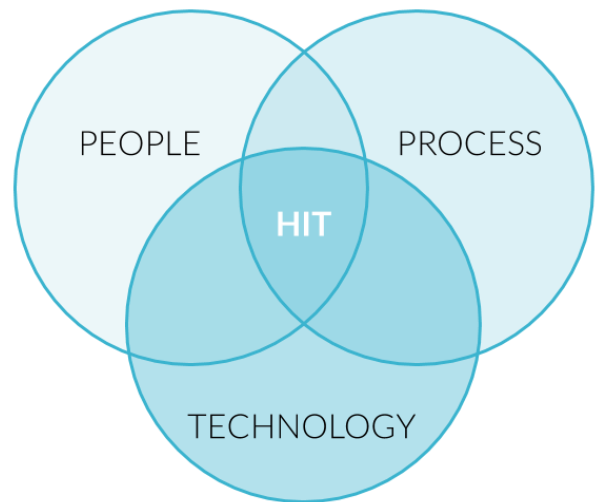
Executive Summary

" We need a system that combines the modern qualities of efficiency and clinical efficacy and notions of ethics but maintains a personal, empathetic, thoughtful feel. For us it must incorporate tradition and ancient culture into today's life."

The Department of Health and Human Services (HHS) IHS Health Information Technology (HIT) Modernization Project provides a comprehensive assessment of the people, process, and technology that comprise the existing IHS HIT system, including the Resource and Patient Management System (RPMS). From its inception, the Modernization Project embraced a human-centered design methodology and was committed to the following principles:

- Honor and respect tribal communities and stakeholders
- Be people-centered
- Utilize impactful, community-serving processes
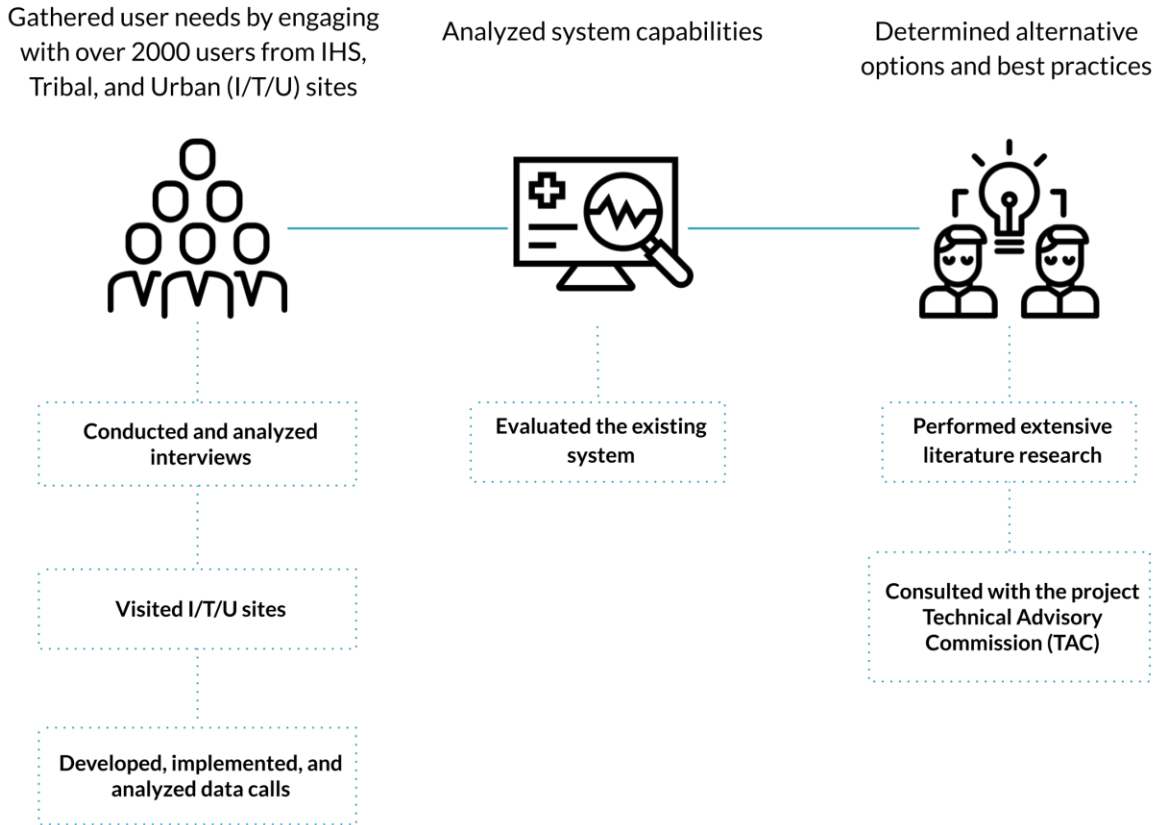- Be data-driven in all decision making

These principles provided the framework for the analysis of HIT within the IHS ecosystem. IHS facilities provide cradle-to-grave care that requires personal, family, and community health data for informed clinical decision-making. IHS and Tribal facilities have an additional commitment to the inclusion of community care, public and population health, and environmental health and epidemiology, making IHS a unique federal healthcare delivery model.[1] The pledge to respect AI/AN self-determination, the increase in government regulation of healthcare, and the transformation of HIT requirements and capabilities nationwide have resulted in an ever-changing milieu for AI/AN healthcare delivery. Understanding this complexity is critical to the HIT modernization effort.

A Three-Pronged Approach

The project team developed and implemented the following three-pronged approach to better understand the current state of the IHS HIT systems and the unique needs of the users that they serve.

To execute the project, the team:

Gathered user needs by engaging with over 2000 users from IHS, Tribal, and Urban (I/T/U) sites

Analyzed system capabilities

Determined alternative options and best practices

Conducted and analyzed interviews

Evaluated the existing system

Performed extensive literature research

Visited I/T/U sites

Consulted with the project Technical Advisory Commission (TAC)

Developed, implemented, and analyzed data calls

The modernization roadmap work initiatives[6] address the insights identified over the course of the project through multiple channels. These insights were transformed into the eight recommendations described below. The recommendations address high-priority concerns identified during field visits and/or direct contact with healthcare providers, leadership, and other users and consumers of HIT.

RECOMMENDATIONS FOR HIT MODERNIZATION

Honor the Federal-Tribal Relationship and its Unique Complexities

The IHS must establish principles to honor the federal-Tribal relationship as it seeks to address HIT challenges.

- Prioritize principles to honor the federal-Tribal relationship
- Charter a joint advisory committee
- Engage with Tribal stakeholder groups

Ensure Consistent Organizational Governance for Leadership

Clinical and technological engagement and effective governance are as important as the specific technology platform selected.

- Establish and maintain compact, effective, and efficient governance
- Form a governing body to interact with inclusive stakeholder groups

Create an Engaging, Modern, Convenient System for Patients

The IHS modernization effort should be patient-focused and aim to create a more engaging, modern, and convenient system for patients to access their healthcare.

- Consult with outside organizations and businesses
- Provide a user-friendly patient portal

Engage End Users to Understand Their Needs

End users should be engaged in all steps of the modernization process to ensure their needs are met by the modernized system.

- Foster listening sessions to learn best practices and challenges
- Follow a five-phase design thinking model
- Develop system requirements from collected data
- Engage experts
- Increase training and support

Provide Full Support for Data Exchange & Interoperability Between IHS Systems & Components

Interoperability should be implemented across all IHS facilities to provide seamless data exchange and communication, ensuring comprehensive patient care.
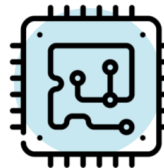
- Establish longitudinal health information exchange
- Support interoperability in any system selected
- Provide continuous evaluation and modification of HIE processes

Improve Analytics & Business Intelligence

Analytics and business intelligence functionalities must be integrated into the modernization process to provide quality public and population patient health care.

- Conduct a user-centered gap analysis
- Determine topology and architecture for analytics
- Align analytics solutions with modernization goals

Modernize the IHS HIT Infrastructure

The IHS HIT Infrastructure must be updated to meet the healthcare delivery needs through appropriate and adequate bandwidth, network, communications, hardware, support, and training.

- Address infrastructure concerns
- Minimize applications, focusing on patient safety, operational fundamentals, and cybersecurity
- Plan for continued maintenance of VA-sourced software

Strengthen IHS Security & Compliance

The HIT ecosystem must be continuously assessed and updated to meet security and privacy compliance.

- Develop a framework for security evaluation and remediation
- Ensure compliance with existing standards
- Leverage other organizations

RECOMMENDED NEXT STEPS FOR IHS MODERNIZATION

▶ **Execute the critical path** to HIT modernization as referenced in the roadmap[6, 7]

▶ **Establish a program management structure** to ensure a coordinated and comprehensive approach to HIT modernization

▶ **Secure commitment to HIT modernization** from clinical and technical leadership who must provide support for appropriate governance, resourcing, and accountability

▶ **Perform ongoing, in-depth analysis** of the current IT landscape, including the review and endorsement of the identified applications, processes, and additional artifacts developed

▶ **Augment and reference initial findings** from this project and previous initiatives developed by IHS as required and ensure that the project maintains a comprehensive approach to HIT modernization

▶ **Ensure consistent engagement with tribes** to establish and maintain transparency with and responsiveness to I/T/U concerns

People and Process

Honor the Federal-Tribal Government Relationship and its Unique Complexities

The IHS must establish principles to honor the federal-Tribal relationship as it seeks to address health IT challenges.

The Challenge

Federally-recognized American Indian and Alaskan Native tribes and villages have a government-to government relationship with the United States. This unique relationship has been given substance through the U.S. Constitution, treaties legislation, Supreme Court decisions, and Executive Orders.

Healthcare delivery has evolved due to Indian self-determination, the increase in government regulation of healthcare, and the transformation of HIT requirements and capabilities nationwide. The mission has not changed, however, and as the agency seeks to address deficiencies and challenges in HIT, it must remain engaged with its partners in that mission. Understanding the complexity of the policies and barriers affecting funding, unique challenges in Indian Health Service, tribally operated, or urban Indian health programs (ITU) operations, reporting requirements imposed by multiple funders, a history of research affecting Tribal policies on data ownership, and increasing health compliance and accreditation standards demand that any HIT system address the need for commonly-accepted performance standards and streamlined, more intuitive data capture and reporting. Failure to address these systemic HIT deficiencies will result in future negative financial consequences for AI/AN people and tribes.

The IHS is not just another HHS program; IHS's mission which is to provide healthcare specifically for AI/AN people, is consistent with the nation-to-nation relationship and the authority granted the agency by Congress. A commitment to honor the Federal-Tribal partnership ensures that the process and outcomes meet the needs of the federal government and the Tribal nations.

> "We are the majority shareholder in this. We not only need to be at the table, **we need to own it.**"

Recommended Approach

The following actions will help honor and strengthen the federal-Tribal relationship and improve *trust* between tribes and the IHS.

- At the start of the HIT modernization planning and decision-making process, prioritize principles which honor the federal-Tribal relationship at the highest levels of IHS
- Charter a HIT Modernization Advisory Committee to support the collaboration necessary to advance innovation for technology improvements for the entire I/T/U health delivery system. Representation should include members who are recognized subject matter experts and have a collective working understanding of the I/T/U's mission, business models, Self-Governance policies, and the opportunities available to address unique intra- and interoperability and data requirements
- HHS/IHS should formalize immediate and continuous engagement with the various key stakeholder groups, including Direct Service tribes, Self-Governance tribes and Urban Indian programs within the I/T/U ecosystem[10]

Create an Engaging, Modern, Convenient System for Patients

The IHS modernization should be patient-focused and aim to create a more engaging, modern, and convenient system for patients to access their healthcare.

The Challenge

The ability for patients and caregivers to easily access and understand medical information from wherever they may be has become increasingly important and relatively standard practice in most healthcare settings. Currently, facilities using the existing HIT system within the I/T/U network have the ability to offer their patients a way to access some of their health information through a Personal Health Record (PHR).[11] However, the PHR is not being well utilized and at many sites is not yet available for use by patients.

Forty percent (40%) of respondents to the Modernization Project Data Call rated the electronic sharing of information with patients through a portal as "very poor" or "somewhat poor."[12] Staff who are familiar with the PHR either as patients themselves at the facility or through patient comments have reported that the PHR, in its current state, is difficult to navigate, contains ineffective patient education material, and does not include relevant clinical information. Additionally, patients may not always possess the necessary technology to access the PHR in its current state. In these instances, it is vital for providers to be able to print and provide patients with relevant, readable information, however this functionality is also lacking in the current system. Tribal health directors who were surveyed for this project rated the increased ability to create and distribute patient-centered care plans as one of their top desires.[13]

> "Look at the way that care is changing. **The way we engage patients is changing**: They're using smart phones; We have a health app that our elderly people are using. **Care is more than registration and appointment.**"

Patients have expressed the desire to access their information, order their medications, schedule their own appointments, and send messages to their care team.[12] Administrative personnel have noted that if patients had the ability to access their own records to make updates to demographic and contact information, it would improve accuracy and save time now spent in waiting rooms. Case managers and providers have noted that if they had a more efficient way of communicating with their patients, they would feel more confident that they are engaging more effectively with their patients.

Recommended Approach

- Improve patient engagement and satisfaction by providing a portal for patients to update their information, view lab results, schedule appointments, communicate with their healthcare team, refill prescriptions, and obtain culturally-relevant healthcare materials
- Embrace the concept of open notes for shared viewing by patients
- Consult outside organizations and businesses who frequently survey customer satisfaction to understand how to create a convenient, intuitive, modern experience for their patients
- Develop appropriate continuous metrics to support quality and patient safety, including longitudinal patient and healthcare team satisfaction

Ensure Consistent Organizational Governance for Leadership

Clinical and technological engagement and effective governance is as important as the specific technology platform selected.

The Challenge

Congress has recognized the right of tribes to direct the development and implementation of federal programs and policies that directly impact their Tribal members by enacting two major pieces of legislation. This legislation outlines the important concepts of Tribal self-determination and self-governance: The Indian Self-Determination and Education Assistance Act of 1975, as amended (25 U.S.C. 450 et seq.)[14] and the Tribal Self-Governance Act of 1994 (25 U.S.C. 458aa et seq.).[15] Through these laws, Congress accorded Tribal governments the authority to administer programs and services usually administered by the Indian Health Service (IHS) for their Tribal members. It also upheld the principle of Tribal consultation, whereby the federal government consults with tribes on federal actions, policies, rules or regulations that will directly affect them.

Recommended Approach

Literature and historical experiences support the conclusion that effective and representative governance is more important than the specific technology platforms selected.

- Governance must be effective and efficient
- The governing body for a project of this complexity must remain small to balance effective and efficient decision making and the need to be representative of a diverse collection of stakeholders
- Establish a multi-member governing body that interacts regularly with stakeholder groups, both formally through Tribal Consultation policies and informally through leadership and subject matter expert (SME) stakeholder user groups
    - The stakeholder groups should be inclusive to effectively represent the inherent diversity of the ecosystem[10]
    - Substantial clinical engagement must be continuous throughout the project

Technology

Engage End Users to Understand Their Needs

End users should be engaged in all steps of the modernization process to ensure that their needs are met by the modernized system.

The Challenge

In the early stages of the existing HIT system, informal collaborative decision-making at the local level allowed for easy customization to reflect Tribal culture and values. This permitted Tribal health organizations to take ownership of their HIT configuration and ensure that it could be agile enough to resolve needs as they came up.[16] However, long-standing underfunding of HIT within IHS coupled with a series of mandates that were unsupported by recurring funding (Meaningful Use and the ICD-10 transition, for example),[17] has hindered the ability of IHS Office of Information Technology (OIT) to keep pace with the industry-wide explosion in HIT capabilities as well as user needs.

> " I would like the EHR to do some things that other modern devices do. When you interact with your smartphone you get plenty of evidence that it's interacting with you; the EHR doesn't do that. It doesn't have any sense of your common diagnoses, it doesn't have any sense of you."

End users are generally dissatisfied with the existing HIT system, with 60% of Data Call respondents believing that the system needs significant improvements.[12] The current user experience (UX) is disjointed across several applications; moreover, current user experience design (UXD) leads to frustration and an increased risk of user error.[11, 18]

The existing HIT system also has limited functionality across several areas of care, including, but not limited to, obstetrics, behavioral health, emergency medicine, pharmacy, radiology, dental, women's health, laboratory, and pediatrics.[11]

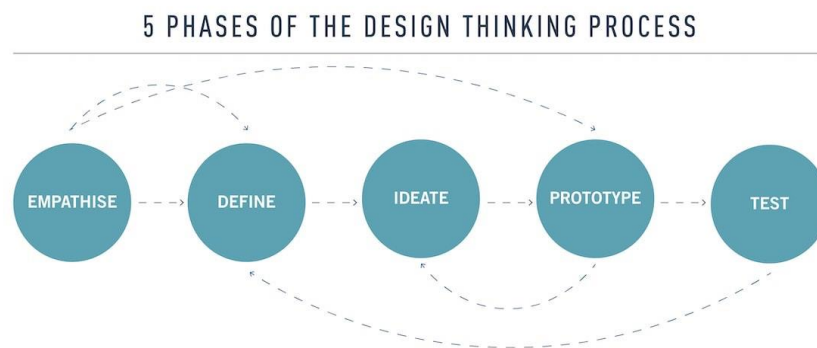> "Our health system currently includes Medical, Pediatrics, Visiting Nurses, Hep C Treatment team, Mental Health, Chemical Dependency, Suboxone treatment, and Dental. RPMS cannot meet the demands of all of these separate services." [11]

While training for the existing HIT system does exist, availability is scarce and occasionally too technical. Users report that it is difficult to apply what they learn in training to their workflow. With limitations in regular, formal training, staff often rely on their co-workers for direction and troubleshooting, which can lead to incomplete information.[11]

Recommended Approach

In order to efficiently manage programs, maximize revenue generation, and provide high-quality care for patients, staff must have access to a comprehensive HIT system that seamlessly integrates into and enhances their workflow.

- In the near term, use human-centered design practices and tools to foster facility-level listening and ideation sessions with the goal of obtaining a better understanding of HIT best practices and challenges across roles. Leverage existing models created by the Modernization Project, Centers for Medicare and Medicaid Services (CMS), or the United States Digital Service (USDS) to create event-in-a-box-style tools for sites
- Follow the design thinking model[18] when designing and implementing a new HIT system

5 PHASES OF THE DESIGN THINKING PROCESS

EMPATHISE — DEFINE — IDEATE — PROTOTYPE — TEST

- Use the data collected by the Modernization Project as the foundation for a list of user-identified system requirements
- Provide resources, both human and financial, to continuously evaluate and evolve the system as new technology and processes become available
- Aim to establish software configuration consistency when appropriate and customization when essential
- Engage usability experts who understand the unique needs of the I/T/U network during the design process
- Develop, adopt, and increase availability of user-centric training and support

Provide Full Support for Data Exchange and Interoperability Between IHS Systems and Components

Interoperability should be implemented across all IHS HIT facilities to provide seamless data exchange and communication, ensuring comprehensive patient care.

The Challenge

Currently, the paucity of data sharing across IHS impacts patient care. Improving data sharing would reap numerous patient benefits. Interoperability, or the ability for different systems and applications to seamlessly exchange data, is essential to supporting comprehensive care. Interoperability and data sharing improves care coordination and patient experiences, supports greater patient safety, privacy, and security, and increases productivity.

The following technology gaps were identified during the course of the Modernization Project:

"In this modern world there is absolutely no reason why an out-of-area Tribal person can't receive care from our facility. **The record needs to revolve around the patient.** I should be able to share it with any provider wherever I go."

- Limited continuity of care within a facility -- Manual transferal of information between applications is burdensome, error-prone, and time-consuming
- Little automatic data capture from biomedical equipment -- Data generated from biomedical equipment should be incorporated directly into the HIT system without the need for additional data entry. Smart machines, such as thermometers, electronic blood pressure instruments, heart monitors, glucometers, scales, EKG machines, and fetal monitoring equipment are available at some sites, but in many cases the data must be entered into the system manually, which requires additional time and increases the risk of data entry error and an absence of critical data at the point of care
- Limited continuity of care between facilities/organizations -- Interoperability is critical for the creation of a longitudinal health record that can be used to provide and improve care. There currently is reliance on a patient's self-reporting in the absence of interoperability. In an environment where it is not uncommon for services for a single patient to be seek care at several sites,[20] the necessity for inter-facility information exchange is paramount

Recommended Approach

The following steps are recommended to move toward system data sharing and interoperability.

- Establish a roadmap that commits to a health information exchange that can provide a patient's longitudinal record across facilities. To be successful, the enterprise model and the heterogeneity of the I/T/U system mandates evaluation of current models and the development of a comprehensive action plan to meet this goal
- Establish governance for evaluation of HIT systems to have processes and policies that ensure that systems developed or purchased support interoperability including current and future data and messaging standards and open application program interfaces (APIs)
- Ensure that historical data is available and integrated into future solutions
- Provide continuous evaluation and modification of processes to help ensure consistency in data quality, including data collection and data entry

Improve Analytics and Business Intelligence

Analytics and business intelligence functionalities must be integrated into the modernization process to provide quality public and population patient healthcare.

The Challenge

During the course of the Modernization Project, users commonly expressed frustration with the limited ability to access the data or reports they needed, even though the existing HIT system offers the ability to do so. It is important for clinicians, clinician leaders, and other managers at I/T/U facilities to have the ability to initiate queries and conduct analytics. There is a clear need and opportunity for improvement in the area of analytics and business intelligence as IHS pursues HIT modernization.

> **"** We did a project to look at high risk pregnancy patients, but the report was crazy. Most women in the report weren't pregnant, and there was a male in the report. You don't trust the data in the report, so we do manual extraction."

The generation of analytics in the existing HIT system has significant issues and deficiencies. Reporting capabilities are distributed across a wide range of applications and most reports and queries can only be executed via menu-driven character interfaces, even if the source applications are graphical. Institutional knowledge about the reporting capabilities of the existing HIT system is waning, and available training is not accessed by or targeted at those who would gain most value by knowledge of these features.

Recommended Approach

To ensuring successful continuation and evolution of facility-level analytics and business intelligence over the course of the HIT modernization effort, the following recommendations are presented:

- Conduct a user-centered gap analysis to identify current barriers and needs for clinical and administrative staff to conduct near real-time queries, both preconfigured and ad hoc, on locally served patients and populations
- Determine the best approach to address the user needs
- Determine the appropriate topology and architecture for the systems supporting analytics, whether it be locally- or centrally-deployed
- Ensure alignment with the overall HIT modernization goals to improve the systems supporting direct care and public health, as well as the analytics needs of the agency

Modernize the IHS HIT Infrastructure

The IHS HIT Infrastructure must be updated to meet the healthcare delivery needs through appropriate and adequate bandwidth, network, communications, hardware, support, and training.

The Challenge

While the existing HIT system runs well within the capabilities of commodity servers, client hardware at the local facilities is often under-provisioned and antiquated. Existing network infrastructure, software maintenance, and database development and support are deemed inadequate. Limited support for system maintenance and patches disrupts patient care and workflows. Sites are constrained by limited support personnel. Some sites have custom modifications to support their needs, presenting a challenge to receiving updates and potentially creating security issues. A modern HIT infrastructure is essential for the future.

"We are Americans, we should have access to quality electronic health records that the rest of the country has."

Recommended Approach

The following activities to achieve infrastructure modernization are recommended:

- Address technological infrastructure concerns and work with consultant groups for modernization guidance
- Select the fewest possible technology suites to minimize integration and maintenance challenges and maximize end-user satisfaction, focusing on three primary areas: patient safety, fundamental operational functions, and cybersecurity
- Restructure the organization, guided by organizational change management (OCM) initiatives, to facilitate IHS HIT infrastructure modernization
- If a commercially available off the shelf (COTS) solution is adopted, the IHS must sustain responsibility for VA-sourced applications or contract for continued maintenance of these applications with VistA-based companies until they are sunset[21]

Begin HIT modernization with the following steps to allow time for training, evaluation, and adoption and implementation of change processes:

- Establish a Program Management Office (PMO) to develop and oversee an implementation strategy
- Develop and implement appropriate governance to ensure decisions are made jointly with clinical and technical input
- Involve end users to ensure that critical requirements, such as the migration of historical data to the new platform, are included in planning
- Establish a consistent software development life cycle including implementation and deployment with the engagement of leadership and clinical personnel to foster transparency
- Complete an in-depth assessment and roadmap to address technical and infrastructure requirements and develop an organizational readiness framework
- Review and modify the proposed roadmap to include a sustainability model and the use of stabilization teams to ensure user needs are understood and prioritized appropriately
- Stabilize and consolidate current HIT infrastructure and processes

Strengthen IHS HIT Security and Compliance

The HIT ecosystem must be continuously assessed and updated to meet security and privacy compliance.

The Challenge

As the healthcare industry increasingly adopts technology and embraces public cloud infrastructure as core capabilities and competitive differentiators in delivery of healthcare services, the associated cybersecurity risks proportionally increase. Innovations in healthcare technology usher in significant value to patients along with cost-efficiencies and economies of scale to service providers. However, healthcare services delivered electronically leave facilities vulnerable to cyber-attacks. These risks exponentially increase in distributed, interconnected healthcare systems through which large volumes of healthcare data and information are exchanged among disparate organizations.

Recommended Approach

The following steps, tasks, and activities will help to strengthen IHS' HIT security and compliance posture to enable the organization to detect and identify security risks in order to protect its HIT ecosystem, and where necessary, respond to and recover from such attacks:

- Augment, implement, and document a framework for ongoing security evaluation and potential remediation of the HIT system
- Utilize real-time security monitoring, application event logging, and security performance metrics to continuously assess and improve HIT security practices
- Leverage other organizations to help identify and evaluate options for lightweight and appropriate data governance and privacy practices
- Continue to support authentication and the principle of least privilege (PoLP) authorization in application design, architecture, and implementation
- Integrate incorporation of security testing throughout the software development lifecycle (SDLC) as well as quality assurance (QA) and quality control (QC) processes
- Continue to ensure compliance with existing and future cybersecurity standards and federal data security and privacy regulations

Next Steps

The IHS HIT Modernization Project was designed to identify and frame the initial critical path required to achieve success; however, the proposed modernization program requires an immediate and long-term commitment. This work is a launching point for IHS HIT modernization requiring active engagement, iteration, and support to achieve the vision of HIT modernization within IHS. The recommendations in this work provide guidance for subsets of subsequent actions. The roadmap provides a more detailed critical path to HIT modernization.[6, 7]

Establishing a program management structure, as well as ownership by an organizational entity, is an essential next step. The organization should be responsible for the oversight and execution of a roadmap, ensuring a coordinated and comprehensive approach to HIT modernization. The roadmap developed for this project provides the initial substrate for the next phase of HIT modernization. Broad-based clinical and technical leadership commitment is essential to the implementation and success of this endeavor. Leadership must fully understand and establish a long-term commitment to the HIT modernization program through engagement and support for appropriate governance, resourcing, and accountability.

Additional understanding and in-depth analysis of the existing IT landscape beyond the current project artifacts are required, including the review and endorsement of the identified applications, processes, and artifacts developed. While this project provides a comprehensive review of the HIT components, there is a need for additional evaluation and endorsement of key findings by IHS.

The roadmap also includes multiple improvement opportunities identified through the human centered design discovery process. Nine strategies and 18 work initiatives were identified that are reflective of the recommendations in this final report. However, the overarching discovery process was not exhaustive. Additional iterative evaluation and work is required to augment these initial findings and ensure that the project maintains a comprehensive approach to this work.

The recommendations, coupled with the roadmap, provide an actionable path forward for HIT modernization within IHS. The collaboration between tribes and federal agencies can show that innovative and appropriate technology, along with streamlined policies and well-designed support, can advance population health and patient-centered care for health systems nationwide. This contributes to the improved health status and health outcomes for populations that remain at risk. Consistent engagement with tribes and transparency and responsiveness to I/T/U concerns are integral components to the HIT modernization enterprise initiative within IHS. The modernization effort belongs to tribes as well as to HHS/IHS.

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Appendix A: Constraints and Mitigations to the HIT Modernization Effort

The following constraints and mitigations were identified during the IHS HIT Modernization Project.

Constraints	Proposed Mitigations
Critical and unique system capabilities currently implemented in RPMS must be persisted to the replacement HIT solution or ecosystem	IHS must provide HIT systems that are attractive to Tribal and urban programs through support for integrated, multidisciplinary care (behavioral health, dental, etc.) as well as population health and individual patient care. Requirements and resultant capabilities and functionality related to traditional medicine, AI/AN population health, etc. must persist in the replacement HIT solution.
Funding and staffing levels	Noted as a foregoing operational issue but not assessed in detail; as such, this report assumes that funding to improve infrastructure, to recruit, train, and retain local and national support staff, and to address development and implementation costs for new or updated systems will be available.
Organizational readiness for change	Through an enterprise-wide organizational change management initiative, IHS shall plan and execute the required strategic and operational changes required for success of the Modernization program.
Site-specific infrastructure constraints related to limited bandwidth, poor cellular signal, degraded or inadequate telephony and wide area network (WAN) infrastructure, etc.	As a primary and critical initial step in IHS HIT Modernization program, IHS must conduct a comprehensive infrastructure analysis and subsequent infrastructure build-out to remediate critical infrastructure deficiencies. Moreover, infrastructure constraints that are too costly to mitigate will proactively inform and influence the selection, architecture, design, and topology of the new HIT solution in order to achieve cost-efficiencies and optimal system quality.
Security, confidentiality, patient privacy	Through ongoing and augmented security practices, IHS shall identify, validate, and prioritize external and internal security vulnerabilities and threats through a security risk assessment (SRA). The results of this assessment will lead to needed improvements in data security, confidentiality, and privacy, thereby driving increased compliance and patient satisfaction.

Interoperability requirements	The replacement HIT solution or ecosystem must be intrinsically interoperable and must support data sharing, both within and external to the I/T/U. The following recommendations will assist in meeting interoperability goals: - Conduct a gap analysis to identify and prioritize interoperability deficiencies in IHS' HIT ecosystem - Define IHS' interoperability strategy and communicate it broadly to stakeholders - Ensure interoperability needs are surfaced through the Requirements Management (RM) and Enterprise Architecture (EA) artifacts - Partner with the Acquisition Planning and Procurement (AP&P) office to integrate interoperability needs into acquisition planning - Adhere to open standards in the design and implementation of interoperable systems - Ensure strict security and privacy of data and information shared across interoperable systems to drive wide-scale adoption - Utilize efficient, cost-effective infrastructure to achieve interoperability across distributed and external systems - Implement unintrusive, value-added data governance practices
Regulatory compliance	Through an improved requirements management process, value-oriented lightweight enterprise architecture (EA) practice, and outcome-driven governance, the replacement HIT solution or ecosystem will need to meet or exceed regulatory requirements, including the Office of the National Coordinator for Health Information Technology (ONC) and the Centers for Medicare and Medicaid (CMS) certification requirements and other regulatory constraints, such as Clinical Laboratory Improvement Amendments (CLIA).
Support for legacy systems/subsystems/ components	Any approach that retains legacy systems/subsystems/components must plan for ongoing operations and maintenance (O&M) or replacement of VistA-derived packages. Moreover, there are associated cost and resource implications as well as related risks.