



VistA Evolution Program Plan

Department of Veterans Affairs

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Executive Summary

The Department of Veterans Affairs (VA) and the Department of Defense (DoD) are working together to fundamentally and positively impact the health outcomes of Veterans, Service members, and their dependents. Achieving interoperability of health records between the two Departments is the chief goal motivating the Departments' electronic health record (EHR) efforts. Seamless integration of health data from VA, DoD, and other healthcare partners enables clinicians and patients to benefit from the availability of a complete longitudinal health record, achieving the goal of developing electronic records that will transition along with them from active-duty to retired status.

The Departments are on complementary paths for modernizing their respective EHR systems, replacing or enhancing existing systems as required to support delivery of the best possible care in their particular environments. For its part, VA will enhance, or *evolve*, its Veterans Health Information Systems and Technology Architecture (VistA) EHR to achieve its interoperability, clinical, and technical objectives. This VistA Evolution Program Plan captures VA's structured approach to executing this mission.

The VistA Evolution Program's chief goal is achieving seamless interoperability with DoD and other healthcare partners; this goal is supported by clinical goals to enhance VistA to support a patient-centric, team-based healthcare delivery model, and technical goals to establish a robust Information Technology (IT) architecture to underpin current usage and future innovation.

VA will deliver its VistA enhancements through a series of milestones, outlined in the Program Plan. The functionality to be delivered in September 2014 will provide the foundational elements of interoperability and clinician-facing enhancements. A regular series of releases delivers both full interoperability and care delivery support on a platform founded on principles of open standards, open architecture, and service-oriented software.

VA has established an organizational and governance structure to lead the VistA Evolution Program and engage Veterans Health Administration (VHA) and Office of Information and Technology (OIT) leadership, who guide the Program, in collaboration and consultation with the VA/DoD Interagency Program Office (IPO) and DoD.

VA, DoD, and the IPO each play significant roles in achieving the interoperability, clinical, and technical objectives of both Departments. Each Department leads the enhancement of its EHR system with full and open communication created on data standards, health information exchange provisions, a service-oriented architecture, and a common interoperability infrastructure. The IPO provides a means for communication and collaboration that is vital to achieving interoperability objectives.

The VistA 4 Product Roadmap is a supplement to the VistA Evolution Program Plan. These two documents should be considered linked therefore; adjustments to one document will require modifications to the other to ensure they remain synchronized.

1. Introduction

The VistA EHR System is vital to VA's ability to deliver care to Veterans, Service members, and their dependents. In order to evolve VistA to meet VA's care delivery objectives, the Department is undertaking an effort to enhance VistA's interoperability, clinical, and technical capabilities. These improvements to VistA are planned and managed under the VistA Evolution Program. This program is focused on advancing VistA to achieve seamless interoperability with other systems and to improve quality, safety, efficiency, and satisfaction in healthcare for Veterans, Service members, and their dependents.

1.1 Document Purpose

The VistA Evolution Program Plan defines VA's structured approach to the development and deployment of an interoperable EHR that exchanges computable health information with DoD and other healthcare partners. It modernizes its EHR software to fully leverage this health information in support of the care delivery model of VHA. Interoperability with DoD EHR systems, with an integrated display of data, will be achieved no later than December 31, 2016. VistA 4 will be delivered in FY18, with the exception of the Laboratory Information System (LIS). Planned incremental deployment of the LIS will begin in FY16 at two VA medical facilities. Following successful deployment at these initial sites, further deployments will take place at 50 VA medical facilities per year, starting in FY17. By the end of FY19, the LIS will be deployed at 152 VA medical facilities.

The Program Plan was developed to directly address the reporting requirements contained within the National Defense Authorization Act (NDAA) for FY 2014, signed into law by President Barack Obama on December 26, 2013. The information within the Program Plan addresses each one of the "programs plan" reporting requirements, which are contained in Section 713, subsection (d), and complies directly with the statute's subsection (e) "limitation of funds" provision. VA's purpose is for the Program Plan to adequately address the concerns of the congressional committees of jurisdiction in order to enable a path forward that includes removal of current funding restrictions in place since FY 2013 and restoration of full funding associated with the electronic health records program.

1.2 Document Scope

The scope of this document is VA's "programs plan", including its approach to and objectives for achieving modernized electronic health record software supporting clinicians through FY 2018, followed by enterprise-wide deployment of the LIS by the end of FY 2019.

2. Background

In 2009, President Barack Obama charged VA and DoD to establish a method by which active and retired Service members and Veterans could easily access their health records. Specifically, the Departments were called upon to “work together to define and build a seamless system of integration so that when a member of the Armed Forces separates from the military, he or she will no longer have to walk paperwork from a DoD duty station to a local VA health center. Their electronic records will transition along with them and remain with them forever.”

VA and DoD are working together to fundamentally and positively impact the health outcomes of Veterans, Service members, and their dependents, pursuing two distinct goals -- create seamless integration of VA, DoD, and private provider health data and modernize the software supporting VA and DoD clinicians. The Departments are on complementary paths for modernizing their respective clinical care software and remain fully committed to the use of open standards and open architecture to ensure seamless interoperability and information sharing across the two systems. Both VA and DoD will update their respective healthcare management systems, replacing or enhancing existing legacy systems to give clinicians and patients the best healthcare software support, including state-of-the-art clinical decision support and analytics, to provide Veterans, Service members, and their dependents the best healthcare possible.

DoD established the DoD Healthcare Management System Modernization (DHMSM) Program to focus on delivering modernized, openly-architected clinical EHR capabilities, with a goal of deployment by no later than 2017. DoD will use a competitive acquisition process to consider commercial alternatives that will likely include VistA-based variants. As part of DoD’s acquisition process, the Department will require offerors to demonstrate how their solution leverages open standards endorsed by the Office of the National Coordinator (ONC) and adheres to key open architecture tenets, such as open transport formats (e.g., HL7 messaging), open interface specifications, and design patterns that enable an open and scalable solution.

VA established the VistA Evolution Program to focus on delivering an evolved VistA that is open architected and non-proprietary in design. VistA 4 will be delivered in FY18, with the exception of the LIS. Planned incremental deployment of the LIS will begin in FY16 at two VA medical facilities. Following successful deployment at these initial sites, further deployments will take place at 50 VA medical facilities per year, starting in FY17. By the end of FY19, the LIS will be deployed at 152 VA medical facilities. By adhering to key open architecture tenets, open interface specifications, and design patterns that enable an open and scalable solution, it is VA’s intent that the evolved VistA will be in a position to effectively exchange data with DoD’s solution.

The VA/DoD Interagency Program Office (IPO) Charter, signed December 5, 2013, establishes the office to serve as the single point of accountability for leading the implementation of national health data standards for interoperability. The IPO will be responsible for establishing, monitoring, and approving the clinical and technical standards profile and processes to ensure seamless integration of health data between the two Departments and private healthcare providers.

This VistA Evolution Program Plan specifically focuses on the system enhancements required to evolve VistA to meet VA's clinical capability goals in 2014, and meet VA/DoD incremental interoperability goals in 2014 and 2016, as established by the IPO, as well as to begin the work necessary to achieve full clinical capability goals in 2018, to be followed by LIS enterprise-wide deployment in 2019. This plan covers delivery of new VistA functionality and changes to VistA data and interfaces that are required to enable seamless interoperability with DoD health records.

Separate plans are being written that cover the work necessary to develop and support the VA/DoD interoperability infrastructure and VA's implementation of the Virtual Lifetime Electronic Record (VLER) Health interoperability infrastructure. This plan does not cover interoperability work performed and delivered by the IPO or DoD, nor the plan for DoD's DHMSM Program.

2.1 History of VistA

In the early 1980s, VA moved from a small number of large-scale computer systems housed in a small number of national data processing centers to the wide spread use of mini-computer systems, located at each VA Medical Center, regional office, and other major program or field offices. Following this, clinicians and IT personnel developed and deployed applications locally to enhance patient care. These applications, based on the Massachusetts General Hospital Utility Multi-Programming System (MUMPS), eventually lead to the Decentralized Hospital Computer Program (DHCP).

The introduction of the Computerized Patient Record System (CPRS), a graphical user interface (GUI) that interacts with the VistA kernel, allowing clinicians to easily view and update a patient's record, marked the transition from DHCP to VistA, with the VistA name achieving official VA recognition in 1994. In the following two decades, VistA has been enhanced and upgraded through development and national release of new capabilities and significant enhancements and modernization of existing capabilities.

In 2012, VA announced the creation of the "Gold Disk" version of VistA. This effort represented a further evolution of VistA, with its primary focus on establishing a homogenous enterprise-wide VistA to foster rapid and efficient deployment of new capabilities while optimizing sustainment. The Gold Disk process created a launch pad by unifying VistA under a common set of applications, upon which future VistA capabilities can be launched.

The VistA Evolution Program will oversee the development of VistA 4, the next evolution of VistA. Based firmly upon the work that has come before, VistA 4 will harness the powerful core of software and business processes embedded within VistA and apply a modern computing architecture that is modular and extensible, fully leveraging VA's investment in VistA, and allowing for an interoperable EHR that provides patient-centered care to Veterans, Service members, and their dependents.

3. Mission

The VistA Evolution Program will enhance VistA's core architecture to serve business needs and to support both its clinical and infrastructure content in order to fulfill the objective to deploy, together with DoD, an interoperable EHR, with seamless electronic sharing of medical health data and integrated data display. Additionally, the use of standardized data and modern computing architecture will support real-time clinical decisions. This seamless interoperability and modernized architecture will serve as a cornerstone of the delivery of care and benefits to Veterans, Service members, and their dependents.

By delivering VistA 4, an interoperable EHR, the Program will reflect the legacy of VistA advancement. The architecture enhancements made in VistA 4 will provide the tools necessary for VA to maintain its track record as a highly acclaimed healthcare provider, with VistA 4 supporting delivery of services that are both Veteran-centered and evidence-based, consistent with VA and federal healthcare goals. VistA 4 will support care coordination—a model of healthcare delivery and quality improvement in which teams of clinicians include the Veteran in collaboratively addressing the Veterans' healthcare needs according to clear Veteran-driven goals. Care coordination also promotes quality improvement in healthcare processes for all Veterans.

The goals of the VistA Evolution Program are:

- Establish seamless electronic sharing of interoperable healthcare data with DoD and other healthcare partners in a real-time, computable manner, using existing data standards, with the objective of achieving one unified, lifetime health record for every Veteran, Service member, and their dependents;
- Improve quality, safety, efficiency, equity, and satisfaction in healthcare for Veterans, Service members, and their dependents; and,
- Reduce risk and cost, and increase quality and speed of health information technology (HIT) acquisitions.

The Program Plan defines VA's approach to meeting these objectives to enable VA, working closely with DoD, to provide a seamless, interoperable EHR system that improves the quality, safety, and efficiency of the care delivered to Veterans, Service members, and their dependents.

4. Program Objectives

The following objectives are associated with the mission and goals of the VistA Evolution Program:

1. Provide program structure, management, and governance to oversee requirements management, acquisition, risk management, communications, training, and transition planning.
2. Establish and maintain flexible system and enterprise architectures that support interoperability with partners and support new applications and features that meet clinical needs.
3. Establish and maintain methods to develop business (clinical and administrative) processes and revise existing procedures and policies that advance VA healthcare and health informatics capabilities.
4. Demonstrate value and guide overall program management, evaluating how program-level activities promote quality, safety, efficiency, and satisfaction in healthcare for Veterans, Service members, and their dependents, in addition to evaluating how acquisition methods and community collaboration reduce costs and increase speed of obtaining desired functionality, in collaboration with external evaluation groups.
5. Promote a robust marketplace for HIT solutions and content that meet VA needs, developing active engagements with federal and state organizations, healthcare systems, vendors, academic institutions, development communities (e.g., Open Health Tools, and Open Source Electronic Health Record Alliance (OSEHRA)), and standards bodies to reduce cost and time to acquire new high-quality functionality and content to meet VA business needs.

4.1 Clinical Objectives

The shift in care delivery to patient-centric team-based care requires a shift from an EHR that is encounter based and operates in many respects like a digitized version of a paper patient chart to an EHR that is care-plan based and facilitates collaboration and data exchange among a distributed care team. By driving the achievement of the objectives outlined in this section, the VistA Evolution Program guides VistA in this shift, resulting in an EHR that provides a new integrated user experience for all members of the healthcare team, including the patient, with underlying care coordination, decision support, and ancillary services interoperating seamlessly with multiple sources of data.

4.1.1 Patient Safety

As VistA evolves throughout the lifecycle of the program, a set of VistA patient-safety goals (V-PSGs), modeled after the Joint Commission's National Patient Safety Goals, will be developed to

positively impact patient safety. The VistA Evolution Program will oversee development of these V-PSGs, following a three-phase approach¹:

Phase 1: Address Safety Concerns Unique to EHR Technology

- Reduce the effect of VistA downtime on safety
 - Ensure that planned upgrades and maintenance are properly scheduled and communicated and that critical capabilities remain online
- Reduce the miscommunication of data transmitted between different components within VistA

Phase 2: Mitigate Safety Concerns Arising from Failure to Use EHR Appropriately

- Mandate Computerized physician order entry (CPOE) for all orders of medications, laboratory tests, and radiologic tests.
- Reduce alert fatigue
 - Alerts with override rates above a certain threshold will be discontinued or modified to increase their specificity
- Workflow management
 - Hard stops must be used only for potentially dangerous errors.
- Ensuring that critical data on medications, allergies, diagnostic test results, and clinical problems are entered as standardized (as identified in the Target Health Standards Profile), structured data in VistA.
- Ensure that all clinical team members are appropriately trained.

Phase 3: Use EHRs to Monitor and Improve Patient Safety

- Use VistA-based triggers to monitor, identify, and report potential safety issues and events.

By structuring the approach in this manner, the VistA Evolution Program will ensure that enhancements to VistA not only deliver improved functionality and interoperability but also protect patient safety.

4.1.2 Care Coordination

Care coordination assures that each patient has a single approved longitudinal care plan that is coordinated, integrated, properly prioritized, not duplicative, and designed to assure cost effective and high quality outcomes. It involves a wide range of care settings across the continuum of patient care, including primary care, specialty care, home care, ambulatory clinics, rehabilitation facilities, hospital bed units, and telemedicine. As described in the VistA 4 Product

¹ <http://www.nejm.org/doi/full/10.1056/NEJMsb1205420>

Road Map, care coordination is built on several foundational activities: activity management, activity-based communication, and the capture of explicit patient goals.

4.1.3 Clinical Decision Support (CDS)

The use of accepted and clinically valid therapies, medications, procedures, and care guidelines can reduce costs and, in some cases, greatly improve outcomes by reducing duplication and errors in care. From a public health perspective, pervasive use of evidence-based CDS can facilitate consistent delivery of care across a larger public health population, possibly reducing the impact of diseases and conditions in a population greater than any one provider, hospital, or health system. CDS technology presents analytically-driven, evidence-based patient-specific health information to clinicians, staff, patients, and other users at appropriate times to enhance healthcare delivery. CDS encompasses a variety of tools that enhance decision-making in the clinical workflow, including alerts and reminders to care providers, Veterans, Service members and their dependents, clinical guidelines, condition-specific order sets, focused patient data reports and summaries, documentation templates, diagnostic support, and contextually relevant reference information among other tools.

4.1.4 Medical Device Integration

Medical device integration is the ability for clinical medical devices to communicate in a consistent, predictable and reliable way, allowing for the exchange of data with other medical devices and with patient data sources and repositories, such as the EHR, in order to enhance device and system functionality. Although requirements for integration of specific devices are not yet fully defined, VA recognizes the significant benefits of medical device integration make a compelling case for early adoption. These benefits include:

- Improved quality of care through reduction of adverse events due to safety interlocks, a means of monitoring and controlling the operation of a medical device;
- Reduced cost of care as a result of reduction in redundant clinical testing;
- Increased clinician productivity due to decreased manual data entry;
- Increased capacity for treatment, secondary to shortening length of stay;
- Increased patient safety through reduction of human errors in assessing critical situations; and,
- Increase ability of healthcare teams to assess the clinical status of patients in real-time through device integration.

4.1.5 Ancillary Services

Improvements to ancillary systems such as laboratory, pharmacy, and radiology solutions will provide enhanced support of laboratory, pharmacy, and imaging functions that allow pathologists, pharmacists, radiologists, and associated technicians to more efficiently follow best practices. These enhanced ancillary services will also enable more robust CDS for clinicians, allowing them to provide improved quality, safety, efficiency, and satisfaction in healthcare for Veterans, Service members, and their dependents.

5. Organization Structure

VA has established the VistA Evolution Program as a matrix organization with single point of accountability assigned to the Chief Information Officer (CIO), to manage the modernization of VA's EHR and properly integrate with DoD's EHR. The VistA Evolution Program will oversee activities related to acquisitions, implementation, and sustainment of the EHR and ancillary HIT systems.

VistA Evolution will govern, oversee, and manage programmatic activities and will be responsible for strategic and high-level tactical direction, keeping the following goals paramount:

- Establish seamless electronic sharing of interoperable healthcare data with DoD and other healthcare partners in a real-time, computable manner, using existing data standards, with the objective of achieving one unified, lifetime health record for each Veteran, Service member, and their dependents;
- Improve quality, safety, efficiency, equity, and satisfaction in healthcare for Veterans; and,
- Reduce risk and cost and increase quality and speed of HIT acquisitions.

VistA Evolution will organize around product lines or portfolios to maintain continuity of strategy and domain expertise. These major product lines include Business Operations, Strategic Planning, Infrastructure, Decision Support, User Experience, and Ancillary Integrated Functionality. These major product lines or portfolios will be staffed with subject matter experts matrixed from OIT and VHA. These individuals will coordinate strategic and high-level tactical management, engineering, and functional approaches to their content areas. Staff will also help coordinate collaborations with federal and community partners. VistA Evolution staff will collaborate with key stakeholders to execute initiatives and to maintain a focus on execution of time and scope limited projects. In accordance with VA standing policy, every project will have assigned a project manager accountable to OIT as the technical lead, and a VHA business owner, in support of an agile methodology to increment management. For a graphical representation of the functional organization structure, please see Appendix B.

6. Roles and Responsibilities

Creating a seamless, interoperable EHR system that improves the quality, safety, and efficiency of the care delivered to Veterans, Service members, and their dependents requires both VA and DoD to work in concert. VA and DoD will work together to meet the interoperability, clinical, and technical requirements for care delivery in their respective environments and support the data standards and open architectures required for true interoperability. Providers and patients will be presented with complete and accurate health information independent of the source of the underlying data. In achieving this objective, the Departments carry out both separate and joint activities.

6.1 Interagency Program Office

VA and DoD collaborate in the development and implementation of capabilities that allow for full interoperability of healthcare information between the Departments. The VA/DoD IPO is chartered to lead the Departments' efforts to implement national health data standards for interoperability and is responsible for establishing, monitoring, and approving the clinical and technical standards profile and process to ensure seamless integration of health data between the two Departments and private healthcare providers. The IPO will actively engage with national and international health standards settings organizations, as well as oversee and approve the VA/DoD's adoption of, and mapping to, national and international health standards, in the interest of promoting interoperability. IPO governance is defined in the VA/DoD Interagency Program Office Charter, signed December 5, 2013. The IPO also collaborates with DoD and VA on the joint responsibilities explained in Section 6.3 below.

6.2 Department of Defense

DoD takes all actions necessary to deploy an EHR that meets its interoperability, clinical and technical requirements for care delivery to support seamless interoperability and data exchange with VA systems. DoD is pursuing a full and open competition to modernize and replace its current EHR systems. The DHMSM Program Management Office will use a competitive acquisition process, considering commercial alternatives that may offer reduced cost, reduced schedule and technical risk, and access to increased current and future capability by leveraging advances in the commercial marketplace. DoD also collaborates with VA on the joint responsibilities explained in Section 6.3 below.

6.3 Department of Veterans Affairs

VA takes all actions necessary to deploy an EHR that meets its interoperability, clinical and technical requirements for care delivery to support seamless interoperability and enable use of DoD and private provider data. VA is enhancing VistA to provide this capability, as described in this VistA Evolution Program Plan, to meet the requirements and standards identified by the IPO.

VA continues to work closely with DoD on existing congressional reporting requirements, most notably those involving the IPO, which requires input from both Departments. The Departments work concurrently with the IPO to produce an Annual Report to Congress, which is reviewed by all of the congressional committees of jurisdiction; a quarterly progress report to update each of these same committees; and an additional report to Congress in which both Departments work with the IPO to expound upon its two previous requirements, providing for an accounting of its expenditures.

VA and DoD have also remained responsive to congressional interest through their involvement with the Government Accountability Office (GAO). Other recurring and intermittent oversight and reporting requirements include producing JEC annual reports to Congress and responding to congressional questions for the record. Throughout the legislative cycle, VA and DoD are tasked with providing responses to pre-and post-hearing questions for the record submitted by the committees of jurisdiction, as well as from Members of Congress regarding the electronic health records program. During 2014, and as mandated by Section 713 (f) (1) NDAA 2014, the Departments are required to submit a quarterly financial summary to the appropriate congressional committees.

6.4 Joint Executive Committee (JEC)

The JEC provides senior leadership a forum for collaboration and resource sharing between VA and DoD. By statute, the Deputy Secretary of Veterans Affairs and the Under Secretary of Defense for Personnel and Readiness co-chair JEC meetings. JEC membership includes the VA/DoD Co-Chairs for the Health Executive Committee (HEC), the Benefits Executive Council (BEC), the Director of the IPO, and other senior leaders, as designated by each Department. The JEC works to remove barriers and challenges which impede collaborative efforts, assert and support mutually beneficial opportunities to improve business practices, ensure high quality cost-effective services for VA and DoD beneficiaries, and facilitate opportunities to improve resource utilization.

Through a strategic planning process, the JEC recommends to the Secretaries the strategic direction for the coordination and sharing of information between the two Departments and oversees the implementation of those efforts. Those efforts include the preparation of the following reports and or documents:

- VA/DoD JEC FY Annual Report. Submitted to Congress and the Secretaries of Defense and Veterans Affairs, as required by law. The intent of the Annual Report is to provide Congress with the collective accomplishments between the two Departments and highlight the current efforts to improve resource sharing
- VA/DoD JEC Joint Strategic Plan (JSP). Developed to advance performance between VA and DoD, the JSP is continuously evaluated, updated, and improved. Contained within the JSP are accomplishments and activities for the fiscal year, as well as associated goals and milestones for the interoperable EHR, James A Lovell Federal Healthcare Center (JAL FHCC), VLER Health, and the development of Specific, Measurable, Achievable, Realistic, and Time-bound (SMART) Objectives.

- VA/DoD IPO annual report to the Departments' Secretaries and Congress. Section 1635 of the NDAA for FY 2008 includes a requirement for the IPO Director to submit an Annual Report through 2014 on IPO activities to the appropriate committees of Congress and to the Departments' Secretaries.

6.5 Health Executive Committee (HEC)

The HEC is the decisional body through which the ICIB, HEC Information Management (IM)/IT Working Group, HARB, and other workgroups report to the JEC. Within the governance structure, the HEC provides high-level interagency cooperation and coordination in a shared effort to improve healthcare services and reduce healthcare costs for the Departments' beneficiaries. The HEC oversees the collaborative efforts of each agency's healthcare organizations, and all councils or work groups designated by the co-chairs and recommends to the VA/DoD JEC the strategic direction, policy development and implementation processes appropriate to support initiatives identified in the VA/DoD Joint Strategic Plan (JSP). Duties include:

- Overseeing the development and implementation of the healthcare initiatives consistent with the VA/DoD JSP developed by the JEC;
- Providing leadership oversight of VA/DoD healthcare collaboration, and all sub-councils or work groups, to include approval of charters for these groups;
- Identifying changes in healthcare related policies, procedures, and practices that would promote mutually beneficial coordination, use, or exchange of use of the health services and resources of the two Departments;
- Identifying and assessing further opportunities for the coordination and sharing of health related services and resources between the Departments that would not adversely affect the range of health services and resources to VA and DoD beneficiaries;
- Reviewing the plans of both Departments for the acquisition of health services and resources in order to further opportunities for coordination and collaborative sharing of healthcare resources; and,
- Reviewing the implementation of activities designed to promote the coordination and sharing of health related services and resources between the two Departments.

6.6 Interagency Clinical Informatics Board (ICIB)

The ICIB provides the HEC with clinical input related to defining and executing interoperability/VLER Health programs in support of the HEC's coordinating role with the Advisory Board. The ICIB is charged with the following overarching responsibilities:

- To actively collaborate on interagency clinical information systems and associated functional processes that will continually improve the provision of healthcare for VA and DoD beneficiaries; and,

- To oversee functional aspects of interagency clinical information systems throughout the development/acquisition lifecycle.

The ICIB co-chairs are senior clinicians from DoD and VA appointed by DoD Assistant Secretary of Defense (Health Affairs) and the VA Under Secretary for Health, respectively.

6.7 Health Architecture Review Board (HARB)

The VA/DoD Health Architecture Review Board (HARB) serves as an advisory working subgroup to the VA/DoD HEC that provides architecture oversight and approval due diligence for joint VA/DoD health programs to facilitate interagency cooperation and foster collaboration on enterprise architecture (EA) for interagency HIT initiatives. This oversight includes standards, quality assurance, integration, transparency, visibility, and monitoring for VA/DoD interagency information exchange. The HARB has prioritized standards-based data exchange specifications for health data interoperability between VA and DoD.

Section 713 of the NDAA for FY 2014 describes the design principles for the deployment of modernized electronic health record software supporting clinicians of the Departments by ensuring continued support and compatibility with the interoperability platform and full standards-based interoperability. The design principles described in the NDAA call for “interoperable electronic health records with integrated display of data, or a single electronic health record.”

7. Technical Objectives and Design Principles

The VistA Evolution Program will enable both seamless interoperability with DoD and other healthcare providers, while modernizing key VistA architecture and capabilities. Embracing open standards and adhering to a “cloud first” infrastructure policy, which involves data center consolidation and a move to virtualization of both back-end and front-end systems, will result in an efficient solution enabling data sharing and fostering a collaborative approach to future growth. The VistA Evolution Program will focus on continuously driving towards incremental delivery to effectively meet the needs of its healthcare team.

7.1 Technical Objectives

To guide the VistA Evolution Program’s technical activities to meet the goal of establishing seamless interoperability and the clinical objectives that underpin it, VA establishes the following technical objectives:

Objective 1: Acquire and maintain EHR and ancillary HIT systems:

- Establish and implement portfolio enterprise investment review for the prioritization, management, and acquisition of EHR and HIT systems;
- Modernize and maintain EHR and ancillary health systems to support new models of patient-centric, team-based direct care and quality improvement, to facilitate disability evaluation, to meet national standards and EHR certification (see Appendix C for more detail), and to enable ancillary capabilities (e.g., laboratory, pharmacy and other ancillary systems);
- Establish and maintain flexible system and enterprise architectures that are in alignment with the VHA Business Architecture and the VA Enterprise Architecture and that allow applications and features to be configured to serve diverse business needs and ensure interoperability with partners, consistent with the VA/DoD IPO direction;
- Enable field staff to more efficiently and effectively innovate, deploy, configure, and use EHR tools in collaboration with VA Central Office (VACO), field health-informatics programs, and the overall VistA Evolution Program; and,
- Adhere to standards and architectures promulgated by the IPO, ONC, and other national and international bodies to ensure interoperability with DoD and community EHR systems.

Objective 2: Re-engineer healthcare business processes:

- Establish practical approaches to improve business processes and to revise procedures, policies, and structures that have evolved with legacy HIT systems.

Objective 3: Demonstrate value and guide program-level management:

- Evaluate how program acquisition methods and community collaboration reduce costs and increase speed of obtaining desired functionality in collaboration with external evaluation groups; and,

- Develop engagements with federal and state organizations, healthcare systems, vendors, academic institutions, development communities (e.g., OSEHRA, Open Health Tools), and standards bodies to reduce cost and time to acquire new high-quality functionality and content to meet VA business needs.

7.2 Design Principles

A set of core design principles guide the development carried out under the VistA Evolution Program, ensuring that interoperability, clinical and IT objectives are met with consistency and efficiency:

- Service Oriented Architecture (SOA). Software applications will use common enterprise services to facilitate re-use, achieve economies of scale, and to reduce development and maintenance costs. Both application services and infrastructure services (such as messaging or Enterprise Service Bus (ESB) software) will adhere to SOA principles.
- Open Architecture. Open standards are a key enabler of interoperability and the sharing of computable health data between VA, DoD and other healthcare partners. In addition to data standards, VA will also document and make widely available application program interfaces (APIs) and technical specifications for both VistA legacy and new or enhanced code. Collaboration with innovators will continue through OSEHRA and other outreach efforts, where Government-developed and third party open source code will be shared.
- Agile Development. Agile development methods will be used to create an environment that is responsive to the needs of end users. An integrated team of program managers, engineers, designers, and end users will take strategic priorities from both clinical and IT leadership, and execute decisions at the lowest level of granularity appropriate for the task.
- Robust IT Infrastructure. To provide flexible, reliable, and cost-effective support for production operations and future innovation, IT infrastructure will comply with data center consolidation, virtualization, and “cloud first” guidelines.

8. Milestones / Schedule

The VistA Evolution Program will manage an integrated schedule of many programs and projects implemented in a parallel manner. To manage all projects, the VistA Evolution Program is committed to using the Project Management Accountability System (PMAS) to ensure the timely delivery of customer-facing functionality in intervals of six months or less. Per VA policy, PMAS is required for all development projects that create new functionality or enhance existing capabilities in the VA IT system or infrastructure. PMAS establishes a robust data collecting, reporting and monitoring IT system, mirrored with strictly enforced IT development business rules to produce IT functionality that customers value and can use. Within PMAS, VistA Evolution project managers are accountable for meeting cost, schedule, and scope goals and senior leaders are accountable for the elimination of obstacles which may be preventing on-time project delivery. By following PMAS process, VistA Evolution project managers will reduce project development risk, institute monitoring, establish accountability and create a reporting discipline.

Each product set plan will be preceded by a comprehensive Product Plan and Architecture Review to ensure that both clinical and interoperable capabilities are fully captured and realized in the development phase. This will be followed by extensive integration testing and a period of user adoption and training, leading to deployment. For a detailed, graphical representation of milestones and schedule, please see **Appendix D: Milestones and Schedule**.

9. Data Standards and Interoperability

The goal of the VistA Evolution Program is to provide all healthcare data and information from existing health systems in a computable real-time manner using existing data standards and establish relevant policies and processes to achieve the objective of creating one federated, lifetime health record for each Veteran and Service member. This goal is directly associated with the mandate outlined within Section 713 (g) (1) in the NDAA for FY 2014, which states that “not later than October 1, 2014, all healthcare data contained in DoD Armed Forces Health Longitudinal Technology Application (AHLTA) and the VA VistA systems shall be computable in real time and comply with the existing national data standards and have a process in place to ensure data is standardized as national standards continue to evolve.”

To facilitate this outcome, the VA/DoD HEC exercises review and approval authority to enable interdepartmental progression via the VA/DoD HARB. The HARB provides enterprise and technical architecture oversight for health IT initiatives, to include the determination of standards, quality assurance and integration. To this end, the HARB is currently performing a critical role in generating standards-based data exchange specifications for health data interoperability between VA and DoD. In light of the Secretaries’ decision in February, 2013 to focus on interoperability among systems and between Departments, the HARB is conducting a comprehensive review of the information technology standards required to ensure compatibility of data and information exchange.

Currently, industry and federal government standards are being reviewed and used to achieve this interoperability using computable, real-time data and information. The definitions and standards of the Institute for Electrical and Electronic Engineering (IEEE) and its many publications, such as their Standard Computer Dictionary definition for Interoperability, the guidelines of the Office of the National Coordinator (ONC), and other established standards bodies are being used by both Departments. From IEEE, VA has adopted the definition of interoperability as “the ability of two or more systems or components to exchange information and to use the information that has been exchanged.” Real-time is being viewed as the study of hardware and software systems that are subject to a "real-time constraint", where deadlines are from event to system response. The Departments are working together to ensure seamless interoperability to meet computable needs by relying on the continued use of standards in the VA/DoD Target Health Standards Profile (HSP). The HSP is a common set of information, data, security, and technical standards. Thus, while using IEEE and the already established body of work by other organizations such as the ONC, the Departments recognize the need to embrace emerging technologies and processes to enable seamless interoperability and real-time data computability.

Moving forward, VistA Evolution envisions a future with one unified, lifetime health record for each Veteran and Service member that encompasses the ability for a clinician to access all patient health records, regardless of where this information may reside. This feeds into the overall concept for interoperability, which extends to external providers in the sense that their data and information will be accessible by both Departments.

The planned mechanism to incorporate the external sources of health record information is to leverage the existing VLER Health gateway. This is being studied now with future plans to use

Health Level 7 (HL7), a non-profit organization involved in the development of international healthcare informatics interoperability standards, to recognize Fast Healthcare Interoperability Resources (FHIR) as a standard for health systems interoperability. As FHIR continues towards broad acceptance, ONC is in the process of recognizing the *FHIR Continuity of Care Document* as a suitable document for healthcare external exchanges. In support of ONC's Federal Health Architecture (FHA) program, Representational State Transfer (REST) architecture-based prototype will be used for health information exchange. The use of FHIR and REST will be applied for simple, secure, and standards-based health information exchange.

VA and DoD have committed to achieving Meaningful Use (MU), as defined by the American Recovery and Reinvestment Act (ARRA) of 2009. To meet this commitment, VA and DoD are implementing the EHR enhancements required for MU certification. VA/DoD interoperability will evolve over time to allow VA and DoD clinicians to use the same medical coding systems more natively, facilitating more precise communication, and reducing the dependence on translation.

The VA and DoD interoperability approach uses harmonized physical models for data in motion, based on Extensible Markup Language (XML) and Javascript Object Notation (JSON) web-standards. These are widely-recognized web-friendly standards that are easily produced and consumed by systems on both ends of the communication. VA/DoD are adopting the use of an Interoperability Architecture Framework (IAF), which will capture what data is exchanged and how that data is modeled (information model); the vocabulary used in the model, especially medical coding systems (terminology model); as well as the format of the data as it passes between enterprises (wire format).

Other standards that VA and DoD are addressing for security comply with federal information assurance requirements, including Federal Information Security Management Act (FISMA), the Health Insurance Portability and Accountability Act (HIPAA), applicable National Institute of Standards and Technology (NIST) standards and special publications as well as specific VA and DoD security requirements to mitigate risk.

VA and DoD will continue the adoption and implementation of interoperability standards for sharing clinical records, which will enable the following:

- Creation of a user experience that integrates information for improved quality and effective clinical decision making. This will provide clinicians with an easier-to-read, consolidated patient record;
- Sharing of information among multiple providers, independent of location. This will reduce the time spent by a clinician on collecting and correlating patient information;
- More accurate clinical decision support, including medication safety checks, by taking into account more information on the patient's clinical condition and treatments; and,
- Provide the capability for clinicians and researchers to deliver evidence-based care, by enabling the definition and management of patient populations across the entire VA. A patient population is a cohort formed by applying specific criteria (e.g., age, weight,

disease, allergies, location). For example, "Rural Diabetic Veteran ages 55-65 exhibiting macular degeneration", would be a type of patient population.

- Interoperability and data standardization are key to enabling VA to share information with DoD's electronic health record system and to achieving an integrated display of data, bringing evidence-based medicine to the point of care.

Data standards provide a level of consistency and commonality through such items as a suite of clinical terminology content, models, services, and tooling to enable an accurate representation of clinical patient data. Accurately represented clinical data is required to completely and faithfully capture the clinical care process. Adopting and implementing the use of data standards improves VA's capability for healthcare data interoperability, allowing different EHR systems/software to meaningfully exchange information in real time and provide useful results.

Once a data standardization solution has been achieved, it will allow VA and DoD to collaborate in the development and implementation of capabilities that allow for full interoperability of healthcare information between the Departments. Through the IPO, clinical and technical standards profiles will be established, monitored, and approved. If national data standards are deficient, VA will leverage DoD codes in the open Health Data Dictionary (HDD) and contribute the necessary codes as conforming extensions to the national data standards.

10. Outcome-Based Metrics

The VistA Evolution Program is a complex undertaking that involves substantial software and business process creation and enhancement in order to meet interoperability, clinical, and technical objectives. A set of measurable metrics which enable the evaluation of the Program in its ability to achieve these objectives and to make a meaningful impact on the care delivered to Veterans, Service members, and their dependents, will be established. Overall value to the healthcare team will be measured by the use of a Benefits Realization Assessment. This assessment will identify benefits and supporting metrics that will measure the degree of attainment of expected benefits, required course corrections, and ultimately, achieving the goal of a modernized EHR, with seamless interoperability, which improves the healthcare experience for Veterans, Service members, and their dependents.

As individual projects under the VistA Evolution Program, and the Program itself, matures, all expected benefits and supporting metrics will be identified and data will be collected, analyzed and reported. A comprehensive report containing a list of attained benefits and opportunities for improvement will be generated so that appropriate course corrections can be taken to ultimately achieve all envisioned goals.

These metrics, described in detail in Appendix E, measure the outcomes of specific benefits:

- Enhanced functionality with technical applications/capabilities. The benefit associated with this metric will improve usability and the quality of a user's experience when interfacing with the system;
- Improved operational efficiency. The benefit associated with this metric is to effectively transform data into useable information;
- Improved quality of care. The benefit associated with this metric is for the improved continuity and timeliness of care in an effort to reduce waits and sometimes unfavorable delays for both those who receive and those who give care;
- Improved patient safety. The benefit associated with this metric is intended to evaluate the degree to which the EHR solutions increase the safety of VA patients. The EHR solution will accommodate a variety of IM/IT functional capabilities required to provide seamless patient care;
- Improved cost savings. The benefit associated with this metric is to decrease the actual costs of providing services related to the delivery of health care, including the costs of procedures, therapies, and medications. It is differentiated from health expenditures, which refers to the amount of money paid for the services, and from fees, which refers to the amount charged, regardless of cost; and,
- Improved customer satisfaction. The benefit associated with this metric is the personnel satisfaction with EHR products and its impact to healthcare.

11. Level of Funding

11.1 Program Development Cost Estimate

The goal of the Vista Evolution program development cost estimate is to represent and understand the total development costs to evolve the VistA applications and infrastructure. This cost estimate does not include existing funding requirements to operate the VistA applications and environments in production today. The cost estimate is inclusive of the costs associated with program, project, and product management, functional and technical design, application development, testing, verification, infrastructure support, training, site-activation, implementation, and the on-going operational maintenance (sustainment) of products added into the current VistA system environment. It is anticipated that the cost estimate will continue to be iteratively refined and updated to support ongoing changes to the VistA Evolution Product Plan.

11.1.1 Cost Estimate Objective

The objective of the VistA cost estimate is to develop a holistic and well documented estimate for the resource impacts on the VistA Program. The timeframe for the cost estimate includes the development and implementation phase of the product and extends 10 years beyond implementation to capture the associated sustainment costs of new products added into the current VistA system environment.

11.1.2 Cost Estimate Process Characteristics

- Functional and technical subject matter experts (SMEs), project managers, and cost estimators from across VA and VHA contributed to the development of cost forecasts for their representative areas and disciplines.
- The cost forecast is structured after a well-vetted industry standard and GAO recommended cost element structure (CES).
- The VistA Evolution cost model is organized with a comprehensive CES (a “checklist”) containing over 200 elements and seven levels of indenture. The CES creates an “itemized invoice” for the Program supporting the identification and completeness of required costs.
- The cost estimate documents scope, ground rules and assumptions, and data sources used throughout the process to assure defensibility, transparency, and support on-going refinement.
- As product scoping and technical solution information becomes better defined, the cost estimate will be continuously refined to increase the forecast confidence and reduce risk of cost and schedule overruns.

11.2 Investment Strategy

The VistA Evolution Program has adopted and leverages existing, enterprise-level sound portfolio and investment management practices. Such practices include established IT

governance for those investments that include components of Development, Modernization, and Enhancement (DME). All DME investments will be compliant with ProPath processes and procedures, PMAS guidance and reporting to the extent that such reporting is also required by the most recently published Office of Management and Budget (OMB) A-11 guidance. VistA Evolution Program DME investments will follow the MYP and budget guidance established within the Financial Management and Internal Controls (FMIC) Guide, to include selecting, controlling and evaluating DME investments for prioritization based primarily upon congressionally-mandated targets.

Investments will be prioritized according to the incremental development plan for the program and will follow a high-value, performance-based management approach. Highest priority will be given to interoperability-based capabilities.

Sourcing decisions will be based on analyzing alternatives that consider several factors:

- Requirements coverage. Ability of a proposed technology to meet some, most, or all user requirements;
- Independent government cost estimate. Estimates will encompass total lifecycle to include development, test, fielding, training, operations, and sustainment. The OIT funded portions of the VistA Evolution Program will follow the *IT Project Cost Estimation Process Guide*;
- Return on investment. Any potential cost savings or cost avoidance realized by replacing an existing capability with a more efficient solution; and,
- Adherence to open source. Make/buy decisions will give preference to open-source solutions that have robust development and user communities, especially those with commercial support. Secondary preference will be given to commercial solutions that adhere to open or industry standard interfaces. Proprietary technologies will be considered provided they have robust user communities that contribute to improved technology and content, and represent the best solution available.

Program funding estimates will be updated as part of VA's multi-year planning cycles and at project event points. The OIT funded portions of the VistA Evolution Program will follow the *OIT IT Program Management Guide*, *IT Project Cost Estimation Process Guide*, and the IT Budget Data Call procedures. Program and Project Managers will create and maintain the process to facilitate the development of cost estimates; this process includes:

- Determining needs and requirements;
- Defining the work;
- Identifying resources and rates;
- Estimating costs;
- Risk adjusting the cost estimate;

- Formulating and submitting the budget; and,
- Managing and controlling costs.

While the IT Resource Management (ITRM) organization under the leadership of the OIT Chief Financial Officer (CFO) has oversight responsibility for all IT appropriation accounts, the overall VistA Evolution Program budget will be managed by the assigned Program Managers and the individual project budgets will be managed and monitored by the Project Managers on a regular basis. The actual project costs are monitored against the quarterly spending plan that has been developed as part of the project based budgeting process. Corrective actions are made quarterly by evaluating deficits or surpluses to the quarterly spending plan. Cost and schedule variances are monitored using an out-of-tolerance report produced by the planner and reviewed on a regular basis by discipline leads, Program/Project Managers, responsible Senior Executives or Equivalents, and the accountable Senior Official. For those DME projects within the VistA Evolution Program investment that require reporting within PMAS to OMB for purposes of visibility on the IT dashboard, variances and performance will be monitored monthly and subject to all applicable milestone reviews and red, yellow, and green flag PMAS processes for visibility, management oversight and corrective action.

12. Path Forward

VA is committed to ensuring that its electronic health record system, VistA, is interoperable, with an integrated display of data, and is on schedule to deploy modernized electronic health record software in support of clinicians by the congressionally-mandated due date of December 31, 2016.

In order for VistA Evolution to advance, it must have sufficient funding support. The future success for the electronic health records program is tied to timely receipt of the full amount of FY 2014 funding. Therefore, VA requests Congress to review and approve the strategy and approach contained within the VistA Evolution Program Plan and to release critical funds in support of interoperability and modernization efforts. Those efforts include the deployment of clinical capabilities and the development of the necessary infrastructures required for the full implementation of associated tasks. Furthermore, the release of funds will enable VistA Evolution to execute a multitude of high priority integrated projects critical to providing future services to our Veterans, Service members, and their dependents.

VA welcomes the support of Congress not only for continued oversight and guidance, but also for the flexibility for the Department to achieve the overriding goal of interoperability for the EHR program in support of Veterans, Service members, and their dependents.

13. Appendix A: Acronym List

Acronym	Description
AHLTA	Armed Forces Health Longitudinal Technology Application
API	Application Program Interface
ARRA	American Recovery and Reinvestment Act
CDS	Clinical Decision Support
CEHRT	Certified EHR Technology
CES	Cost Element Structure
CFO	Chief Financial Officer
CIO	Chief Information Officer
CMS	Centers for Medicare & Medicaid
CPOE	Computerized physician order entry
CPRS	Computerized Patient Record System
DHCP	Decentralized Hospital Computer Program
DHMSM	DoD Healthcare Management System Modernization
DME	Development, Modernization, and Enhancement
DoD	Department of Defense
EHR	Electronic Health Record
ESB	Enterprise Service Bus
FHIR	Fast Healthcare Interoperability Resources
FISMA	Federal Information Security Management Act
FMIC	Financial Management and Internal Controls
FY	Fiscal Year
GAO	Government Accountability Office
GUI	Graphical User Interface
HARB	Health Architecture Review Board
HDD	Health Data Dictionary
HEC	Health Executive Committee
HIE	Health Information Exchange
HIPAA	Health Insurance Portability and Accountability Act
HIT	Health Information Technology
HL7	Health Level 7
HSP	Health Standards Profile
IAF	Interoperability Architecture Framework
ICIB	Interagency Clinical Informatics Board
IEEE	Institute for Electrical and Electronic Engineering
IM	Information Management
IPO	Interagency Program Office
IT	Information Technology
ITRM	IT Resource Management
JAL FHCC	James A Lovell Federal Healthcare Center

Acronym	Description
JEC	Joint Executive Committee
JSON	Javascript Object Notation
JSP	Joint Strategic Plan
MU	Meaningful Use
MUMPS	Massachusetts General Hospital Utility Multi-Programming System
MYP	Multi-Year Plan
NDAA	National Defense Authorization Act
NIST	National Institute of Standards and Technology
OIT	Office of Information and Technology
OMB	Office of Management and Budget
ONC	Office of the National Coordinator
OSEHRA	Open Source Electronic Health Record Alliance
PMAS	Project Management Accountability System
REST	Representational State Transfer
SMART	Specific, Measurable, Achievable, Realistic, and Time-bound
SME	Subject Matter Expert
SOA	Service Oriented Architecture
TCO	Total Cost of Ownership
VA	Department of Veterans Affairs
VACO	Veterans Affairs Central Office
VHA	Veterans Health Administration
VistA	Veterans Health Information Systems and Technology Architecture
VLER	Virtual Lifetime Electronic Record
V-PSG	VistA Patient Safety Goal
XML	Extensible Markup Language

14. Appendix B: Functional Organization Structure

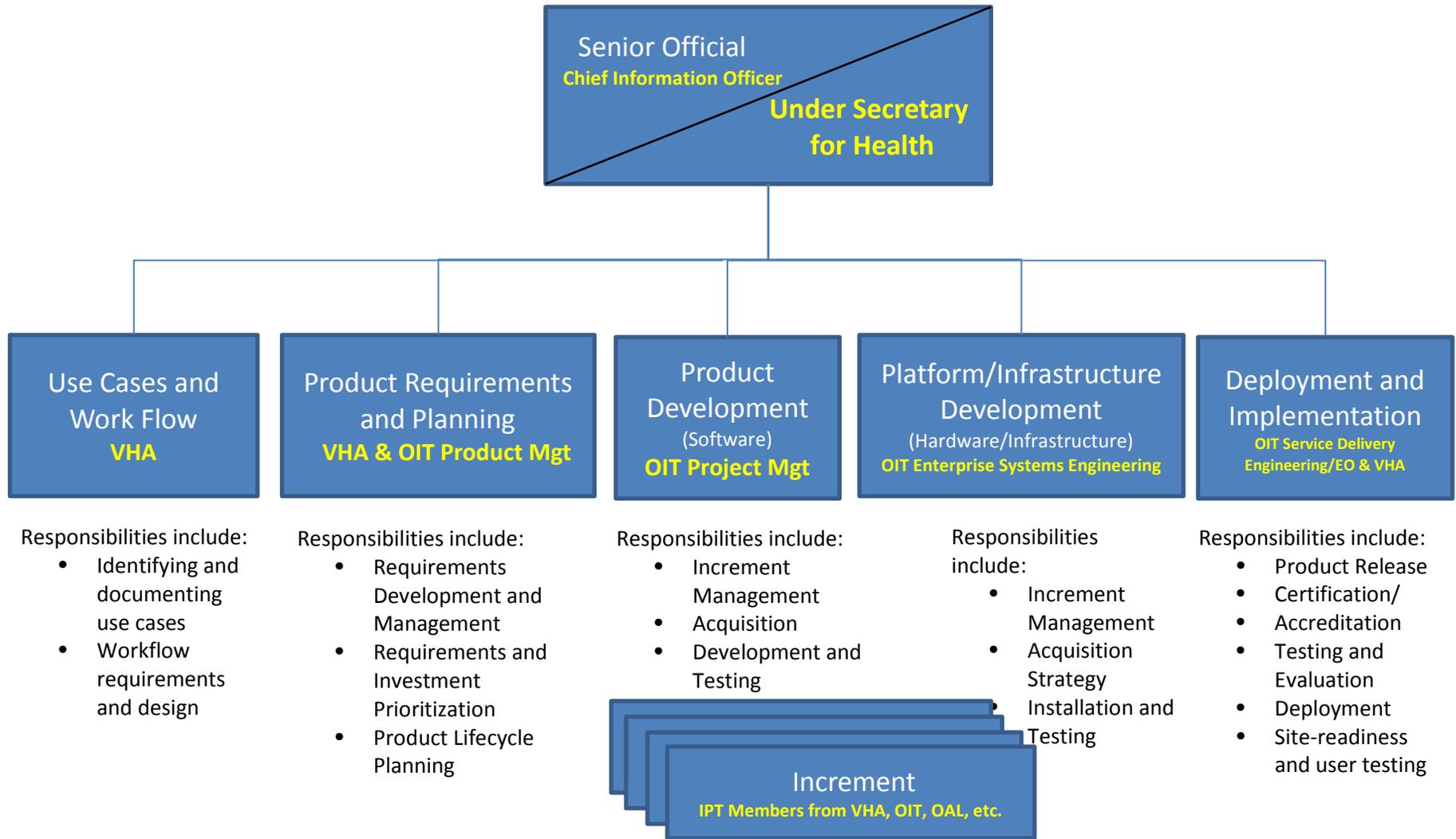


Figure 1. Functional Organization Structure

15. Appendix C: EHR Certification and Meaningful Use

Meaningful Use (MU) is the set of requirements defined by the Centers for Medicare & Medicaid Services (CMS) Incentive Programs that governs the use of electronic health records and allows eligible providers and hospitals to earn incentive payments by meeting specific criteria. The goal of MU is to promote the spread of electronic health records to improve healthcare in the United States.

OMB issued a memorandum on September 17, 2010 requiring that selected federal agencies, including VA, achieve five HIT Principle Processes by the end of FY 2012. Included in these HIT Principle Processes is the requirement to become Meaningful Users of Certified EHR Technology (CEHRT). It further specified that federal entities with HIT investments and activities become Meaningful Users by meeting the defined MU criteria, or demonstrating the process to meet those criteria in their systems regardless of eligibility for HIT incentive payments. The memorandum required that recipient agencies respond with clear plans for incorporating the identified policy and technology principles by FY 2012.

VA has committed to achieving MU as defined by ARRA of 2009 and cannot meet that commitment without implementing the EHR enhancements required for certification. ONC establishes the certification criteria EHRs must meet to be certified. ONC periodically releases editions of the EHR certification criteria and VA is currently addressing development required to prepare VistA for certification in both ambulatory and inpatient settings under current ONC 2014 Edition (formerly referred to as “Stage 2”) certification criteria. MU demonstration is a staged approach, where two years of MU demonstration must occur in each stage before moving to the next stage, where requirements become more difficult to achieve.

Ultimately, the VistA 4 technology will comply with ONC’s certification criteria to support demonstration of MU by VA providers and hospitals. While CPRS/VistA in its current state meets some of the certification criteria, such as computerized provider order entry and maintaining medication and medication allergy lists, many certification criteria require software development (i.e., “certification gaps”). Examples of development needs include outbound electronic prescribing and health information exchange of a structured summary of care record. While incorporation of the foundations will occur in FY 2014 for meeting two of the certification gaps (i.e., smoking status and preferred language), many other certification gaps exist and must be met before VA can certify CPRS/VistA, deploy the certified software to all facilities, and enable providers, and hospitals to begin MU Stage 1 demonstration.

16. Appendix D: Milestones and Schedule

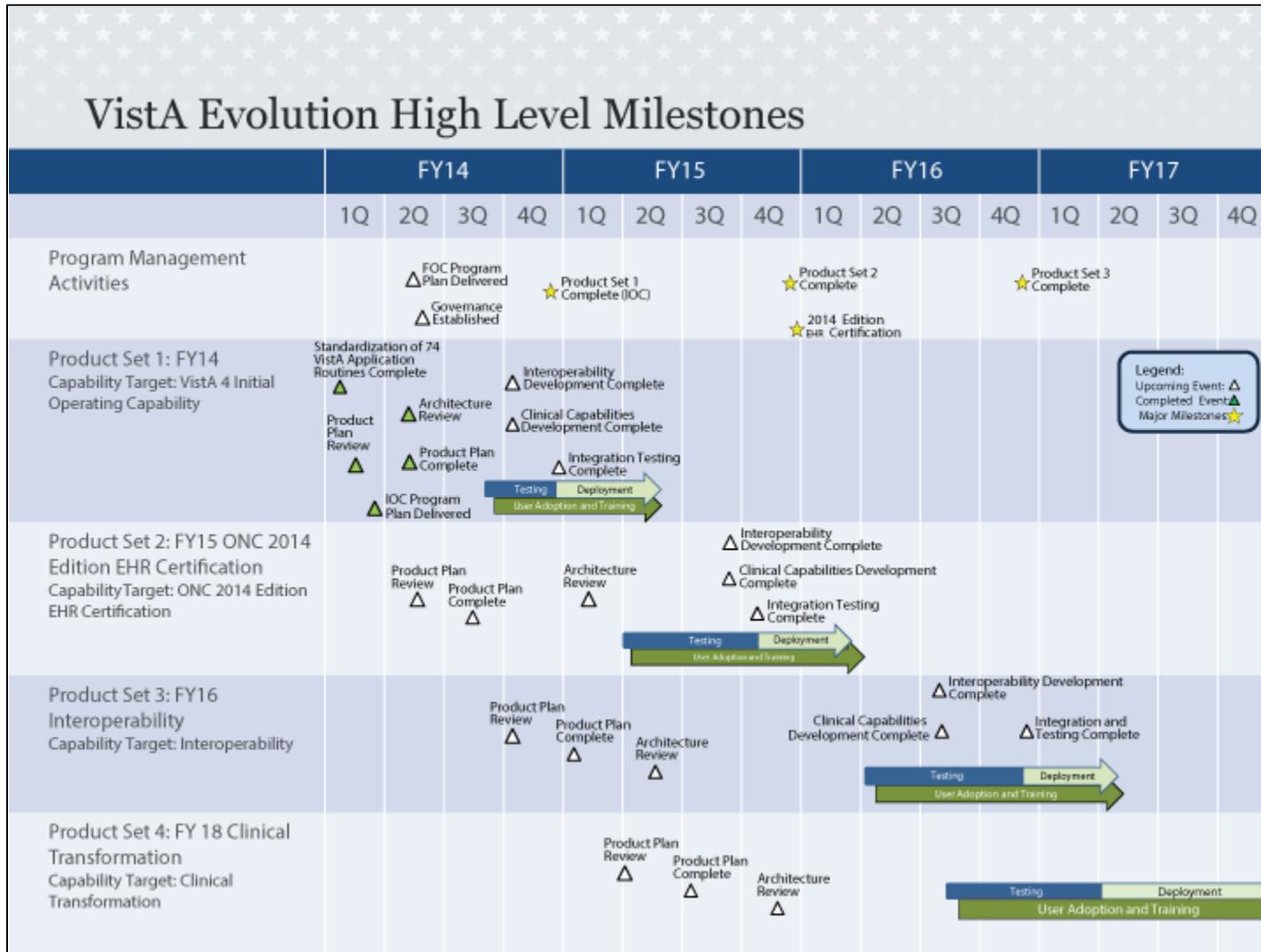


Figure 2. Milestones and Schedule – FY2014 through FY2017

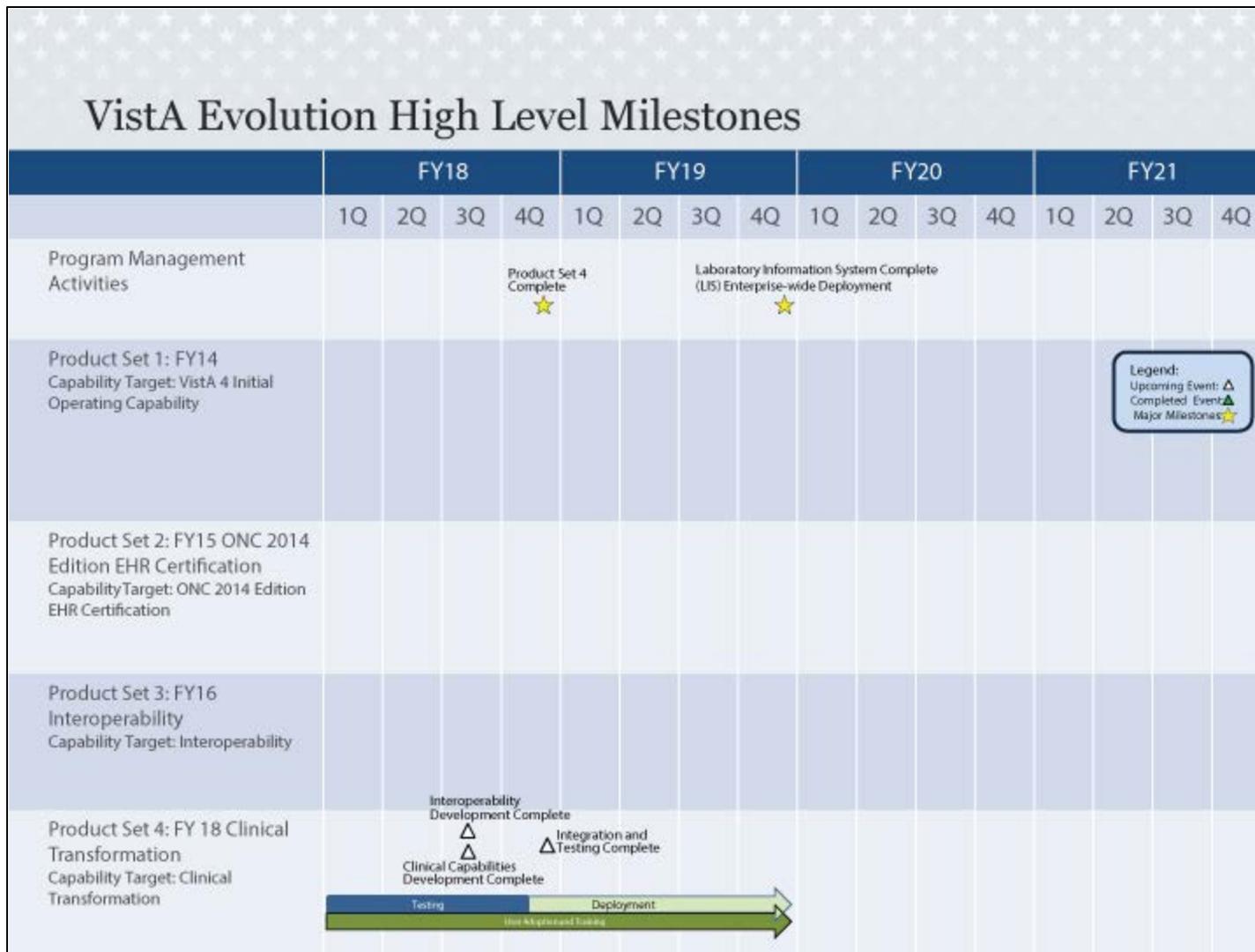


Figure 3. Milestones and Schedule – FY 2018 through FY 2019

17. Appendix E: Outcome-Based Metrics

Table 1. List of Benefits, Definition, and Performance Measure

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #1: Enhanced Functionality with Technical Applications / Capabilities		
Definition: In information technology, functionality (from Latin function meaning "to perform") is the sum or any aspect of what a product, such as a software application or computing device, can do for a user. (Search SOA.techtarget.com)		
Benefit Grouping/Definition	Benefit/Definition	Performance Measure(s)
System Architecture The underlying structure of networks and computer hardware and software.	Improved System Architecture: The discipline that combines system elements which, working together, create unique structural and behavioral capabilities that none could produce alone. The degree to which well-designed systems-level architectures are critical to the success of large-scale projects—or the lack thereof to failure—has been dramatically demonstrated. The explosion of technological opportunities and customer demands has driven up the size, complexity, costs, and investment risks of such projects to levels feasible for only major companies and governments. Without sound systems architectures, these projects lack the firm foundation and robust structure on which to build. (McGraw-Hill Concise Encyclopedia of Engineering. © 2002 by The McGraw-Hill Companies, Inc; on-line Dictionary by Farlex)	<ul style="list-style-type: none"> • System Integration • Network Capability
System Architecture	Improved System Performance: The totality of the system's technical/functional performance to include the integration of capabilities. Measures associated with how the technical and functional components of the system itself functions.	<ul style="list-style-type: none"> • Capacity • Application Performance
System Architecture	Data Interoperability: The ability to provide high fidelity data exchange through extraction and transfer technologies and protocols.	<ul style="list-style-type: none"> • Improved/Maintained Electronic Health Information Sharing: The ability to share data/information in a meaningful way through specific technical capabilities, such as the eHealth Exchange and Direct Secure Messaging Program, with public and/or private sector partners.
Usability How well users can learn and use a product to achieve their goals. It also refers to how satisfied users are with that process.	Improved Usability: The quality of a user's experience when interfacing with a product or system.	<ul style="list-style-type: none"> • Ease of Use; User Satisfaction • Learnability - Intuitive • Simplicity • Naturalness • Consistency • Minimizing Cognitive Load • Efficient interactions • Effective information presentation

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #2: Improved Operational Efficiency		
Definition: Avoiding wasting time and other resources (IOM)		
Benefit Grouping/Definition	Benefit/Definition	Performance Measure(s)
<p>Operational Efficiency The ability of an organization to execute its tactical plans while maintaining a healthy balance between cost and productivity. (http://www.linkedin.com/answers/business-operations/quality-management-standards/OPS_QMA/623387-26896725)</p>	<p>Improved Operational Efficiency: What occurs when the right combination of people, process, and technology come together to enhance the productivity and value of any business operation, while driving down the cost of routine operations to a desired level. The end result is that resources previously needed to manage operational tasks can be redirected to new, high-value initiatives that bring additional capabilities to the organization. (eSynch, 2005–2007. “Achieving Business Agility through Operational Efficiency—The Challenge.” www.esynch.com.)</p>	<ul style="list-style-type: none"> • Data transformed into information • Standardized Business Processes: Involves 3 components: (1)The creation of a customer-oriented business management method (business processes or value chains.) (2) The creation of procedures to oversee the organizations operations. (3) The integration of IT resources using a business process approach (www.bptrends.com)
<p>Operational Efficiency</p>	<p>Managerial Decision Support: Any computer based support of medical, managerial, administrative, and financial decisions in health using some processing logic with knowledge bases and/or reference materials. (HL7, Glossary) A decision support system may present information graphically and may include an expert system or artificial intelligence (AI). It may be aimed at business executives or some other group of knowledge workers.</p>	<ul style="list-style-type: none"> • Staffing • Business Processes: Measures that monitor the management of budgets, costs, third-party payer contracts, and revenues to improve day-to-day operations, manage operational effectiveness, evaluate payer performance • Physician performance
<p>Operational Efficiency</p>	<p>Improved Access to Business Intelligence: Business intelligence (BI) is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions. BI applications include the activities of decision support systems, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining.</p>	<ul style="list-style-type: none"> • Projected revenue figures based on new process
<p>Operational Efficiency</p>	<p>Improved Cost Savings: Improved cost savings related to improved compliance with Standards of Care/Standards of Practice / improved quality.</p>	<ul style="list-style-type: none"> • Number of malpractice cases against the organization • Cost of malpractice cases

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #2: Improved Operational Efficiency (continued)		
Benefit Grouping/Definition	Benefit/Definition	Performance Measure(s)
Operational Efficiency	New opportunities to potentially increase efficiency in training across VA and DoD, where feasible.	Qualitative measures: <ul style="list-style-type: none"> • Provider/personnel satisfaction • Training support package effectiveness
Operational Efficiency	Prevention of increased workload for personnel. Example: After the introduction of an EHR, personnel may have to spend more time on documentation because they are required to provide more and more detailed information than with a paper chart. While this information may be helpful, the process of entering the information may be time consuming, especially at first. (AHRQ)	<ul style="list-style-type: none"> • Personnel time using EHR • Provider time with EHR during patient appointments
Operational Efficiency	Realistic management of never ending demands for system changes. Example: As EHRs evolve, users rely more heavily on the software and demand more sophisticated functionality and new features. The addition of new functionalities necessitates that more resources be devoted to EHR implementation and maintenance. (AHRQ)	<ul style="list-style-type: none"> • Personnel requirements for EHR • Sustainment Costs for EHR
Operational Efficiency	Improved Failure Modes and Effects Analysis (FMEA). A widely used risk assessment technique for identifying, prioritizing, and fixing potential system failures before an adverse event actually occurs. Because FMEA is prospective - rather than retrospective - it focuses on systems rather than events. A common process used to prospectively identify error risk within a particular process. (AHRQ, Guide to reducing Unintended Consequences of EHR)	<ul style="list-style-type: none"> • FMEAs conducted
Operational Efficiency	Decreased impact of Unfavorable Workflow changes. Example: Computerized physician order entry (CPOE) automates the medication and test ordering process by reducing the number of clinicians and clerical staff involved, but by doing so it also eliminates checks and counter checks in the manual ordering process. That is, with the older system, nurses or clerks may have noticed errors, whereas now the order goes directly from the physician to the pharmacy or lab. (AHRQ)	<ul style="list-style-type: none"> • Errors associated with automation

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #2: Improved Operational Efficiency (continued)		
Benefit Grouping/Definition	Benefit/Definition	Performance Measure(s)
Operational Efficiency	<p>Decreased impact of Unfavorable changes in communication patterns and practices. Example: Effective interpersonal communication—real-time, face-to-face or phone conversations —allows clinicians—physicians, nurses and other practitioners—to acquire nuanced information from patients and other clinicians that cannot easily be communicated in medical records, including social context, values, preferences and issues specific to complex patients. Better communication between patients and physicians and between primary care physicians and specialists is a key component of care coordination and leads to improved patient outcomes. While EMRs are expected to improve information sharing, it is less clear how their actual use affects interpersonal communication. (www.hschange.com, EMRs and Communication with Patients and other Clinicians: Are we talking less?, Apr 2010, Issue Brief No. 131)</p>	<ul style="list-style-type: none"> • Communication Patterns: Quantitative Example: EHRs create an "illusion of communication" (i.e. a belief that simply entering an order ensures that others will see it and act upon it.) For example, a physician fails to speak with a nurse about administering a medication, assuming that the nurse will see the note in the EHR and act upon it. (AHRQ) • Communication Patterns: Quantitative example: IM alerts that distract a provider during a patient visit. • Communication Patterns: Clinician perception that the "wealth of data" causes them to communicate less with the patient or other clinicians.
Operational Efficiency	<p>Prevent delayed data entry that appears to be noncompliance. Example: Situations in which the data entry in the EHR may not reflect the order or timing of events. Example: blood culture before antibiotic administration, usually separated in time by a few minutes, may appear out of order if the medication administration is recorded before the blood draw.</p>	<ul style="list-style-type: none"> • Reporting Compliance: Report to identify reporting compliance issues within individual patient records (ability to have manual audit may be required).

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #3: Quality - Better Care

Definition: Degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge. (Kohn) IOM defines healthcare quality as the extent to which health services provided to individuals and patient populations improve desired health outcomes. The care should be based on the strongest clinical evidence and provided in a technically and culturally competent manner with good communication and shared decision making.

Benefit Grouping /Definition	Benefit / Definition	Performance Measure
<p>Continuity of Care Continuity of care is the process by which the patient and the provider are cooperatively involved in ongoing healthcare management toward the goal of high quality, cost-effective medical care. (http://www.aafp.org/online/en/home/policy/policies/c/continuityofcaredefinition.html)</p>	<p>Improved Continuity of Care</p>	<ul style="list-style-type: none"> • Timeliness of Care: Reducing waits and sometimes unfavorable delays for both those who receive and those who give care. (IOM) • Access to Care: The availability of medical care. The quality of one's access to medical care is determined by location, transportation options, and the type of medical care facilities available in the area, etc. • Readmission: Readmission to the facility, that is unexpected, for issues this is / may be associated with previous healthcare encounter.
<p>Population Health The health outcomes of a group of individuals, including the distribution of such outcomes within the group. (http://www.improvingpopulationhealth.org)</p>	<p>Improved Population Health: Reducing health inequities among population groups. Population health seeks to step beyond the individual-level focus of mainstream medicine and public health by addressing a broad range of factors that impact health on a population-level, such as environment, social structure, resource distribution, etc.</p>	<ul style="list-style-type: none"> • Prevention and chronic care alert reminders (This list may represent HEDIS measures as recommended by NCQA).
<p>Population Health</p>	<p>Improved Care for Homeless Veteran Population (VA 2011-2015 Strategic Plan Refresh)</p>	<ul style="list-style-type: none"> • Mental healthcare documentation • Preventive Care • Treatment

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #3: Quality - Better Care (continued)		
Benefit Grouping /Definition	Benefit / Definition	Performance Measure
<p>Medical Decision Support Clinical Decision Support refers broadly to providing clinicians or patients with clinical knowledge and patient-related information, intelligently filtered or presented at appropriate times, to enhance patient care. Clinical knowledge of interest could range from simple facts and relationships to best practices for managing patients with specific disease states, new medical knowledge from clinical research and other types of information. (HL7, Glossary)</p>	<p>Access to practice guidelines: Systematically developed statements to standardize care and to assist in practitioner and patient decisions about the appropriate healthcare for specific circumstances. Practice guidelines are usually developed through a process that combines scientific evidence of effectiveness with expert opinion. Practice guidelines are also referred to as clinical criteria, protocols, algorithms, review criteria, and guidelines.(HL7, Glossary)</p>	<ul style="list-style-type: none"> • Qualitative: overall staff satisfaction surveys to determine if the Management Base, continuing references, is meeting their needs. • Quantitative: measure how many times the knowledge base is accessed for a particular guideline, or overall. • Rapidity of changed guideline implementation.
<p>Medical Decision Support</p>	<p>Improved Analytic Capability: Analytical skill is the ability to visualize, articulate, and solve both complex and uncomplicated problems and concepts and make decisions that make sense based on available information.</p>	<ul style="list-style-type: none"> • The number of Sentinel events, Failure Mode Effects Analysis (FMEA) reports, Root Cause Analysis events. • Qualitative methods to survey satisfaction level of those who work in Risk Management, Quality department, or leaders who receive reports and need to act on the results.
<p>Medical Decision Support</p>	<p>Rapid Application of Best Practices: A method or technique that has consistently shown results superior to those achieved with other means, and that is used as a benchmark. (http://www.businessdictionary.com/definition/best-practice.html) A best practice is a technique or methodology that, through experience and research, has proven to reliably lead to a desired result. A commitment to using the best practices in any field is a commitment to using all the knowledge and technology at one's disposal to ensure success. (http://searchsoftwarequality.techtarget.com/definition/best-practice)</p>	<ul style="list-style-type: none"> • Monitor for noted deficiencies to the National Patient Safety Goals that are based evidence-based best practices, ORYX measures.

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #4: Improved Patient Safety

Definition: The prevention of healthcare errors, and the elimination or mitigation of patient injury caused by healthcare errors. This benefit is intended to evaluate the degree to which the EHR solutions increase the safety of VA patients. The EHR solution will accommodate a variety of IM/IT functional capabilities required to provide seamless patient care. Each product that is integrated with the EHR will not only bring it's intended functionality, but may also enhance data and information available at each patient encounter, or for measures associated with groups of patients. Enhancing proactive identification of patients who are "at risk" for a safety related issues can prevent them; enhancing rapid identification of patients who have a safety related event can mitigate further complications for a single patient or prevent further incidents in other patients.

Benefit Grouping /Definition	Benefit / Definition	Performance Measure
Demonstrate Compliance	Increased Regulatory Compliance: In general, compliance means conforming to a rule, such as a specification, policy, standard or law. Regulatory compliance describes the goal that corporations or public agencies aspire to achieve in their efforts to ensure that personnel are aware of and take steps to comply with relevant laws and regulations.	<ul style="list-style-type: none"> • Review last accreditation report from The Joint Commission for any deficiencies, which facilities were accredited? Findings? • HIPAA Compliance (HITECH Act)
Demonstrate Compliance	Improved Adherence to Federal Regulations / Standards: Able to demonstrate compliance to Federal regulations /standards through governance, policies and procedures.	<ul style="list-style-type: none"> • Demonstrate compliance to any GAO audits, Quality assurance and compliance measurement programs, research protocols
Demonstrate Compliance	Improved Credentialing of Providers/Practitioners: Facility requirement to confirm licensing and privileges of a given provider/practitioner. This data should be "owned" by the provider/practitioners main organization but should be available to other DoD / VA organizations in which the provider/practitioner practices. (GAO finding)	<ul style="list-style-type: none"> • Credential data available for individual provider, department, or facility. • Provider credentials available to partner facilities • Medical record delinquency (hospitals only)
Demonstrate Compliance	Improved Research Support	<ul style="list-style-type: none"> • Research Compliance • Graduate Medical Education Support
Clinical Outcomes	Improved Identification of Patient Safety Related Issues: Patient safety as an attribute of healthcare systems that minimizes the incidence and impact of adverse events and maximizes recovery from such events.	<ul style="list-style-type: none"> • Number of deficiencies noted in any Joint Commission accreditation reports concerning National Patient Safety Goals, Joint Commission ORYX measurements • Clinical rules data bases with alerts • E-prescribing with full interaction checks and alerts. (MU)

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #4: Improved Patient Safety (continued)		
Benefit Grouping /Definition	Benefit / Definition	Performance Measure
Clinical Outcomes	Decreased Healthcare Errors: An unintended healthcare outcome caused by a defect in the delivery of care to a patient. Healthcare errors may be errors of commission (doing the wrong thing), omission (not doing the right thing), or execution (doing the right thing incorrectly). Errors may be made by any member of the healthcare team in any healthcare setting.	<ul style="list-style-type: none"> • Healthcare-acquired infection rates • Wrong-site Surgery numbers • Diagnostic errors • The number of Sentinel events, Failure Mode Effects Analysis (FMEA) reports, Root Cause Analysis events • Peer review process
Clinical Outcomes	Decreased Duplicity: The quality or state of being twofold or double (http://www.wordnik.com/words/duplicity)	<ul style="list-style-type: none"> • Multiple-entry (Safety Concern): Multiple entry points for identical information can lead to conflicting or ambiguous data, or omissions. Examples: allergy, height and weight information may be entered into the patient record at multiple points in our system. (ESRD)
Clinical Outcomes	Enables rapid response to recalls: Medical pharmaceuticals, supplies, implants, and other items used in the care and treatment of patients may be identified for recall for any variety of reasons. The EHR can enable the rapid location of such products and the identification of patients on whom these products were used.	<ul style="list-style-type: none"> • Pharmaceutical recalls • Implant device recalls • Medical supply recalls
Readiness	Improves response to Events (Natural / Manmade): Emergency management is the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters.	<ul style="list-style-type: none"> • Response time • Noted deficiencies in any Joint Commission reports • Annual survey of emergency management supplies

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #5: Improved Cost Savings

Definition: The actual costs of providing services related to the delivery of healthcare, including the costs of procedures, therapies, and medications. It is differentiated from health expenditures, which refers to the amount of money paid for the services, and from fees, which refers to the amount charged, regardless of cost. (www.mondofacto.com)

Benefit Grouping /Definition	Benefit / Definition	Performance Measure
<p>Responsibly Manage Total Healthcare Costs</p>	<p>Decreased Healthcare Costs: Decreasing the actual costs of providing services related to the delivery of healthcare, including the costs of procedures, therapies, and medications. It is differentiated from health expenditures, which refers to the amount of money paid for the services, and from fees, which refers to the amount charged, regardless of cost.</p>	<ul style="list-style-type: none"> • Cost Efficiency: A comparison of the relative cost-efficiencies of two or more ways of performing a task or achieving an objective. (Saunders Comprehensive Veterinary Dictionary, 3 ed. © 2007 Elsevier, Inc.) • Cost Avoidance: Action taken to reduce future costs, such as replacing parts before they fail and cause damage to other parts. Cost avoidance may incur higher (or additional) costs in the short run but the final or life cycle cost would be lower. (http://www.businessdictionary.com/definition/cost-avoidance.html#ixzz2IHTKH7vk) • Cost reduction: Assessment of co-morbidity, costs, and outcomes of specific DRGs
<p>Responsibly Manage Total Healthcare Costs</p>	<p>Demonstrates Economy of Scale: The reduction in long-run average and marginal costs arising from an increase in size of an operation unit. Economics of scale can be internal to an organization (cost reduction due to technology and management factors) or external (cost reduction due to the effect of technology in an industry). (http://www.businessdictionary.com/definition/economies-of-scale.html)</p>	<ul style="list-style-type: none"> • Collect number of patients enrolled into a program and cost savings

This table is an approximation of anticipated benefits/metrics and is expected to change.

Benefit #6: Improved Customer Satisfaction

Definition: A term frequently used in marketing, is a measure of how products and services supplied by a company meet or surpass customer expectation. Customer satisfaction is defined as "the number of customers, or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals." (Wikipedia)

Benefit Grouping /Definition	Benefit / Definition	Performance Measure
Personnel Satisfaction	Improved Personnel Satisfaction: The overall experience, in general or specifics, a user, customer, or audience member has with a product, service, or event. In the Usability field, this experience is usually defined in terms of ease-of-use. However, the experience encompasses more than merely function and flow, but the understanding compiled through all of the senses. (Shedroff; http://www.allaboutux.org/ux-definitions)	<ul style="list-style-type: none"> • Personnel Satisfaction with EHR products and the impact to healthcare
Personnel Satisfaction	Personnel Productivity: Personnel identify improved efficiency, effectiveness and support in patient care and population health related activities that they can directly attribute to the EHR.	<ul style="list-style-type: none"> • Personnel productivity • Personnel morale • Personnel records complete time • Personnel workflow occurs without changing the order of tasks.
Patient Satisfaction	Improved Patient Satisfaction: Patient identifies an improved attitude and perception of the clinical and business side of healthcare experience.	<ul style="list-style-type: none"> • Qualitative measures Patient perception • Greater patient access to medical data • Patient perception of care event
Patient Care Giver Satisfaction	Improved Patient Care Giver Satisfaction: Patient identifies an improved attitude and perception of the clinical and business side of healthcare experience.	<ul style="list-style-type: none"> • Qualitative measures patient care giver perception • Family member/care giver perception of the care event - billing accuracy and timeliness
User Adoption Adoption is an individual process detailing the series of stages one undergoes from first hearing about a product to finally adopting it.	Increased Adoption of EHR Application	<ul style="list-style-type: none"> • Rate of user adoption

18. Appendix F: References

1. Section 713 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2014, P.L. 113-066.
2. Section 1635 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2008, P.L. 110-181.
3. Department of Defense and Department of Veterans Affairs Interagency Program Office (IPO) Charter.
4. Department of Defense and Department of Veterans Affairs Health Executive Council Interagency Clinical Board (ICIB) Charter.
5. Department of Defense and Department of Veterans Affairs Health Executive Council Health Architecture Review Board (HARB) Charter.
6. Department of Veterans Affairs VistA 4 Product Roadmap.