Deliverable 25: Final

Joint DoD-VA Inpatient EHR: Final Report

Task Order W81XWH-07-F-0353: Joint DoD-VA Inpatient Electronic Health Record (EHR) Project Support

Department of Defense and Department of Veterans Affairs

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1.0 Executive Summary

In July of 2007, the Department of Defense (DoD) and the Department of Veterans Affairs (VA) initiated a study to explore the feasibility of a joint inpatient Electronic Health Record (EHR) solution.¹ The first phase of the study focused on assessing the question of feasibility. This phase performed an objective and holistic analysis of whether it is feasible for DoD and VA to pursue a common inpatient EHR system (EHR-S). Chiefly, the first phase was intended to evaluate the hypothesis that DoD and VA care for inpatients in a similar manner and, thus, could share a common solution. The second phase would focus on evaluating potential solutions that could satisfy the joint inpatient requirements. This report represents the culmination of the first phase of the study. It summarizes key findings from the first phase, presents the overall assessment of feasibility, and offers recommendations for moving forward.

1.1 Drivers of this Study

DoD and VA have made significant progress over the last decade in the implementation of robust, comprehensive EHR systems. Both Departments have large, shared beneficiary populations and, for almost a decade, have been pursuing ways to share health information and create more comprehensive electronic medical records through a number of joint data sharing initiatives. Though much progress has been made, both Departments realize that the overarching challenge, as yet unmet, is to provide seamless, comprehensive information interoperability to support joint strategic goals.

VA’s electronic health record system, known as the Computerized Patient Record System (CPRS), is part of the Veterans Health Information System and Architecture (VistA). VistA is a platform that integrates functionality for inpatient, outpatient, home health, and all other physical care environments into a comprehensive integrated EHR-S. VistA supports a broad range of clinical activity across all disciplines and has had measurable impact on improving both the quality of care provided to veterans and the safety and efficiency of the care environment. Despite VistA’s clinical utility and success, it is an aging platform in need of a technology refresh.

The DoD EHR-S, AHLTA, is an enterprise-wide medical and dental clinical information system for use in all fixed military medical facilities, on board ships, and in deployed medical facilities. It generates, maintains, stores and provides secure real-time access to patient records. In contrast to VistA, AHLTA is an outpatient EHR-S. Although DoD is deploying an interim inpatient EHR-S, DoD continues to work toward an enterprise inpatient EHR-S in order to achieve its vision of sharing all health information seamlessly across military treatment facilities. The need to modernize VistA, and the need to implement an enterprise inpatient EHR-S across DoD, introduces a unique opportunity for the Departments to investigate the feasibility of a common solution.

¹ Note: The term "joint" in the context of this deliverable and the Joint DoD VA Inpatient EHR Project means an interagency, collaborative effort between the DoD and the VA
1.2 Key Findings

Key findings are presented in the context of how the feasibility study was structured and executed. As shown in the Deliverable Network Diagram below (Figure 1), this study was comprised of fourteen key interrelated deliverables (D12-D25) grouped into seven major sections (A-G). All deliverables focused on addressing the overall question of the feasibility of DoD-VA acquiring a joint, interoperable inpatient EHR-S. The deliverables also established the foundation for future phases of this project and provided the “source material” for the findings and recommendations summarized in this final report.

Figure 1: Deliverable Network Diagram

1.2.1 Section A – What is the definition and scope of the Joint DoD-VA Inpatient EHR-S?

The Departments defined the Joint DoD-VA Inpatient EHR-S as “the collection of patient-centric data and associated processes which directly support inpatient care and clinical status reporting within and across the Departments of Defense and Veterans Affairs. This Joint DoD-VA Inpatient EHR-S must support continuity of care, the continuum of care, the concept of interoperability, and shareable data and processes.” The scope of the DoD-VA joint inpatient EHR-S includes eight core capabilities: Manage Documentation, Manage Orders, Manage Results, Provide Automated Clinical, Decision Support, Manage Clinical Tasks & Processes, Manage Patient Reported Data, Provide Knowledge Resources, and Manage Pharmacy Services. These core capabilities interact with cooperating and subscribing capabilities which were also defined in this study. While DoD and VA agreed on definition and scope, they also agreed that they cannot study or design the inpatient EHR-S in isolation of a patient’s complete, longitudinal...
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EHR. Ultimately, DoD and VA need a comprehensive patient record that allows clinicians to take care of a patient in any setting across the health care continuum.

1.2.2 Section B – What are the clinical and business requirements, and what is the degree of commonality?

This study verified the hypothesis that there is extensive commonality in the way DoD and VA care for inpatients and in the functionality needed to support that care. Over 1,800 inpatient EHR-S functional requirements were documented, analyzed, and validated through interviews and offsite workshops that included participation from over 200 DoD-VA clinicians, business users, and technical subject matter experts. In the final analysis, 97% of the requirements were deemed to be “joint” and 3% “Department specific”. This overwhelming level of jointness confirms the main hypothesis of this study, that DoD and VA care for patients in a similar manner and thus share similar functional requirements. The primary differences were in the Admission, Discharge, and Transfer (ADT) capability. Analysis of theatre, polytrauma, and domiciliary care environments revealed that these settings do not have unique functional requirements. Nevertheless, significant technical and infrastructure challenges are faced when deploying to theater and need to be considered in Phase Two (e.g., the ability for systems to function in low/no communications environments, conform to physical weight limitations, and move data asynchronously to theatre databases).

1.2.3 Section C – What is industry's perspective?

Gartner reports and 24 responses to a Request for Information (RFI) indicated that industry believes that there are a range of solutions which may address the capability areas required by a joint DoD-VA inpatient EHR-S. These included approaches that would leverage current DoD-VA platforms (i.e., “evolve and modernize”), COTS solutions, open source EHR software suites, and loosely coupled approaches for delivering information services. Adopting available standards and ontologies, and building an integrated joint architecture are a key to ensuring the success of a joint solution.

1.2.4 Section D – What are the head start opportunities?

Technical and non-technical head start opportunities can provide value today and prepare the Departments for a joint inpatient EHR-S regardless of the ultimate solution. Eighteen technical and non-technical head start opportunities were identified. Top technical opportunities include developing a common data model, standardizing inpatient data elements, and expanding on existing DoD-VA sharing initiatives. Top non-technical opportunities include developing a change management plan, formalizing a joint requirements management methodology, and sharing lessons learned with the Great Lakes Federal Health Care Center (FHCC), Ft. Drum, and other DoD-VA medical facilities in Hawaii, Alaska, Texas, New Mexico, and other locations.

1.2.5 Section E – What are the potential costs, schedules, and risks?

Although premature to provide specific estimates for specific joint inpatient EHR solutions, a high-level assessment of cost, schedule, and risk was performed to inform the overall feasibility
assessment. Estimates vary at this stage, with costs ranging from $1.4 billion to $5.2 billion and full deployment schedule estimates ranging from seven to sixteen years. A detailed cost-benefit analysis for a range of options should be conducted in Phase Two.

1.2.6 Section F – How should this be managed?

Successful management of an effort of this size and complexity will require three changes to the existing structure: a modified joint strategy, expanded joint governance, and a new joint program management office (PMO). The Joint Strategic Plan should be updated to include new goals, objectives, strategies and performance measures that will guide the development and implementation of the DoD-VA joint inpatient EHR-S. The existing DoD-VA joint governance structure should be modified by adding a new Inpatient EHR Working Group, for effective joint decision-making and to oversee the joint PMO, as well as a new Joint Advisory Board to provide ongoing EHR expertise that will inform and guide Inpatient EHR decisions. Finally, a joint PMO should be established with full authority to execute the program under the guidance of the existing DoD-VA joint governance structure. In implementing this joint management model, DoD and VA should introduce integrated joint program management processes and a framework to manage the business value of the Inpatient EHR-S, while leveraging the strengths of their respective management practices (e.g., requirements management, clinician leadership) as the foundation for future operations.

1.3 Overall Assessment of Feasibility

This study has concluded that the acquisition/development of a Joint DoD-VA Inpatient EHR-S, which meets the inpatient requirements of both Departments, is feasible.

- A Joint Inpatient EHR-S will advance the goals, objectives, and strategies of the DoD and VA Joint Strategic Plan (JSP)
- DoD and VA agree on the definition and scope of an inpatient EHR-S, which must support the full continuum of care in a patient centric fashion
- There is over 95% commonality in the Departments’ inpatient functional requirements
- A range of potential solutions exists including modernizing current DoD-VA systems, COTS solutions, open source EHR software suites, and loosely coupled approaches for delivering information services
- The foundational Joint governance structure is established
- A high level joint PMO design is in place with legislation pending
- A strong joint community exists, backed by strong Joint leadership

1.4 Recommendations

The overall recommendation from this feasible study is that DoD and VA should move forward together to conduct a detailed analysis of joint solutions. Specific recommendations include the following:
• **Recommendation #1 – With a definition, scope, and Joint requirements in place, move into Phase Two analysis.** The next level of analysis should cover several important areas. First, the Departments need to think beyond creating the digital version of the paper record by developing a 5-10 year plan for the EHR and by anticipating future innovations in health care and health informatics. While this study provides the groundwork and foundational requirements, the next level of joint brainstorming needs to occur. Second, while further refinement of the core requirements is necessary, DoD and VA should spend at least as much time studying how the core capabilities will interact with cooperating and subscribing capabilities. Third, usability and user satisfaction of any systems under consideration should be performed through a variety of techniques including survey, observation, and focus groups. Fourth, technical and infrastructure constraints for deployed settings must be addressed as the solutions analysis evolves. And finally, the ultimate vision should move beyond a joint inpatient EHR-S to a solution that is not described by the artificial boundaries between inpatient, outpatient and other care environments.

• **Recommendation #2 – Conduct a detailed cost-benefit analysis for several options.** A range of potential options (e.g., leverage existing DoD-VA systems, procure and implement one or more COTS products, maintain the status quo) should be assessed in Phase 2. This extended analysis will include a more detailed analysis of cost, schedule, and risk, as well as the benefits of each option.

• **Recommendation #3 – Continue to take a holistic view of this challenge.** The Departments recognize that this is much more than a technical problem. Although the next phase should perform an analysis of technical solutions, DoD and VA should continue to take a multidimensional approach to this study to include factors such as culture, governance, communications, policy, and economics. This should lead to a comprehensive change management plan to transition the organizations to the desired future state.

• **Recommendation #4 – Standup interagency PMO and make related changes to the Joint Governance and the JSP.** The Departments should move forward with the establishment of a DoD-VA Interagency PMO to execute the Joint Inpatient EHR program, and the addition of a new Health Executive Council (HEC) Working Group and Advisory Board for Joint Inpatient EHR decision-making. Joint requirements and portfolio management capabilities should be implemented via the existing DoD-VA governance structure. While this study is limited to the inpatient EHR, the Departments should consider a broader outcomes management approach to track the business value of all joint resources. Finally DoD and VA should solidify commitment from leadership by writing Joint Inpatient EHR related goals, objectives, and performance measures into future legislation and strategic plans (Joint Strategic Plan, MHS Strategic Plan, and VA Strategic Plan).
• **Recommendation #5 – Commit to a joint investment in the evolution of a standard-based architecture.** The Departments should continue to invest in a Joint integrated architecture framework using available standards and accepted ontologies. DoD and VA should mandate using established data standards (e.g., SNOMED-CT, RxNORM, LOINC, HL7 RIM, HL7 CDA, ICD9-CM, CPT4), messaging standards (e.g., HL7 2.x and 3.x), and technology standards (e.g., XML, HTTPS/SSL, TCP/IP, SOAP) and create interim “standards” from proven DOD-VA applications when controlled vocabularies are not available. As this architecture evolves it should be used as a mechanism to integrate future chosen systems and/or modularized technologies over the longer term.

• **Recommendation #6 – Continue to foster, leverage, and extend the Joint DoD-VA community.** Beyond the technical analysis performed in this study, one of the most encouraging observations is the level of cooperation, collegiality, and, above all, commitment to delivering high quality patient centered care. This study directly involved over 200 DoD-VA executive leaders, clinicians, business managers, and technical subject matter experts, yet this is just the beginning. DoD and VA must continue to foster the current community and rely on this community to help reach others as needed—this will expand consensus and incorporate additional input. A stakeholder management plan and process should be established to enhance and expand this joint community.

• **Recommendation #7 – Continue to lead the nation in HIT by seizing this opportunity to move forward together.** The joint DoD-VA inpatient EHR-S is a strategic effort for Departments that supports the advancement of the Nationwide Health Information Network (NHIN). As this effort moves forward, DoD and VA should continue to work with other federal agencies and industry to ensure consistency with national efforts. The analysis of potential solutions in Phase 2 must consider the required standards and certification criteria being developed by the Healthcare Information Technology Standards Panel (HITSP) and Certification Commission for Healthcare Information Technology (CCHIT). Where no standard is set, this project may influence the Office of the National Coordinator and the private sector marketplace, simply because it will be leading the pack. The Departments should also share lessons learned from this effort with other interagency collaboration efforts including the Senior Oversight Committee (SOC) Lines of Action (LOAs) that are addressing several high-priority health care and transition issues and the FHCC joint venture that is grappling with related technical, cultural, financial, and management issues. More generally, DoD and VA should provide transparency to help other care delivery organizations understand how the nation’s two largest health systems are moving toward interoperability and joint solutions.

* * * * *

Though the challenges of a joint DoD-VA inpatient EHR-S are great, the opportunities are greater. By implementing a common solution both organizations could avoid duplicate
development or acquisition costs and benefit from economies of scale\(^2\). By visioning a future state in which the EHR is not just a digitized version of a paper record, but an advanced decision support tool, the VA and DoD can provide an EHR-S that is an active enabler of evidence based medicine, a tool to dramatically increase patient safety, and a vehicle that provides clinicians with access, not just to clinical data, but to clinical information. Most importantly they would provide a seamless transition of care from the battlefield, through multiple DoD and VA care venues. By providing comprehensive and current healthcare information to providers at each stage of this journey, the care provided to Wounded Warriors and other veterans will be significantly improved.

\(^2\) Examples of economies of scale that the Departments could realize through a common solution include greater purchasing power, lower application integration costs, and lower combined training costs.
2.0 Introduction

2.1 Background
The DoD and VA have made significant progress over the last decade in the implementation of robust, comprehensive EHR systems. In contrast to most private sector provider organizations, DoD and VA were early adopters of the EHR systems and are arguably among the most advanced users of EHR systems in the nation. Both DoD and VA have large beneficiary populations which, taken together, span the continuum from young, healthy active duty service members and their families, to elderly veterans receiving domiciliary care. As such, the focus of each organization’s EHR-S has been different.

These systems, which serve active duty service members and veterans, are currently exchanging electronic health care information through efforts such as the Federal Health Information Exchange (FHIE), the Bidirectional Health Information Exchange (BHIE), and Clinical Data Repository/Health Data Repository (CHDR). In the last decade, the health data shared between the Departments has greatly increased, with the primary benefit being more complete and accurate health records for Service members and veterans.

Today, the Departments continue to pursue initiatives to improve the secure exchange of appropriate health information and to increase the quantity and types of health data being shared. However, both agencies realize that the overarching challenge, as yet unmet, is to provide seamless, comprehensive information interoperability, particularly in this time of conflict, to support the Wounded Warrior.

Wounded Warriors serving in Iraq and Afghanistan are surviving injuries which were not survivable in previous conflicts. They are surviving with multiple conditions and disabilities which require complex multidisciplinary treatments both within and across DoD and VA systems of care. As illustrated by the case of Private First Class PJ shown at right, the Wounded Warrior often receives care in multiple venues, from the battlefield, to multiple military treatment facilities, to multiple VA facilities, to community based facilities, in both inpatient and outpatient environments. For PJ to receive optimal care at each step in the care process, all his health information should be available, in real time, to every provider caring for him at each stage and venue of care. Today, for PJ, as for most other Americans, that is not...
possible. The long standing activity of sharing information across DoD and VA has, in the context of the current conflicts, reached a new level of urgency and generated requirements for a new level of sophistication.

This is not just urgent for servicemen, veterans and their families; it is an issue of significance for all Americans. In 2004, President Bush issued an Executive Order mandating widespread use of interoperable EHRs within 10 years. However, slow rates of EHR adoption and extensive challenges to interoperability threaten that vision. DoD and VA have an opportunity not only to further optimize the outstanding care they provide to active duty men and women and veterans, but to lead the nation on the transformational path to electronic health information sharing and the interoperability supporting it. This would be an achievement of great national significance.

### 2.2 The Opportunity for a Common Inpatient EHR-S

The VA VistA Computerized Patient Record System (CPRS), is a comprehensive tool that integrates functionality for inpatient, outpatient, home health, and all other physical care environments in a single EHR-S. This highly functional EHR-S supports a broad range of clinical activity across all disciplines (physicians, nurses, pharmacists, chaplains, social workers, physical therapists and others) and has had measurable impact on improving both the quality of care provided to veterans and the safety and efficiency of the care environment. However, despite VistA’s clinical utility and success, it is an aging system in need of a technology “refresh.” VA must do this in a way that preserves the full spectrum of current functionalities.

The DoD EHR-S, AHLTA, has enabled DoD providers to share patient information across its enterprise and also provides decision support that enhances the quality of care. Unlike VA’s VistA, which was developed “in house,” AHLTA was developed largely through the integration of government-off-the-shelf (GOTS) and commercial-off-the-shelf (COTS) products. In contrast to VistA, AHLTA is an outpatient EHR-S. Although DoD is deploying an interim inpatient EHR-S solution, Clincomp Essentris, DoD continues to work toward a definitive inpatient EHR-S, similar to VistA, in order to achieve its vision of sharing all health information seamlessly across military treatment facilities.

The need to modernize VA VistA, and the need to implement an inpatient EHR-S across DoD, introduce a unique opportunity for DoD and VA to invest in a common, interoperable solution.

### 2.3 About this Study

This study was commissioned by the Secretary of Veterans Affairs and the Secretary of Defense, and endorsed by the DoD-VA Joint Executive Council (JEC). It represents an objective assessment of the feasibility of acquiring or developing a joint DoD-VA inpatient EHR solution by the Booz Allen Hamilton Team. The first phase of this study was conducted over a six month period from July 31, 2007 to January 31, 2008 and focused on the feasibility of a DoD-VA joint EHR-S. The second phase, if exercised, would focus on evaluating potential solutions that could satisfy the joint needs.
This study was jointly funded and jointly managed by DoD and VA. Throughout the study, every effort was made to support transparency, broad joint participation, and unbiased analysis. The Booz Allen team, which included Gartner Inc. and nationally recognized EHR experts, used a wide range of inputs to inform its analysis including:

- Government furnished documentation (e.g., strategic plans, requirements spreadsheets, architecture models, user manuals)
- On-site visits to DoD and VA facilities
- Product demonstrations of existing DoD-VA EHR solutions including VistA CPRS, AHLTA, and Clincomp Essentris
- Interviews with over 200 DoD and VA personnel, including over 50 clinicians
- Four days of clinically focused offsite workshops that included over 75 participants from DoD, VA, and industry
- Perspectives from multiple care venues (e.g., theatre, polytrauma centers, domiciliary)
- Reviews of industry EHR capability definitions and reference models (e.g., Health Level Seven (HL7), Certification Commission for Healthcare Information Technology (CCHIT))
- Case studies and lessons learned from large-scale EHR-S implementations and collaborative IT initiatives
- A Gartner survey of industry COTS EHR-S products that support inpatient capabilities
- RFI responses 24 from System Integrators, COTS EHR-S vendors, and other health care organizations
3.0 Key Findings

Phase One of this study was comprised of interrelated deliverables that provide the “source material” for this final report. These Phase One deliverables focused on addressing the overall question of the feasibility and/or setting the groundwork for future phases of this project. To help organize, sequence, and maintain focus on the overall goal of Phase One, a “Deliverable Network Diagram” was created. As shown in Figure 2 this network diagram groups the fourteen core deliverables (D12-D25) into seven major sections (A-G).

**Figure 2: Project Deliverable Network Diagram**

This portion of the report summarizes key findings from each of the project deliverables presented in the context of the network diagram. Detailed findings, justifications, and other background material can be found in the source deliverables.

3.1 Section A – Definition and Scope

**The DoD-VA Joint Inpatient EHR-S was defined and its foundational capabilities identified**

3.1.1 What We Did

The top priority at the beginning of the study was to establish a definition and scope for the joint inpatient EHR solution. This was important to give stakeholders a common understanding of
scope and focus downstream project efforts such as the requirements analysis, COTS EHR-S product survey, and RFI. To accomplish this, the study team:

1. **Reviewed DoD-VA documentation related to the Joint Inpatient EHR-S.** Over 30 documents were reviewed ranging from strategic plans and Congressional testimonies to enterprise architectures, requirements documentation, and user manuals.
2. **Participated in product demonstrations.** The study team visited DoD and VA facilities to participate in interactive product demonstrations of VistA CPRS, AHLTA, and Clinicomp Essentris.
3. **Conducted interviews.** The study team met with over 200 DoD and VA personnel which included over 50 clinicians.
4. **Reviewed industry EHR-S capability definitions.** Reference models and capability definitions developed by the Institute of Medicine (IOM), Health Level Seven (HL7), the Healthcare Information and Management Systems Society (HIMSS), the Certification Commission for Healthcare Information Technology (CCHIT), and the American Health Information Management Association (AHIMA) were analyzed to provide a baseline set of capabilities.
5. **Convened workshop.** Over 40 DoD, VA and industry experts participated in a two-day offsite workshop to: 1) define high-level inpatient EHR-S capabilities and major activities; 2) identify key stakeholders and strategic goals of a joint inpatient EHR-S; and 3) define the objectives, challenges and opportunities of a joint inpatient EHR-S.
6. **Reconciled workshop results.** The study team reviewed the workshop results and consulted with industry EHR-S experts to produce the DoD-VA Joint Inpatient EHR-S definition and scope (defined in terms of capabilities).

### 3.1.2 Key Findings

#### 3.1.2.1 Finding #1 – DoD and VA share a common definition of the joint inpatient EHR-S

Three patient scenarios were used during the workshop to elucidate the context in which DoD and VA healthcare providers work and some of the challenges they need to overcome. These included:

- A Wounded Warrior with complex injuries who received care in multiple venues from the battlefield, to multiple military, VA, and community facilities in both inpatient and outpatient settings (Figure 3).
- A diabetic spouse of a service member who delivers a premature baby in a community hospital. After intensive care in the community then military hospital, the baby receives ongoing general and specialty care and preventive services.
- A elderly veteran with history of heart disease and diabetes along with several service-related conditions who received care by multiple specialty physicians primarily in the outpatient setting. He receives home nursing care and uses his personal health record to log blood glucose levels and symptoms.

Described more fully in Appendix A, these scenarios highlight the breadth, depth and critical
transitions in the care of patients serviced by DoD and VA providers. As discussions of these scenarios unfolded, several guiding principles emerged shaping the definition of what a joint DoD-VA inpatient EHR-S is and what it should do to address the fundamental business issue to be addressed: to get the right information to the right people at the right place and time. Solving this problem will enhance the delivery of high-quality and efficient healthcare and preventive services, as well as provide resources to help patients take better care of themselves. To be able to address this business problem, the definition and scope of the joint inpatient EHR-S should adhere to the following four guidelines.

### Figure 4: Guidelines for the DoD-VA Joint Inpatient EHR-S

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<td><strong>Support direct patient care</strong></td>
<td>A joint inpatient EHR-S must directly support the delivery of patient care. A joint inpatient EHR-S may also facilitate secondary uses of data for internal (e.g., quality measurement, patient registries) or external (e.g., adverse event reporting, public health reporting, or clinical trial recruitment) purposes. While a joint inpatient EHR-S focuses on the delivery of inpatient care, workshop participants emphasized that optimal delivery of inpatient care requires access to health information from all care venues.</td>
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<td><strong>Support the continuity of care</strong></td>
<td>The information the EHR-S helps manage must seamlessly support the continuity of care as patients move across care settings or among healthcare professionals. Additionally, the information that the EHR-S helps manage must also transcend ages, geographies, and levels of acuity.</td>
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<td><strong>Support patient-centric care</strong></td>
<td>To achieve ubiquitous availability of timely and protected information required to care for a specific patient, a joint inpatient EHR-S, at its core, must be patient-centric; not clinician-, venue- or population-centric. A patient-centric perspective places patients in the center of the healthcare delivery process and focuses information sharing on the integration of patient information from all providers and venues of care.</td>
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<th>Description</th>
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<tbody>
<tr>
<td>Include data but also functionality</td>
<td>More than just a clinical data repository, the joint inpatient EHR-S includes functionality that enhances the care delivery process, the analysis of clinical data, and the process of clinical decision-making. Furthermore, it contains the full array of functionality that supports any venue of care, and may be tightly coupled to other functional capabilities that are not directly related to patient care but are required to manage an inpatient stay.</td>
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<tr>
<td>Address usability and human factors challenges</td>
<td>The joint EHR-S must address usability and human factors challenges to ensure effective and efficient use across the full range of EHR-S users including physicians, nurses, pharmacists, administrators and others involved in the patient care process. It must ensure that vital patient information is available, accurate, and usable, and that methods for data capture are not intrusive or disruptive to the care delivery process. Indeed it must support and enhance optimized human processes. The solution must also be contextually aware and intuitive, displaying information in a way that is most relevant to specific health care providers.</td>
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By consensus, the workshop participants agreed to the following working definition of a joint inpatient EHR-S:

**DoD-VA Joint Inpatient EHR Definition**

"The DoD-VA joint inpatient EHR is the collection of patient-centric data and associated processes which directly support inpatient care and clinical status reporting within and across the Departments of Defense and Veterans Affairs. This joint inpatient EHR must support: continuity of care, the continuum of care, and shareable data and processes."

3.1.2.2 Finding #2 – Eight capabilities comprise the DoD-VA joint inpatient EHR-S

A conceptual model that defined functional capabilities that are core to a joint inpatient EHR-S (effectively characterizing its scope) was also developed. This model shown in Figure 5 depicts the clinical and business functional capabilities that are important to the delivery of healthcare in the inpatient setting.

The functional capabilities were differentiated first by whether they directly or indirectly support the inpatient care delivery process. Those capabilities directly supporting the care delivery process are designated as core functional capabilities of a joint inpatient EHR-S (e.g., manage results, manage documents). Functional capabilities that only indirectly support the delivery of inpatient care, but interact with the EHR-S, are further differentiated by the type of interaction they have with the EHR-S.

Subscribing capabilities may provide input but primarily consume outputs of the EHR-S, while cooperating capabilities do both and thus have a more robust bidirectional information exchange

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3 "Human Factors" refers to the engineering profession that focuses on how people interact with tasks, machines (or computers), and the environment with the consideration that humans have certain limitations
with the EHR-S and are more tightly interwoven with the core functionality. A full list of capability definitions can be found in Appendix B.

Figure 5: Joint DoD-VA Inpatient EHR-S Capabilities Reference Model

Core capabilities are required to provide direct care in an inpatient setting. Subscribing capabilities primarily consume outputs from the inpatient EHR. Cooperating capabilities provide inputs to and consume outputs from the inpatient EHR.

Core capabilities are considered in scope for the DoD-VA joint inpatient EHR. During the initial scoping exercises, three cooperating capabilities—Manage ADT, Manage Scheduling and Resource Allocation, and Manage Ancillary Services—were difficult to classify and required further analysis. The rationale for final classification of these capabilities can be found in Appendix C.

3.1.2.3 Finding #3 – The Departments cannot study or design the inpatient EHR-S in isolation of a patient's complete, longitudinal EHR

Even with consensus on the definition of inpatient and its scope, an EHR-S whose data is limited to the inpatient environment would miss the mark. Any EHR-S developed or implemented should, according to its strategic objectives, support the continuity of care. That should include relevant data from all previous sources of care and patient settings, inpatient or otherwise. Ultimately, DoD and VA need a comprehensive patient record that allows clinicians to take care of a patient in any setting across the health care continuum.
3.2 Section B – Functional Requirements

Over 1,800 joint inpatient EHR-S functional requirements were documented, analyzed, and aligned with clinical care scenarios

3.2.1 What We Did

With the initial scope of the inpatient EHR-S established within the first 30 days of the study, the team identified clinical and business functional requirements that are common to both organizations and those that are unique to each organization. These differences could be driven by different mission requirements or care delivery processes. The primary question these activities answered is whether clinical care delivery in the two health systems is substantially the same or substantially different. To accomplish the requirements analysis, the study team:

1. **Established clinical context.** The story introduced earlier of Private First Class PJ, a wounded warrior, provided clinical context for the requirements analysis. PJ’s story depicts the sequence of care settings in which a hypothetical patient, a wounded warrior, receives medical care from battlefield through DoD and VA inpatient medical facilities, then at home and in outpatient settings. To facilitate the requirements analysis, the study team “disassembled” PJ’s inpatient stay into its essential parts, called Segments:

<table>
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<th>Inpatient Segments</th>
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<tr>
<td>Segment 1: Admission to the Receiving Hospital – Registration and Bed Assignment</td>
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<td>Segment 2: Admission to the Receiving Hospital – Clinical Evaluation and Initial Care Plan</td>
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<tr>
<td>Segment 3: Pre-operative Care</td>
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<td>Segment 4: Pre-operative Care: Ancillary Services – Laboratory and Radiology</td>
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<td>Segment 5: Admission Day +1 – Day of Surgery</td>
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<td>Segment 6: Post-operative ICU Care</td>
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<td>Segment 7: Post-operative Surgical Ward Care</td>
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<td>Segment 8: Preparation for Discharge and Discharge</td>
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2. **Defined initial requirements set.** Initial requirements were developed by reviewing DoD and VA documentation, and conducting on-site visits, interviews, and system demonstrations.

3. **Assembled requirements packages.** Each segment was decomposed into multiple vignettes, short business processes that captured key clinical or administrative activities that happened during that specific point in PJ’s care. Functional requirements were then mapped to the activities, thus placing the requirements in clinical context.
4. **Conducted initial reviews with DoD and VA experts.** The eight requirements packages were sent to the VA and DoD project leaders, who distributed them to their respective expert reviewers. Reviewers were given the option to provide comments via a comments spreadsheet, a conference call, or both.

5. **Convened workshop of DoD and VA experts.** After processing the feedback from initial reviews, a two-day offsite workshop was convened with clinical, business, and technical experts from DoD and VA to conduct a collaborative review of the requirements packages. The goals of the workshop were 1) to ensure the sample of activities and requirements used in the study reflected clinical care delivery at DoD and VA inpatient facilities; 2) to identify those activities and requirements that are common to both DoD and VA; and 3) to understand the unique clinical and business requirements for theater, polytrauma, and domiciliary inpatient care settings.

6. **Reconciled workshop results.** Workshop feedback was compiled and each requirement was identified as being common to both organizations (joint) or unique to one organization (Department specific). The team then reprocessed the requirements sets in keeping with workshop discussions and feedback. This included consolidating similar requirements, generalizing others, and removing those deemed out-of-scope (e.g. outpatient-focused, system requirements, or requirements not mapped to the EHR-S capabilities being considered).

### 3.2.2 Key Findings

#### 3.2.2.1 Finding #1 – The Departments have similar functional requirements

The study team’s assessment determined than 97% are joint and 3% are Department specific as shown in Figure 6. This provides for an objective and quantitative assessment of the degree of commonality. This overwhelming level of jointness confirms the main hypothesis of this study, that DoD and VA care for patients in a similar manner and thus share similar functional requirements. Many across DoD and VA seemed to know this intuitively—this study provided a fact-based assessment and the necessary due diligence to remove any doubt.
3.2.2.2 Finding #2 – The main areas of differentiation are not an impediment to feasibility

Despite the high degree of commonality, there were areas of discontinuity that were uncovered. 42 of the 1,818 requirements in the final requirements set were found to be unique to a specific agency. Most of these unique requirements related to Admission, Discharge, and Transfer (ADT) and Scheduling and Resource Management capabilities, and mapped to the admission and discharge segments of the inpatient care scenario.

Most of the unique requirements do not have a substantive impact on the functionality supported by a joint inpatient EHR-S. For example, VA prefers to capture hemodialysis data on a customized tracking flowsheet specific to hemodialysis, while DoD believes much of this content can be tracked in a general Intake and Output (I&O) flowsheet. Both agencies concur on general functions of flowsheets, such as the ability to add and modify data elements, access relevant order entry or MAR content from the flowsheet screens, download relevant data from medical devices or physiologic monitors, etc. Both agencies also concur on the ability to create custom flowsheets. Accordingly, the hemodialysis flowsheet is a specific instance of a flowsheet, but does not reflect unique functionality in the EHR-S.

Similarly, some requirements in the analysis are unique due to the context they are considered in, not because of the concept they represent. For example, VA has unique requirements regarding...
a social work “surrogate supervisor”, which allows the user to assign a “surrogate” to cover the functions of the social work supervisor when the supervisor is away, for instance on vacation. DoD does not have similar requirements for social work supervisors. Yet, the concept of a “surrogate” is not unique. As a case in point, physicians want the ability to assign a designee to receive critical lab values (abnormal results that need to be acted on immediately) when the physician is unavailable (e.g., off call, on vacation). Again, the requirement is uniquely VA because DoD does not support that function in the social work context that was presented.

3.2.2.3 Finding #3 – Unique venues of care do not create unique functional requirements

DoD and VA provide inpatient care in settings other than the traditional acute care hospital. For example, DoD provides inpatient care in theater, and VA provides inpatient care in domiciliaries and polytrauma centers. Since a joint inpatient EHR-S must support these settings, the study team interviewed clinicians from these settings to identify unique clinical or functional requirements.

3.2.2.3.1 Theatre

With respect to theatre care, the overarching question was “Is there a difference between caring for a patient in theater and caring for a patient at Walter Reed?”

<table>
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<td>Health care in theater is provided by medical units with varying capabilities. Some examples are:</td>
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**Battalion Aid Stations (BAS).** Small units that operate far forward and are very mobile. A BAS conducts routine sick call and provides Advanced Trauma Life Support including stabilization for trauma patients. It has no patient holding capability. Trauma patients are stabilized and quickly evacuated for more definitive care. The BAS usually operates under conditions with limited communications capability and unstable power.

**Forward Surgical Teams (FST).** FSTs are small units that are also very mobile and operate as far forward as possible. FSTs are designed to provide life saving surgery for trauma patients as close as possible to the point of injury. FSTs have very limited patient holding capabilities. FST personnel stabilize and evacuate trauma patients as quickly as possible. Like the BAS, FSTs often operate in environments with limited communications and unreliable power.

**Combat Support Hospitals (CSH).** CSHs are deployable hospitals. A full CSH is capable of providing up to 300 hospital beds. A CSH is capable of providing routine sick call, treatment of non-battle injuries, and treatment of battle trauma. A CSH provides a full laboratory, pharmacy, radiology, and inpatient capability. Early in a deployment a CSH usually has limited communications capabilities. As a deployment and theater matures, the communications capabilities for the CSH usually improve to provide reasonably stable network access, but not at the bandwidth speed that CONUS military treatment facilities (MTFs) enjoy.

**Gray-hulled Ships.** Navy ships are the sole deployable platform which is not set-up in the theater of operations, but deployed with its infrastructure and crew intact. Capabilities vary from simple primary care with a single Independent Duty Corpsman (frigate, destroyer, cruiser) to surgically capable resuscitative surgery and intensive care (large deck amphibious and aircraft carrier). Network access is severely restricted and intermittent on small vessels and fairly robust and available on the larger platforms.

After interviewing theatre subject matter experts—including a military physician serving at Craig Theater Hospital, Bagram Air Field; a representative from ODASD, Force Health

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4 Source: Theater Medical Information Program-Joint (TMIP-J), Joint Concept of Employment, June 2007.
Deliverable 25: Joint DoD-VA Inpatient EHR Final Report
Task Order W81XWH-07-F-0353: Joint DoD-VA Inpatient Electronic Health Record (EHR) Support

Protection; and a theatre requirements management specialist—the answer that came back was that there are few differences from a functional perspective. In fact, the DoD characterized its theatre requirements as “a subset of the inpatient EHR-S requirements used in this study.” The main functional differences are actually features that are not needed in theatre.

Although functionality is comparable, there are significant technical and infrastructure challenges when deploying to theater, such as the ability for systems to function in low/no communications environments, conform to physical weight limitations, and move data asynchronously to theatre databases. These will be studied in greater detail in Phase Two.

3.2.2.3.2 Polytrauma Centers

As with the theatre and domiciliary environments, the polytrauma center does not have unique clinical or functional requirements. However, like the domiciliary environment, there is a considerable emphasis on interdisciplinary care planning and documentation. Both medical and psychosocial services are provided. ADT functionality must support admissions of military service members in addition to veterans, and transfers back to MTFs. Access to information from the military health system is important.

Support of patient and caregiver education is also important, including tracking completion of context-specific training and scanning in documents showing patient affirmation that educational materials were provided. In addition to the interdisciplinary note, VA noted that polytrauma centers may benefit from “open notes” which allow contributions from other providers with streamlined access control and efficient mechanisms to document family meetings.

3.2.2.3.3 Domiciliary

In the domiciliary setting, clinical documentation occurs upon admission, then infrequently, except for that directly related to rehabilitative services. Ordering and dispensing of medication occurs, and management of controlled substances is particularly important. Multidisciplinary services are provide as determine by the care plan established. Portions of the plan are time-bound while other portions are long term. Although the type of care and frequency of services differ from acute inpatient settings, the core functions of care are the same. The domiciliary environment requires greater EHR-S support in a number of areas such as coordinating outpatient services from an inpatient setting, tracking leaves-of-absence, identifying specific bed-types to reflect type
and location of care in the facility, and supporting group and interdisciplinary notes.

Group notes allow a single note to be written to summarize a group session, but then allowing veteran-specific comments to be included that appear only in the individual veteran’s record. Interdisciplinary notes support care coordination by allowing entries from multiple providers from different disciplines to contribute to a common note. Domiciliary environments also need an efficient mechanism to record health and status checks since nurses or health techs in this environment observe a large number of veterans. Finally, tools to facilitate documentation of breathalyzer results and mental health-related assessments would be helpful.

### 3.3 Section C – Industry Perspective

| C | A range of technical solutions exist to address the joint needs. Mandating the use of available standards and ontologies is key. |

#### 3.3.1 What We Did

As DoD and VA consider moving to a common inpatient EHR-S, industry perspective was important to capture lessons learned and inform the analysis of solutions planned for Phase Two. To accomplish this, the study team:

1. **Conducted a Request for Information (RFI).** A formal RFI was conducted to obtain industry perspective on the DoD-VA inpatient EHR-S. Interested parties were provided background information, as well as the DoD-VA inpatient EHR-S capabilities reference model (Figure 5), and were asked to respond to questions covering nine areas: technical solution, benefits, timeline, costs, risks, governance structure and management, acquisition strategy, lessons learned, industry standards and compliance. 24 responses were received from a range of organizations from Systems Integrators, COTS EHR-S product vendors, and other health care industry organizations.

2. **Surveyed industry-best COTS EHR products.** As DoD and VA consider moving to a common inpatient EHR system, an industry scan of commercially available EHR products was important to inform and shape the analysis of potential solutions. A Gartner COTS EHR product survey was performed at the capability-level in Phase 1; a more detailed, requirements level analysis of potential COTS options will take place in Phase 2. In addition to evaluating specific products, the COTS EHR survey was also designed to identify key themes which will help DoD and VA to better understand the EHR market and its evolution.

3. **Studied other large EHR-S implementations and collaborative IT efforts.** Several case studies were analyzed to gain insight into the key issues DoD and VA are facing as they consider a Joint Inpatient EHR solution. While the study team tried to select comparable examples, there is currently not a one-to-one match of a large, geographically dispersed EHR implementation on the same scale, size and complexity of DoD-VA.
3.3.2 Key Findings

3.3.2.1 Industry Perspective #1 – Fewer care delivery organizations are implementing custom built solutions

Three decades ago care delivery organizations (CDOs) that wanted clinical systems had to make their own. VA did so and the DoD followed suit. Two decades ago commercial systems for focused clinical departments or services became common, however provider organizations had to select software from many different companies and use interfaces to integrate these to create comprehensive clinical systems. Today, fewer CDOs appear to be designing end-to-end custom EHR solutions.

3.3.2.2 Industry Perspective #2 – Industry is transitioning from best-of-breed to integrated applications

As healthcare practice moves to a more patient-centric view to provide more comprehensive care, vendors and CDOs have evolved their EHR systems to a more comprehensive healthcare architecture with embedded components that work together. This patient-centric perspective is designed to improve patient outcomes by making sure every aspect of the healthcare architecture is directly related to patient care. The shift in healthcare architecture is shown in Figure 7.

![Figure 7: Healthcare Architecture Shift](image)

The implications of the new health care architecture model or EHR-S implementations are pervasive. In the traditional model, health care functions were isolated and the relationships between functions were clear. For example, the lab rarely needed to communicate with the pharmacy, but had a clear relationship with the clinic. In the new model, the entire healthcare enterprise is integrated through patient care. More importantly, in the new model the electronic health record becomes the digital representation of the patient and serves as an integration vehicle between the functional areas of the health care system. Clearly, the new model suggests an increasing focus on patient care functionality. Indeed, vendors have developed a wealth of clinical applications. However, to say that this is a fundamental shift away from back office...
functionality misses the point. The point of the new model is a fully integrated system where clinical and back office functionality combine to improve patient care. While this architecture shift is occurring, few mature, fully integrated EHR solutions built on modern technology exist today.

3.3.2.3 Industry Perspective #3 – A high level survey indicated that, to varying degrees, COTS EHR-S products may support the DoD-VA joint inpatient EHR-S capabilities

Realizing there has never been a COTS EHR-S implementation on the scale of the combined DoD-VA health care systems, a product survey was performed at the capability level to provide an initial perspective on the types of COTS EHR-S products available. The product survey, based on the Gartner Inc. “Generations of EHR Systems Model” (see Appendix D for details of this model), indicated that the seven vendors studied could potentially support the joint inpatient EHR-S core capabilities at varying degrees of maturity as shown in Figure 8.

Figure 8: Joint Inpatient EHR COTS Survey

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Source: Gartner Inc.

It is important to note that this assessment According to the Garner analysis, Cerner and Epic are the only full “Generation 3” EHR systems which means they support various clinicians (nurses, physicians, pharmacists and others), support a variety of care venues (ambulatory,

5 Open source solutions, increasingly used in commercial and government organizations, such as OpenVistA were not evaluated in this study, nor were commercially available versions of VistA by solution providers such as MedSphere and DSS.
medical/surgical departments, and at least the intensive care unit or emergency department), and have the technical capability to bring evidence-based medicine to the point of care.

3.3.2.4 Industry Perspective #4 – Mega-suite EHR vendors are emerging

As CDO requirements evolve, EHR products are maturing and vendors and system integrators are gaining more product development and implementation experience. Meanwhile, EHR vendors are continuing to augment and update product capabilities to address the growing demands of CDOs as discussed above. Vendors have been adding capabilities to address the spectrum of care venues (i.e., ER, ICU) as well as ancillary clinical systems (i.e., laboratory, radiology, and pathology). Additionally, vendors are combining clinical and financial (i.e., accounting, billing) applications.

In the commercial EHR product market, there appears to be two different approaches vendors are taking to expand their EHR product suites: organic product development approach and acquisition approach. Vendors such as Cerner, Epic, McKesson, Meditech, and Siemens are developing additional EHR capabilities (e.g., additional care venues, ancillary systems, etc.) internally. Other vendors such as Eclipsys and GE are pursuing an acquisition strategy to expand their EHR products’ capabilities. These vendors tend to have several standalone modules that can be interfaced into the core EHR system. On a related note, experience, track record, and service and support, in addition to product functionality, are rapidly becoming key differentiators in vendor selections. This signals that functionality is no longer the sole decision criterion in evaluating EHR products. It remains to be seen whether this mega-suite strategy will be successful in providing the support required by CDOs.

3.3.2.5 Finding #5 – Standards-based architectures and ontologies are critical to maintaining flexibility and interoperability

Integration, seamless interoperability, and interdependence between the two largest health care systems in the nation calls for a dynamic and secure standards-based approach founded on a services architecture. This approach can support dynamic information integration using “best of breed” technologies, including Service Oriented Architectures (SOA), semantic Data Service Layers (DSL), standards-based and event-driven messaging, dynamic discovery and late binding, and domain ontologies.

3.4 Section D – Head Start Opportunities

Technical and non-technical head start opportunities can provide value today and prepare the Departments regardless of the ultimate solution.

3.4.1 What We Did

Head start opportunities can further DoD-VA interoperability and information sharing efforts in the near term and prepare the Departments for a joint inpatient EHR-S. These opportunities were defined as activities which could be initiated in the short term (FY08-09) and brought to completion within 24 months. To identify and evaluate head start opportunities, the study team:
1. **Assessed technical and non-technical opportunities.** Eighteen candidate technical and non-technical opportunities were identified through interviews with DoD and VA, including representatives from the Madigan Army Medical Center (MAMC), VA/DoD Interagency Project Office in Bay Pines, and Army Telemedicine and Advanced Technology Research Center (TARTC). Each opportunity was evaluated and ranked for impact (Strategic Alignment, Efficiency, Effectiveness, Stakeholder Service, Feasibility) and complexity (Policies, Standards and Processes, Technology, Stakeholders, Organizations, Scope).

2. **Assessed data sharing opportunities.** Candidate data sharing opportunities that can further expand DoD and VA interoperability and health information sharing initiatives (e.g. FHIE, BHIE, CHDR) were identified. A universe of data sharing opportunities was generated by evaluating three primary sources. Data currently shared through interagency efforts was mapped against this universe, resulting in a set of unshared data categories that were evaluated and ranked.

### 3.4.2 Key Findings

**3.4.2.1 Opportunity #1 – Formalize joint requirements management methodology**

Although for many years the DoD and VA have defined requirements for joint initiatives, a formal process for joint requirements management has not been established. Success has been based on strong joint leadership, an effective joint governance structure, and the collaborative spirit that exists between the two Departments. Since the number and complexity of further DoD-VA joint efforts is increasing, it is important that the Departments invest in a joint requirements management process. This process is a foundational element that enables the planning, budgeting, design and acquisition of joint solutions.

**3.4.2.2 Opportunity #2 – Develop common data model**

A thorough evaluation of existing data architectures is necessary to define the information that is needed to support joint business processes and all the applications that support these processes. If combined with a joint enterprise application and data integration strategy, this not only reduces the number of interfaces to be built and maintained, but also provides a basis for integrating applications in a way that reduces point-to-point interfaces.

**3.4.2.3 Opportunity #3 – Develop process to facilitate the adoption of health IT standards**

DoD and VA have been active participants in the national effort to adopt and implement health data standards. In order to enhance the benefits derived from this investment, a process could be established which synchronizes the adoption and implementation of nationally and jointly accepted standards across DoD and VA health systems.

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6 Three sources were used to develop the universe of data sharing opportunities: 1) data specified in the Health Level 7 (HL7) Clinical Document Architecture (CDA) Release 2 Continuity of Care Document (CCD); 2) data needed to support joint inpatient EHR capabilities; and DoD-VA specific data (e.g. pre/post deployment health assessment and post deployment health reassessment information).
3.4.2.4 **Opportunity #4 – Map DoD battlefield injury codes to Social Security Administration (SSA) benefit codes**

In order to streamline the delivery of benefits, consensus must be achieved across the DoD, VA and the Social Security Administration (SSA) on the appropriate coding to be used for each type of battlefield injury. Once these codes have been agreed upon, the next step to be considered is the development of a mechanism to permit these accepted codes, once entered in an EHR-S, to automatically provide the appropriate information to the designated agencies for benefit determination. This will require the one-time matching of records and implementation of a process by which this alignment can be achieved going forward.

3.4.2.5 **Opportunity #5 – Share lessons learned with the Great Lakes FHCC initiative and other early experiments**

Earlier this year, DoD and VA announced that the North Chicago VAMC and Naval Care Clinic Great Lakes will fully integrate the two facilities, a first for the two Departments, to form the Captain James A. Lovell Federal Health Care Center (FHCC). Although the FHCC effort is different in scope (FHCC will address all aspects of the facilities, not just inpatient) and scale (FHCC focuses on just two facilities instead of the two health care systems), there are many common challenges that it shares with the Joint Inpatient EHR-S. These include joint management, requirements, funding, acquisition, transition planning, and change management.

3.4.2.6 **Opportunity #6 – Enhance the current DoD-VA data sharing infrastructure and share additional data elements relevant to inpatient care**

In the last decade, the health data shared between the Departments has greatly increased, with the primary benefit being more complete and accurate health records for Service members and veterans. Given that a potential joint solution is several years away, the study team was asked to evaluate data sharing opportunities that can be implemented in the next 12-24 months. From a data sharing infrastructure perspective, opportunities exist to develop an enhanced algorithm for patient correlation and to explore the use of the BHIE framework for the secure exchange of health information with organizations external to DoD and VA (e.g., states, purchased care providers). In terms of sharing additional data elements, the study team identified 11 top data sharing opportunities, shown in figure at right, that can be implemented via BHIE or CHDR. Additionally, requirements emanating from the Wounded Warrior Lines of Action (LOAs) should be incorporated into the DoD-VA sharing strategy.

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<th>Top Data Sharing Opportunities</th>
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<tr>
<td>Anatomic Pathology</td>
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<td>Procedure Observations</td>
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<tr>
<td>Cardiac Echo</td>
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<td>Blood Pressure</td>
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<td>Implanted Medical Device</td>
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<td>Health Risk Factor</td>
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<td>Heart Rate</td>
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<td>Occupational</td>
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<tr>
<td>Environmental</td>
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<tr>
<td>Immunization (Current Immunization Status)</td>
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<td>Immunization (Immunization History)</td>
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3.5 Section E – Top Level Assessment of Cost, Schedule, and Risk

Estimates vary at this stage, with costs ranging from 1.4B to $5.2B and full deployment schedule estimates ranging from seven to sixteen years, depending on the option.

3.5.1 What We Did

Although premature to provide specific estimates for a joint inpatient EHR solution, a high-level assessment of cost, schedule, and risk was performed to inform the overall feasibility assessment. Although potential options were identified, the purpose of identifying these options was to provide a vehicle for determining an overall range of costs, schedules and risks. It was not the intent to evaluate those options against each other, nor to identify which option is “best”. That analysis would be performed in a subsequent phase of the project, which would incorporate a more complete understanding of the strategic requirements for the joint system and a fuller definition of specific options. To perform the top level cost, schedule, and risk assessment, the study team:

1. **Identified a range of options.** The range of options for a joint inpatient EHR-S was determined by reviewing the results from other project deliverables, including the *Survey of Industry-Best EHR Products, Lessons Learned from Other EHR Implementations and Similar Collaborative IT Projects*, and *Results from Request for Information*. Four potential options emerged: Single COTS, Multiple COTS (i.e. Best of Breed), Custom Build, and Adopt DoD or VA System.

2. **Developed cost estimates.** Costs were assessed for each of the four options along a comment Cost Element Structure (CES) comprised of three components: 1) System Planning; 2) Systems Development, Acquisition, and Implementation; and 3) Operations and Maintenance. This analysis focused on the incremental costs associated with this initiative. It did not capture costs associated with legacy systems and did not capture benefits that would be realized from this initiative. The team developed estimates for each part of the CES by evaluating projects of similar magnitude and complexity, utilizing advanced estimating tools such as SEER-SEM, ACE-IT, and Crystal Ball, and leveraging the collective expertise of the study team.

3. **Developed schedule estimates.** The study team developed a set of activities for each option and assigned a level of effort to come up with an overall schedule by option. While it is possible that DoD and VA may choose to utilize an iterative deployment strategy, for purposes of this exercise, the study team assumed that the system would be fully designed, developed, and tested prior to deployment.

4. **Developed risk estimates.** Risks were identified in 13 categories, based on OMB Circular A-11. These risk categories include Technology, Procurement, Organizational Change, Project Team, Cost, and other types of risks associated with a systems development and implementation project of this type and scale. For each of these 13 categories, the project team assessed the probability of the risk occurring, and also the severity on the project if that risk were to occur. Combining the probability with the severity leads to an overall risk impact assessment.
3.5.2 Key Findings

3.5.2.1 Finding #1 – Potential costs are in the range of $1.4 billion to $5.2 billion

The total expected cost of a Joint DoD/VA Inpatient EHR-S could range from approximately $1.4 billion to approximately $5.2 billion, depending on the option. These costs are inclusive of program management, planning, acquisition, development, implementation, and five years of ongoing operations and maintenance. The wide range of cost estimates reflect the differences in the four potential options, in addition to the uncertainty associated with several key variables and assumptions.

Total costs for Program Planning and Management are estimated at between $55 million and $170 million; costs for Systems Development, Acquisition and Implementation are estimated at between $770 million and $3.2 billion; and costs for five years of Operations and Maintenance are estimated at between $630 million and $1.8 billion. All costs are presented in ranges rather than point estimates to reflect the uncertainty associated with the DoD-VA Inpatient EHR-S project being in its early conceptual phase. The most significant cost driver in this assessment is the System Development cost element, which includes requirements definition, design, development, configuration, test, and integration. Utilizing the parametric estimating tool SEER-SEM, the project team estimated that System Development could cost between approximately $500 million and $2.2 billion, depending on the option.

Sensitivity analysis was used to model how the results might change based on adjustments to the underlying assumptions. The project team utilized Crystal Ball®, a software tool that employs Monte Carlo simulation, to conduct sensitivity analyses on the Excel-based model built for this study. The analysis shows that variations to assumptions associated with software development, data conversion, number of interfaces, and the program duration have the greatest impact on the overall costs for the project.

3.5.2.2 Finding #2 – Planning, development and implementation range from seven years to more than 16 years, depending on the option

In total, the potential duration for planning, designing, developing and implementing a Joint DoD/VA Inpatient EHR-S could be as short as seven years or as long as 16 years, depending on the option selected. Schedule was assessed using a Work Breakdown Structure (WBS), similar to the CES used for estimating costs. The schedule assessment indicates that the initial Program Planning phase would last approximately two to four years, depending on the option. The second phase, System Development and Implementation, has the greatest variability in duration. In particular, the System Development task, which includes design, development, configuration, and testing of customizations and interfaces, could take three to five years, or as long as ten years. The Operations and Maintenance phase begins upon the completion of the System Development and Implementation phase.
3.5.2.3 **Finding #3 – Top risks are in the areas of technology, organizational change, data, cost, and funding**

Large technology and organizational change projects, such as a Joint Inpatient EHR-S, are inherently complex endeavors, require substantial investment of financial and managerial resources, and involve considerable risk. For a Joint DoD/VA Inpatient EHR-S, the areas of technology, organizational change, data, cost, and funding present the greatest overall risk. Notable risks are listed below.

<table>
<thead>
<tr>
<th>Notable Risks</th>
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<tbody>
<tr>
<td>• Segmenting inpatient from outpatient</td>
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<td>• Integrating with existing applications</td>
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<tr>
<td>• Transitioning legacy systems</td>
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<tr>
<td>• Data conversion</td>
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<td>• Resolving policy issues in a timely manner</td>
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<tr>
<td>• Sheer size of effort: number of site implementations, records, stakeholders, regions</td>
</tr>
<tr>
<td>• Not working closely with clinical and business stakeholders</td>
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<tr>
<td>• Failure to address privacy and confidentiality appropriately at the outset</td>
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</table>

3.6 **Section F – Joint Management**

**Successful management of an effort of this size and complexity will require three changes to the existing structure: a modified joint strategy, expanded joint governance, and a new joint program management office (PMO)**

3.6.1 **What We Did**

Since the DoD-VA were mandated by law to share healthcare resources (see Public Law 97-174, “The Veterans Administration and Department of Defense Health Resource Sharing and Emergency Operations Act”), the Departments have made significant progress in joint healthcare resource sharing efforts. While DoD and VA have had success with information sharing initiatives such as FHIE, BHIE, and CHDR, the sheer magnitude and complexity of a joint inpatient EHR-S will present new management challenges. To develop the joint management approach, the study team:

1. **Evaluated Current DoD-VA Joint Management Environment.** The study team assessed the current joint management environment focusing on three components: joint strategy, joint governance and joint program management. The Joint DoD/VA Strategic Plan (JSP) was reviewed as well as the current joint management and governance functions under the Joint Executive Council (JEC) and the Health Executive Council (HEC). GAO documents, the Dole-Shalala report, and Congressional Testimonies were also reviewed to further identify challenge areas in the current arrangement. Pending legislation (Bill S.1606) mandating the establishment of DoD-VA Interagency Program Office for a Joint EHR was also evaluated to identify potential Congressional requirements for a joint management model (JMM). Finally, interview sessions were held with leads from the DoD-VA sharing program offices to understand current challenges and constraints with the existing joint management model.
2. **Analyzed DoD-VA Joint Management Options.** The study team investigated multiple options for the JMM requirements of Joint Governance and Joint PMO. They also conducted a high-level assessment of JMM options for an acquisition strategy. Decisions on each of these JMM components were driven by the specific program attributes unique to the Joint Inpatient EHR Program Office being established as well as best practices leveraged from government and commercial joint PMO efforts such as the Joint Strike Fighter (JSF), the Cancer Biomedical Informatics Grid (caBIG), and the Department of State eGov PMO.

3. **Defined DoD-VA Joint Management Specifications.** The study team reviewed the various options and developed design specifications for the standup of a new joint PMO to include roles, responsibilities and accountabilities, new integrated joint program management functions, a suggested organizational structure, and a new Outcomes Management framework to measure Joint Inpatient EHR program results. From a governance perspective, the team recommended changes to the existing DoD-VA Health Executive Council (HEC) governance structure to include the addition of a new Joint Inpatient EHR Working Group and a Joint Advisory Board. Finally, from a strategic perspective, several recommended changes to the Joint Strategic Plan were offered.

### 3.6.2 Key Findings

#### 3.6.2.1 Finding #1 – The Joint Strategic Plan should be expanded so that it continues to drive this initiative

The VA/DoD Joint Executive Council 2008-2010 Strategic Plan (JSP), updated annually and endorsed by the VA Deputy Secretary and the DoD Under Secretary for Personnel and Readiness, is the primary strategic document that has guided—and should continue to guide—this effort. A DoD-VA Joint Inpatient EHR supports the JSP goals of: Leadership, Commitment, and Accountability (Goal 1), Providing High Quality Health Care (Goal 2), Integrating Information Sharing (Goal 4), and Efficiency of Operations (Goal 5). The JSP and the OMB DoD-VA Sharing Scorecard also provide effective mechanisms for establishing performance measures and communicating progress. As this initiative progresses the JSP should be updated to reflect DoD-VA activities related to managing the Joint Inpatient EHR program. Examples of JSP modifications are shown in Figure 9.
### Figure 9: Example Changes to the Joint Strategic Plan

<table>
<thead>
<tr>
<th>JSP Goal</th>
<th>Related Objective</th>
<th>Potential Addition</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Leadership, Commitment &amp; Accountability</td>
<td>Objective 1.1: Improve the access, quality, cost effectiveness, and efficiency with which benefits and services are provided to beneficiaries of VA and DoD through increased resource sharing and organizational collaboration</td>
<td>Create new strategy and performance measure to reflect the stand up of the new Joint Inpatient EHR Working Group, Advisory Board and IT PMO. Create new strategy and performance measure to reflect the development and publication of a Joint Inpatient EHR strategy. Define Leadership role and accountabilities for behaving consistently with the Inpatient EHR strategy.</td>
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<tr>
<td></td>
<td>Objective 1.2: Improve stakeholder awareness of sharing and collaboration initiatives, and communicate and promote results and best practices throughout the two Departments and to external stakeholders.</td>
<td>Create new activity for Strategy 1.2 to reflect the creation of a new website for the Joint Inpatient EHR initiative. The website should provide relevant information pertaining to the collaboration that can be disseminated to multiple stakeholders. This website can have both public access and internal access. Create new performance measure for the Joint Inpatient EHR initiative that is outcomes focused (building on Outcomes Management approach detailed in section 6.3).</td>
</tr>
<tr>
<td>#2 High Quality Health Care</td>
<td></td>
<td>Create new objectives and relevant strategies/PM to define how HEC Working Groups (Patient Safety, Evidence Practice, Mental Health and Graduate Medical Education) will conduct an impact assessment and identify needs related to a Joint Inpatient EHR.</td>
</tr>
<tr>
<td>#4 Integrated Information Sharing</td>
<td>Objective 4.2: VA and DoD will structure their health enterprise architectures to support sharing of timely, consistent health data</td>
<td>Create new strategy to identify how the DoD/VA Health Architecture Interagency Group (HAIG) will access and validate the impact of a Joint Inpatient EHR on the DoD and VA health architectures.</td>
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<td></td>
<td></td>
<td>Create new objective identifying Joint Inpatient EHR pilot. Under this objective, create strategies/performance measures to reflect standup of Joint Inpatient EHR PMO and selection of Joint Inpatient EHR solution (to include architecture).</td>
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#### 3.6.2.2 Finding #2 – The foundational joint governance structure is in place, but changes are necessary

To be successful with this dual-agency business, clinical, technology, and change management effort, DoD and VA will need a new level of joint governance. First and foremost, this will involve a new Governing Board be setup under the Health Executive Council structure. This board should be given clear accountability for the success of the Joint Inpatient EHR program. In keeping with the existing HEC structure and Working Group terminology, this joint board should be represented as a new Joint Inpatient EHR Working Group (WG) and consist of business, clinical and IT members from across the DoD and VA. A Joint Advisory Board should also be established to provide ongoing EHR expertise that will inform and guide the Joint Inpatient EHR WG and PMO decisions.

In addition to gathering input from the Joint Inpatient EHR Advisory Board and working directly with the HEC IM/IT WG on the technical aspects of the Joint Inpatient EHR solution, the Joint Inpatient EHR WG should collaborate with existing BEC and HEC WGs to include: Medical Records, Information Sharing/IT, Evidence-Based Clinical Practice Guidelines, Graduate
Medical Education, Pharmacy, Continuing Education and Training, Deployment Health and Patient Safety. Each of these WGs provide a high-level of expertise within their respective WG area that should be leveraged for optimal Joint Inpatient EHR governance. Likewise, each of the WGs has a series of initiatives that may impact or be impacted by the Joint Inpatient EHR. Coordination can span many areas including functional requirements, data standardization, stakeholder outreach, communications and training. Figure 10 depicts the proposed DoD-VA Joint Management Model.

3.6.2.3 Finding #3 – Integrated joint program management processes are needed

Integrated, management processes are needed to support joint management functions such as funding, acquisition, performance, communications and portfolio management. Program management functions for today’s joint IM/IT efforts are performed by the DoD and VA Program Executive Offices (PEOs) with a “meet in the middle” philosophy. Consequently, development efforts tend to be limited to system interfaces or offshoots of existing Department-specific clinical systems, as opposed to net new joint solutions. A PMO with full authority over the program is needed to effectively coordinate and execute the delivery of the joint solution. The proposed functions of the joint PMO are listed in Figure 11.
In implementing the joint management model, DoD and VA should leverage the strengths of their respective management practices (e.g., requirements management, clinician leadership) as the foundation for future operations. The Departments should also seek to integrate an Outcomes Management framework to measure the business value of the Joint Inpatient EHR-S (e.g., reductions in medical errors, cuts in healthcare costs through increased efficiency, improved patient satisfaction, and overall improvement in patient care).

|----------------------|-----------------------------|---------------------------------------------------------------------------------|----------------------------|--------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------------------|--------------------------|-------------------------|--------------------------|--------------------------|

Figure 11: DoD-VA Joint Inpatient EHR PMO Functions

Deliverable 25: Joint DoD-VA Inpatient EHR Final Report
Task Order W81XWH-07-F-0353: Joint DoD-VA Inpatient Electronic Health Record (EHR) Support

Booz Allen Hamilton
FOUO/ Acquisition Sensitive
4.0 Overall Feasibility Assessment

The overall conclusion of this study is that a Joint DoD-VA Inpatient EHR-S is feasible and the Departments should move forward together.

In Section Three, the major findings of this study are presented in the context of how the study was structured and executed. We close this assessment by presenting our overall conclusion in a slightly different fashion, one that highlights the multi-dimensional nature of feasibility. As illustrated in Figure 12, five dimensions of feasibility were explored to varying degrees in Phase One. Each dimension has a number of key questions and is backed by supporting materials.

From a mission perspective it is clear that DoD and VA are part of a permanent and enduring partnership and require a comprehensive patient record that allows clinicians to take care of a patient in any setting across the health care continuum. The need to share information is not a temporary need, it is a critical goal explicitly stated in the Joint Strategic Plan, MHS Strategic Plan, and VA Strategic Plan. With an agreed upon joint inpatient EHR definition, scope, and 98% commonality in functional requirements, the Departments are well positioned to investigate a joint DoD-VA inpatient EHR solution together.
Industry, as represented by the 24 RFI responses and other independent analyses, believes that a number of potential solution sets exist, ranging from the modernization and extension of existing DoD and VA systems, to fully integrated COTS suites. Effective joint management and operations will require three foundational elements to come together. The first two—a joint strategy and joint governance—are in place, but will need to be extended as the program moves forward. The third, a joint program management office has a high-level design in place with legislation pending. From an adoption and transition standpoint, several technical and non-technical head start opportunities have been identified. It is also clear that a strong Joint community exists, backed by strong Joint leadership.
5.0 Recommendations

The Departments are well positioned to move forward with this effort. Recommended next steps include the following:

- **Recommendation #1 – With a definition, scope, and Joint requirements in place, move into Phase Two analysis.** The next level of analysis should cover several important areas. First, the Departments need to think beyond creating the digital version of the paper record by developing a 5-10 year plan for the EHR and by anticipating future innovations in healthcare and health informatics. While this study provides the groundwork and foundational requirements, the next level of joint brainstorming needs to occur. Second, while further refinement of the core requirements is necessary, DoD and VA should spend at least as much time studying how the core capabilities will interact with cooperating and subscribing capabilities. Third, usability and user satisfaction of any systems under consideration should be performed through a variety of techniques including survey, observation, and focus groups. Fourth, technical and infrastructure constraints for deployed settings must be addressed as the solutions analysis evolves. And finally, the ultimate vision should move beyond a joint inpatient EHR-S to a solution that is not described by the artificial boundaries between inpatient, outpatient and other care environments.

- **Recommendation #2 – Conduct a detailed cost-benefit analysis for several options.** A range of potential options (e.g., leverage existing DoD-VA systems, procure and implement one or more COTS products, maintain the status quo) should be assessed in Phase 2. This extended analysis will include a more detailed analysis of cost, schedule, and risk, as well as the benefits of each option.

- **Recommendation #3 – Continue to take a holistic view of this challenge.** The Departments recognize that this is much more than a technical problem. Although the next phase should perform an analysis of technical solutions, DoD and VA should continue to take a multidimensional approach to this study to include factors such as culture, governance, communications, policy, and economics. This should lead to a comprehensive change management plan to transition the organizations to the desired future state.

- **Recommendation #4 – Standup interagency PMO and make related changes to the Joint Governance and the JSP.** The Departments should move forward with the establishment of a DoD-VA Interagency PMO to execute the Joint Inpatient EHR program, and the addition of a new Health Executive Council (HEC) Working Group and Advisory Board for Joint Inpatient EHR decision-making. Joint requirements and portfolio management capabilities should be implemented via the existing DoD-VA governance structure. While this study is limited to the inpatient EHR, the Departments should consider a broader outcomes management approach to track the business value of all joint resources. Finally DoD and VA should solidify commitment from leadership by
writing Joint Inpatient EHR related goals, objectives, and performance measures into future legislation and strategic plans (Joint Strategic Plan, MHS Strategic Plan, and VA Strategic Plan).

- **Recommendation #5 – Commit to a joint investment in the evolution of a standard-based architecture.** The Departments should continue to invest in a Joint integrated architecture framework using available standards and accepted ontologies. DoD and VA should mandate using established data standards (e.g., SNOMED-CT, RxNORM, LOINC, HL7 RIM, HL7 CDA, ICD9-CM, CPT4), messaging standards (e.g., HL7 2.x and 3.x), and technology standards (e.g., XML, HTTPS/SSL, TCP/IP, SOAP) and create interim “standards” from proven DOD-VA applications when controlled vocabularies are not available. As this architecture evolves it should be used as a mechanism to integrate future chosen systems and/or modularized technologies over the longer term.

- **Recommendation #6 – Continue to foster, leverage, and extend the Joint DoD-VA community.** Beyond the technical analysis performed in this study, one of the most encouraging observations is the level of cooperation, collegiality, and, above all, commitment to delivering high quality patient centered care. This study directly involved over 200 DoD-VA executive leaders, clinicians, business managers, and technical subject matter experts, yet this is just the beginning. DoD and VA must continue to foster the current community and rely on this community to help reach others as needed—this will expand consensus and incorporate additional input. A stakeholder management plan and process should be established to enhance and expand this joint community.

- **Recommendation #7 – Continue to lead the nation in HIT by seizing this opportunity to move forward together.** The joint DoD-VA inpatient EHR-S is a strategic effort for Departments that supports the advancement of the Nationwide Health Information Network (NHIN). As this effort moves forward, DoD and VA should continue to work with other federal agencies and industry to ensure consistency with national efforts. The analysis of potential solutions in Phase 2 must consider the required standards and certification criteria being developed by the Healthcare Information Technology Standards Panel (HITSP) and Certification Commission for Healthcare Information Technology (CCHIT). Where no standard is set, this project may influence the Office of the National Coordinator and the private sector marketplace, simply because it will be leading the pack. The Departments should also share lessons learned from this effort with other interagency collaboration efforts including the Senior Oversight Committee (SOC) Lines of Action (LOAs) that are addressing several high-priority health care and transition issues and the FHCC joint venture that is grappling with related technical, cultural, financial, and management issues. More generally, DoD and VA should provide transparency to help other care delivery organizations understand how the nation’s two largest health systems are moving toward interoperability and joint solutions.
Adopting a joint system across two large agencies will be a challenge, but the opportunities are greater. By implementing a joint DoD-VA inpatient EHR-S both organizations could avoid duplicate development or acquisition costs and would benefit from economies of scale. By visioning a future state in which the EHR is not just a digitized version of a paper record but an advanced decision support tool, the VA and DoD can provide an EHR-S that is an active enabler of evidence based medicine, a tool to dramatically increase patient safety, and a vehicle that provides clinicians with access, not just to clinical data, but to clinical information. Most importantly they would provide a seamless transition of care from the battlefield, through multiple DoD and VA care venues. By providing comprehensive and current healthcare information to providers at each stage of this journey, the care provided to Wounded Warriors and other veterans will be significantly improved. Our Nation's heroes deserve nothing less.
Appendix A: Context of Care - Patient Scenarios

The following patient scenarios exemplify the context in which DoD and VA healthcare providers operate and some of the challenges they need to overcome.

Scenario #1: Wounded Warrior with Complex Injuries

Private First Class PJ was severely wounded in the battlefield and received healthcare services by a variety of clinicians in multiple care settings in the US and abroad, which spanned the military, VA and private sector health systems. Along his journey, PJ variously received inpatient, outpatient, and home healthcare services. As depicted in Figure A below, PJ’s story illustrates the many transitions of responsibility – or “handoffs” – that may occur in the management of a patient with complex medical problems. These transitions may occur across similar or different types of care setting, e.g., between hospitals or between hospitals and outpatient clinics. These transitions may also occur within a single setting, for example between wards within a hospital or between clinics in a multi-specialty outpatient center, or between clinicians on different clinical services.

Scenario #1: The Wounded Warrior

- PFC PJ was severely injured when his Humvee rolled over an improvised explosive devise (IED) just outside Baghdad.
- Suffering severe abdominal injuries and a severed lower limb he was evacuated to the mobile hospital unit where he was stabilized.
- He was then evacuated, with ICU level care in-flight, to the Level IV Military Treatment Facility (MTF) in Landstuhl Germany for definitive treatment.
- From there he was transported to the Walter Reed Army Medical Center (WRAMC), where subtle signs of traumatic brain injury were detected and he was fitted with a lower limb prosthesis.
- He was then transferred to a VA Polytrauma Center for months of multidisciplinary care including mental health services and physical rehabilitation.
- After discharge from the Army he went home where he received home healthcare services, outpatient care from the VA and his private doctor, and inpatient care at the VA.
Particularly challenging for DoD and VA, these transitions and information flows may occur across health systems as well. PJ, for example, transferred from the DoD to the VA systems going from an MTF to a VA Polytrauma Rehabilitation Center while still a service member, and again upon separation from the military. As a veteran, he also received outpatient and inpatient services in the private sector. Although not in PJ’s story, transitions may also occur from VA to DoD. For example, a workshop participant noted that when Guard and Reserve members, who may receive care at the VA, are called to active duty, their information will have to flow from VA to DoD. Others noted that sometimes even veterans discharged from the military and receiving care in the VA may return to a DoD hospital for certain specialized services such as cases of difficult shrapnel removal.

Despite the variations, at each of these transitions of responsibility, a transfer of information must occur to provide high quality, efficient continuity of care. An EHR-S provides a mechanism to make relevant information available when and where needed.

**Scenario #2: Premature Delivery in Community Hospital**

This scenario involves a 28 year old dependent wife with diabetes, who gives birth to a premature baby boy in a community hospital. The baby requires care in a community hospital neonatal intensive care unit (NICU) then a military NICU until he is mature enough to go home. As an outpatient, he receives general and specialty pediatric care and preventive services.

This scenario extends the breath of care considered to include dependents – both spouses and children – some of whom may require subspecialty services. As noted by a workshop participant, DoD and VA periodically provide healthcare to other Congressionally-mandated populations such as Iraqi civilians during combat
or otherwise non-eligible Americans during natural disasters. This scenario highlights the care continuum provided by DoD and VA, in this case across the age continuum, whose care may be captured in the federal EHR Systems, and care provided to non-eligible individuals in unique situations whose care may not be tracked in the federal EHR Systems.

**Scenario #3: Elderly Veteran with Chronic Disease**

In this final scenario, VW is a 70 year old male veteran with chronic disease common to many elderly men in addition to his service-related conditions. VW receives all his care in VA facilities, mostly in the outpatient setting. He requires both general and specialty services, and relies on a home health nurse to support his diabetes management. VW actively participates in his care by reporting blood sugar results and symptoms through his personal health record and proactively reviews patient education material relevant to his conditions. Telemedicine capabilities have increased his access to specialists despite living in a rural setting.

This case highlights the preventive, longer term perspective of much of VA care, with patient participation in data gathering and, through review of educational materials, care management.
### Appendix B: Capability Definitions

#### Core and Cooperating Capabilities

<table>
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<tr>
<th>Capability</th>
<th>Definition</th>
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<tr>
<td><strong>Manage Documentation</strong></td>
<td>Manage Documentation is comprised of two “sub-capabilities”: Manage Clinical Documentation and Manage Other Documentation.</td>
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<td></td>
<td>Manage Clinical Documentation—Provides content, management processes, and design support for facilitating clinical documentation at either a computational or human interoperable level which may include the use of standardized structures and/or clinical terminologies and/or template-based tools. Able to document all areas of care: assessment, problem identification, planning, treatment/ intervention, and evaluation, nursing care plans and flow sheets. The clinical documentation includes the medication administration record (MAR) which tracks pending medication administration, medications previously administered, and those past due. The development of a patient’s problem list will include both historical and current problems and the medical history will consist of verbally communicated patient history as well as previous encounters, lab results, images, and discharge summaries. The data captured during a clinician’s assessment of a patient is documented appropriately (including psychosocial findings), a plan of care is developed and any treatment or intervention is completed and documented at this time. Re-evaluation takes place and further findings are captured and documented as necessary. As patients are transitioned from shift-to-shift and ward-to-ward/unit-to-unit, hand-offs are documented. All clinical notes must be completed and signed. Manage Other Documentation— Other documentation necessary for patient care consists of signed consent forms (including but not limited to procedures, operations, blood products, treatment, etc.), Advance Directives, and Continuity of Care Documents (CCDs).</td>
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<tr>
<td><strong>Manage Orders</strong></td>
<td>Provides computer provider order entry (CPOE) ability for authorized users to order, modify, and/or discontinue orders concerning procedures, laboratory tests, radiology procedures, immunizations, blood products, medication, specimens, and consults as well as the ability to create and manage order sets. (Includes the ordering of all ancillary services.) The ordering of medication includes the verification that it is on-formulary. Upon submission of the order, it is acknowledged and prioritized prior to completion. Futures orders are initiated as necessary and activated at the appropriate time. The provider must sign all orders and co-sign obligations must be designated.</td>
</tr>
<tr>
<td><strong>Manage Results</strong></td>
<td>Supports accessing, viewing and forwarding of “observations,” whether they are made by machines, clinicians, or patients themselves. These results include those from all ordered tests and/or performed procedures including, but not limited to, laboratory, radiology, microbiology, pathology, and consults. After results analysis is completed by the clinician, the result can be annotated to capture the findings. As results become available, authorized clinicians will be notified/alerted. The various results should be showcased in multiple ways and different presenting styles including trends, comparisons, and graphs.</td>
</tr>
<tr>
<td><strong>Provide Automated Decision Support</strong></td>
<td>Aids in the clinical decision making process of estimation, evaluation, and comparison of alternatives when providing healthcare. Includes the identification of contraindications and provides drug alerts, medication screening alerts, lab alerts (and trends), reminders and clinical messaging for preventative services, and allergy interactions. Clinical calculators test sensitivity, specificity, predictive values and likelihood ratios. Provide tools and support systems for decision-making processes in patient care based on a systematic review of clinical evidence. Supports evidence-based protocols (criteria outlining the management steps for a single condition or multiple health states) and assists with the identification of patients for possible recruitment.</td>
</tr>
<tr>
<td>Capability</td>
<td>Definition</td>
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<tr>
<td><strong>Manage Clinical Tasks and Processes</strong></td>
<td>Support tools that aid clinical providers with completing their daily process of providing healthcare. Providers identify workflow for a specific patient based on the treatment/intervention necessary. This workflow guides clinicians for daily tasks or activities that must be completed in a particular sequence. Includes the ability to list certain data elements (patient lists, medication lists, problem lists) that aid the clinician in the organization and prioritization of tasks throughout their shift. Specifically, problem lists organize patient data and both historical and current problem areas. Medication lists aid the clinician in the identification of medication that must be administered on a scheduled basis and those that are PRN (as needed). A provider list aids in the assignment of patients to appropriate providers and nurses on a shift basis. Also includes the ability to show/determine patient acuity/severity of illness to support risk adjustment (e.g., trauma scores), and clinical task management abilities that assign and delegate administrative tasks to appropriate parties.</td>
</tr>
<tr>
<td><strong>Manage Patient-Reported Data</strong></td>
<td>Provides support for a variety of patient-specific data entered into the provider system (e.g., information normally included in a “clipboard”). Patients can report health-related data and preferences in a variety of ways including on-line journals and questionnaires. This data is available to the clinician for review at any stage. This may also include clinical data entered by devices or individuals at home (e.g., blood glucose monitoring for patients with diabetes). This capability does not include data managed in a patient’s Personal Health Record (PHR).</td>
</tr>
<tr>
<td><strong>Manage Knowledge Resources</strong></td>
<td>Provides a presentation of reference material to a clinician to aid decisions such as diagnoses or orders as well as supporting the provision of educational materials. In particular the generation of educational materials includes supporting the creation, editing, and access to education materials (standard or customized) for patients as well as for the family or caregiver of the patient to help with pre-op and post-op education, disease education, discharge planning and the integration back home, etc. These materials can include written instructions to prepare a patient for procedures or treatment as well as preparation for discharge. The patient should also receive information on disease-specific preventative measures such as wellness, diet and exercise.</td>
</tr>
<tr>
<td><strong>Manage Admission, Discharge, and Transfer (ADT)</strong></td>
<td>The patient’s eligibility is verified and if he/she is not currently registered in the system, the patient will be added with supporting demographic data and administrative information. Upon admittance the patient is assigned a bed (bed management) and as the patient transitions through the inpatient stay the patient location and status will be updated.</td>
</tr>
<tr>
<td><strong>Manage Scheduling and Resource Allocation</strong></td>
<td>Supports patient-related scheduling, personnel scheduling, and resource management such as operating room, major imaging, stress tests, etc. Provides access to all related scheduling functions (e.g. reschedule, cancel, view detail) and minimizes scheduling errors and missed appointments. Should be able to perform conflict checking ability by patient, resource, personnel, equipment, and appointment type. Also includes the ordering and allocation of medical equipment and devices.</td>
</tr>
<tr>
<td><strong>Manage Ancillary Services</strong></td>
<td>Multidisciplinary services that are necessary to support and supplement a range of care that can directly or indirectly effect a patient’s well-being. Includes all tests, imaging, and procedure services that provide data to the clinician to make informed decisions regarding the diagnosis or course of treatment. Additionally, aids various therapy in support of patient treatment and ultimately recovery measures.</td>
</tr>
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</table>
## Subscribing Capabilities

<table>
<thead>
<tr>
<th>Subscribing Capabilities</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage Coding and Billing</td>
<td>Supports medical coding, medical billing, and medical claims processing activities. Assists with a range of coding services such as facility coding, physician coding, radiology and anesthesia coding. Provides analysis of ICD-9 and CPT-4 code sets, patient &amp; insurance payment application, deductibles and insurance co-pays, and insurance adjustments. Efficiently processes various types of insurance claims to improve the cash flow of the organization.</td>
</tr>
<tr>
<td>Support Population Reporting</td>
<td>Provides reporting tools for the analysis of healthcare information for various populations of study. Quantifies differences in health status among patient populations and identifies potential gaps in care. Offers a variety of reporting options and results data (diagrams, trends, graphs, pie charts, etc). Report formats can be specified by the organization or customized to meet an individual’s need.</td>
</tr>
<tr>
<td>Support Continuous Quality Improvement</td>
<td>Provides tools for ongoing measurement and monitoring of patient, provider, and employee feedback. By focusing on the full scope of service delivery in all parts of an organization, the Continuous Quality of Care capabilities will enhance patient outcomes and experiences. Evaluates the performance of an operation against benchmarks or industry standards and applies this information to ultimately improve program operations.</td>
</tr>
<tr>
<td>Support Risk Management</td>
<td>Supports the process of gathering information to make informed decisions to minimize the risk of adverse effects to the patient. Provides practices of risk identification, analysis, and peer review. Acts as a resource to advance practice and creates a forum for the exchange of ideas and information to promote professional development and conduct.</td>
</tr>
<tr>
<td>Support Performance Management</td>
<td>Provides a strategic reporting system that accurately monitors progress towards achieving organizational goals. Supports defining a mission and desired outcomes, setting performance standards, analyzing and reporting results, and having accountability for results. Measures, monitors and evaluates performance relative to employee and physician retention, internal operations and clinical care, and productivity enhancement. The process of basing organization actions and decisions on actual measured results of performance.</td>
</tr>
<tr>
<td>Support Case Management</td>
<td>Supports the collaborative process of assessment, planning, facilitation, and advocacy for options and services to meet a consumer’s health needs through communication and available resources to promote high quality, cost-effective outcomes. Provides tools to document high-risk patients managed across the continuum of care and should assist with defining case management rules and parameters for accurate data management. Coordinates care for patients between care-givers and care settings to ensure the best treatment is provided.</td>
</tr>
<tr>
<td>Support Disease Management</td>
<td>Provides a system of coordinated healthcare interventions and communications for populations with conditions in which patient self-care efforts are significant (diabetes, obesity, congestive heart failure, etc). Supply tools that empower patients, as well as physicians and other care providers, to effectively manage disease and prevent complications through adherence to medication regimens, regular monitoring of vital signs and healthful diet, exercise and other lifestyle choices. Evaluates clinical, humanistic, and economic outcomes on an on-going basis with the goal of improving overall health.</td>
</tr>
<tr>
<td>Support Clinical Research</td>
<td>Supports patient-oriented research that is conducted with human subjects (or on material of human origin such as tissues, specimens and cognitive phenomena) for which an investigator or colleague directly interacts with human subjects. Provides tools that aid in the process in which a medication or medical treatment is tested for safety and effectiveness.</td>
</tr>
</tbody>
</table>
Appendix C: Rationale for Capability Classifications

As described in Deliverables 12/13, DoD-VA Joint Inpatient EHR Definition and Scope, a few capabilities were challenging to classify with certainty and needed further analysis to determine whether they were in scope. These included 1) Manage Patient-Reported Data; 2) Provide Knowledge Resources; 3) Manage Ancillary Services; and 4) Manage Admission, Discharge, and Transfer (ADT).

Rationale for classification of these capabilities is presented below.

<table>
<thead>
<tr>
<th>Capability</th>
<th>Classification</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage Patient-Reported Data</td>
<td>Core</td>
<td>Essentially another mechanism of clinical documentation, whether patient completes forms or downloads information from home health devices. Content may need to be filtered to ensure appropriateness and to label source. Managing personal health record remains out-of-scope.</td>
</tr>
<tr>
<td>Provide Knowledge Resources</td>
<td>Core</td>
<td>Content is important for education and clinical decision making. Important to access content through EHR-S although EHR-S not need to contain all content. For example, its helpful to have clinical guidelines within the system to enhance workflow and decision support, but online textbooks may be external.</td>
</tr>
<tr>
<td>Manage Ancillary Services (Pharmacy)</td>
<td>Core</td>
<td>Becoming increasingly integral to healthcare delivery. Closed-loop order entry, a key patient safety strategy, is enhanced when order entry and pharmacy systems are together, Pharmacist increasingly assuming clinical role, e.g., managing anticoagulation at VA.</td>
</tr>
<tr>
<td>Manage Ancillary Services (Radiology and Laboratory)</td>
<td>Cooperating</td>
<td>Remain largely specimen-based services. Although clinical information is important, reports are based on reading of images, laboratory tests, and pathology specimens. Interventional radiology and cardiology may increasingly blur the lines over time as will advances in genomics that impact laboratory decision-making.</td>
</tr>
<tr>
<td>Manage Scheduling / Resource Allocation</td>
<td>Cooperating</td>
<td>Remains primarily an administrative function. Has not jet become integral to clinical decision-making or workflow management. Least concordance between DoD and VA requirements compared to other capabilities.</td>
</tr>
<tr>
<td>Manage Admission, Discharge, and Transfer (ADT)</td>
<td>Cooperating</td>
<td>Remains primarily an administrative function. Most demographic information ADT functions contain are not clinically significant. Those that are, e.g., gender, can be captured in clinical systems. Less commonality between DoD and VA requirements compared to other capabilities. Responsibility for capture of demographic information in military falls outside healthcare system.</td>
</tr>
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Appendix D: The Five Generations of EHR Systems Model

To effectively evaluate EHR systems that have varying levels of functionality, Gartner considered how these industry-best products span across five generations of EHR. The Five Generations of EHR Systems Model articulates how an EHR system may evolve over time and can provide a range of functionality from basic to fully-integrated systems. Using this generation model provides the DoD and VA with an EHR Capability Generation Model to better inform the future joint inpatient EHR features and functionality. Figure 14 below shows the Five Generations of EHR Systems.

Each stage in the Generations Model has a different level of functionality that is expected. The stages are described as follows:

<table>
<thead>
<tr>
<th>Subscribing Capabilities</th>
<th>Definition</th>
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<tbody>
<tr>
<td><strong>Generation 1: The Collector</strong></td>
<td>Results oriented tools that enable users to access clinical data that previously may be scattered across multiple systems or only available in hard copy for one individual at a time</td>
</tr>
<tr>
<td><strong>Generation 2: The Documenter</strong></td>
<td>Basic systems that permit clinicians to do more than access data, including rudimentary documentation functionality</td>
</tr>
<tr>
<td><strong>Generation 3: The Helper</strong></td>
<td>Products that allow users more direct interaction with the system and data, and have technical capability of facilitating CDO’s attempts to bring evidence-based medicine to the point of care; functionality for multiple care venues is required</td>
</tr>
<tr>
<td><strong>Generation 4: The Colleague</strong></td>
<td>Advanced systems that have more decision support and workflow capabilities, along with tools that permit CDOs to more easily bring EBM to the point of care</td>
</tr>
<tr>
<td><strong>Generation 5: The Mentor</strong></td>
<td>Systems that can guide the clinicians in caring for patients, especially those with conditions the user may not have diagnosed or treated before</td>
</tr>
</tbody>
</table>

Figure 14: The Five Generations of EHR Systems

Source: Gartner
Appendix E: References

Government Furnished Documents

- Department of Defense (2007). AHLTA: DoD’s Electronic Health Record (Demonstrations and Discussion)
- Department of Defense (2007). AHLTA Inpatient Capabilities Scenarios – Block 3
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- Department of Defense (2004). AHLTA Requirements, Inpatient EHR 3.52
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- Department of Defense and Department of Veterans Affairs (2005). FHIE_BHIE Architecture
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- Department of Defense and Department of Veterans Affairs (2002). FHIE-ACC Functional Overview: FHIE Capabilities Briefing, Near Term Solution
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- Department of Veterans Affairs. VistA User Manuals
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- VA statement on “Service Members Seamless Transition into Civilian Life – Our Hero’s Return,” Testimony of Steven G. Scott, MD Medical Director, Tampa Polytrauma Rehabilitation Center Department of Veterans Affairs Before the Subcommittee on Oversight and Investigation Committee on Veterans’ Affairs U.S. House of Representatives (2007)

Additional Documents Referenced


• Department of Veterans Affairs. (2005) “VistA Monograph.” Department of Veterans Affairs and Veterans Health Administration Office of Information.


## Appendix F: Writers and Reviewers of this Report

<table>
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<th>Organization</th>
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<td>Gartner Inc.</td>
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