Applying Systems Engineering and Lean Healthcare Tactics to the Veterans Health Administration Enrollment System

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Executive Summary

• A whistleblower recently divulged information about major flaws in VHA application enrollment system and huge backlog of pending applications
  ▪ An internal audit validated whistleblower claims

• The VHA must utilize various Systems Engineering and Lean Engineering initiatives to fix the issues within the enrollment system
Agenda

- Background on Veterans Health Administration
- Description of issues with current VHA systems
- Discussion on Ethics
- Proposed Systems and Lean approaches to fix issues in VHA enrollment system
Veterans Health Administration

- Organization within U.S. Department of Veterans Affairs

- Operates largest integrated healthcare delivery system in America
  - Broad range of primary care, specialized care, and related medical and social support services

- Nation's largest provider of healthcare education and training for physician residents and other healthcare trainees

Veterans Health Administration

- 150 Medical Centers
- 300 Vet Centers
- 820 Community-Based Outpatient Clinics (CBOC)
- 135 VA Community Living Centers
- 6 Independent Output Clinics
- 104 Domiciliary Residential Rehabilitation Centers
- 229 National and State Cemeteries
- 56 Regional Offices

Veterans Health Administration: Mission Statement

- To fulfill President Lincoln’s promise from his Second Inaugural Address:
  - “To care for him who shall have borne the battle, and for his widow and his orphan” by serving and honoring the men and women who are America’s Veterans

Department of Veteran Affairs
Organizational Structure

Secretary
——
Deputy Secretary
——
Chief of Staff

Support Offices
Immediate Office of the Secretary
Special Staff Offices

General Counsel
Board of Veterans' Appeals
Inspector General
Acquisition, Logistics, and Construction

Assistant Secretary for Management
Assistant Secretary for Information and Technology
Assistant Secretary for Policy and Planning
Assistant Secretary for Operations, Security and Preparedness
Assistant Secretary for Human Resources and Administration
Assistant Secretary for Public and Intergovernmental Affairs
Assistant Secretary for Congressional and Legislative Affairs

Veterans Benefits Administration
Veterans Health Administration
National Cemetery Administration

Veterans Health Administration: “ConOps” (5 Ws)

- **Who**: Veteran’s and veteran’s family members, VHA and medical affiliates, taxpayer
- **What**: healthcare for veterans and their families, education and training for medical professionals
- **Where**: Various locations around US
- **When**: ASAP (depending on case)
- **Why**: “By serving and honoring the men and women who are America’s Veterans”
Problem Definition

- The VHA is unable to effectively manage patient enrollment and healthcare services
  
  - Whistleblower leaked information regarding the mismanagement of customer applications and care, including up to 10,000 unprocessed applications that may have accidentally been deleted
  
  - VA Office of Inspector General audited the VHA at the request of the Chairman of the U.S. House Committee on Veterans’ Affairs and generated report “Review of Alleged Mismanagement at the Health Eligibility Center” (Sept. 2015)

VHA Audited by VA Inspector General

- **Allegation 1**: Did the Health Eligibility Center (HEC) have a backlog of 889,000 healthcare applications in a pending status?

- **Allegation 2**: Did 47,000 veterans die while their healthcare applications were in a pending status?

- **Allegation 3**: Were over 10,000 veteran health records purged or deleted at the HEC?

- **Allegation 4**: Were 40,000 unprocessed applications, spanning a 3-year time period, discovered in January 2013?

VA Inspector General Audit

- **Allegation 1**: Did the Health Eligibility Center (HEC) have a backlog of 889,000 healthcare applications in a pending status?
  - **Verdict: Substantiated**
    - Existence of about 867,000 pending records as of September 30, 2014
    - Due to limitations in the HEC Enrollment System (ES) data, it was unclear how many records were associated with actual applications for enrollment and how many were never processed
  - **Reason: Poor/Unclear System Requirements**
    - Data limitations occur because the enrollment program does not adequately define, collect, or manage enrollment data to monitor the performance of application processing
    - In addition, VA guidance does not require that applications reach a final determination in a set timeframe or establish how long ES records may remain in a pending status
VA Inspector General Audit

- **Allegation 2**: Did 47,000 veterans die while their healthcare applications were in a pending status?
  - **Verdict: Substantiated**
    - Pending ES records included entries for individuals reported to be deceased
    - As of September 30, 2014, over 307,000 pending ES records were for individuals reported as deceased by the Social Security Administration (SSA). However, due to the data weaknesses identified in Allegation 1, the audit couldn’t determine specifically how many pending ES records represent veterans who applied for healthcare benefits or when they may have applied

  - **Reason: Inadequate Procedures and Processes**
    - VHA lacks adequate procedures and management oversight to identify and implement necessary updates to the individual’s status and the method for identifying deaths was inadequate

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VA Inspector General Audit

- **Allegation 3:** Were over 10,000 veteran health records purged or deleted at the HEC?
  - **Verdict: Substantiated**
    - Employees incorrectly marked unprocessed applications as completed and possibly deleted 10,000 or more transactions from the Workload Reporting and Productivity (WRAP) tool over the past 5 years.
    - The HEC often deleted transactions for legitimate purposes, such as the removal of duplicate transactions or to replace illegible scanned documents. However, information security deficiencies within the WRAP application limited the ability to review some issues fully and rule out the manipulation of data.

  - **Reason: Poor System and Personnel Management**
    - The integrity of WRAP data is at risk and vulnerable to accidental or intentional compromise because the HEC does not ensure that adequate business processes and security controls are in place.
    - They also do not adequately manage WRAP user permissions or document and review deleted transactions.
    - In addition, the Office of Information & Technology does not provide proper oversight for the development, security, and data backup retention for WRAP.

VA Inspector General Audit

- **Allegation 4**: Were 40,000 unprocessed applications, spanning a 3-year time period, discovered in January 2013?
  - Verdict: Substantiated
    - HEC identified over 11,000 unprocessed healthcare applications and about 28,000 transactions related to healthcare application updates, correspondence, and alerts in January 2013.
    - The oldest unprocessed healthcare application had a date of September 2012, four months prior to discovery. The oldest unprocessed WRAP transaction was an entry dated January 2012, a year prior to discovery, rather than the 3 years alleged.

- Reason: Poor Process Control and Management Oversight
  - The backlog was developed because the HEC did not adequately monitor and manage its workload.
  - The HEC did not identify the backlog earlier because it lacked controls to ensure the entry of WRAP workload into ES.
    - The unprocessed applications and transactions were cleared using about 7,700 overtime hours, and resulted in delays of up to 6 months for processing healthcare applications.
Issues Identified

- Systems
  - HEC Enrollment System limitations
    - Poor requirements definition of program, especially in regards to timeframes, controls, user permissions
    - Could not identify and report backlog of activity
  - Workload Reporting and Productivity
    - Could not report a backlog of activity to the HEC ES

- Procedures
  - Process not mature enough to mitigate mistakes
  - Not enough process and system quality controls

- Management
  - Lack of oversight and leadership
  - Lack of authority and ownership of products and processes
  - Lack of employee training
  - Not promoting culture that is conducive to process improvements
  - Not promoting culture that’s able to elevate issues to management
Why Fix the Current Process?

- Ethical Issues
  - Mission statement has ethics embedded in it
    - "To care for him who shall have borne the battle, and for his widow and his orphan"
  - Ethic of Reciprocity – "The Golden Rule"
    - "One should treat others as one would like others to treat oneself"
    - It is suggested that this rule can be found in almost every ethical tradition
  - Ethic of Duty
    - *Ethics in Engineering* – "The right actions are those required by duties to respect the liberty or autonomy of individuals"
    - Immanuel Kant – "Act so that you treat humanity, whether in your own person or in that of another, always as an end and never as a means only"

Why Fix the Current Process?

- Ethical Issues
  - Costing taxpayer money
    - Obvious waste and inefficiencies in VHA process
    - Organizations and officials have a duty to utilize tax money efficiently
  - President Obama wrote Executive Order 13576, titled “Delivering an Efficient, Effective, and Accountable Government” in 2011

Using the Systems Engineering Approach to Fix Issues with the VHA

- Systems Engineering Management
- Systems Engineering Management Plan (SEMP)
- System Architecture
- Lean Engineering and Lean Healthcare
- Risk Management
Systems Engineering Management

Systems Engineering Management

Systems Engineering Management: Systems Engineering Process

Process Input
- Customer Needs/Objectives/Requirements
- Missions
- Measures of Effectiveness
- Environments
- Constraints
- Technology Base
- Output Requirements from Prior Development: Effort
- Program Decision Requirements
- Requirements Applied Through Specifications and Standards

Related Terms:
- Customer = Organizations responsible for Primary Functions
- Primary Functions = Development, Production/Construction, Verification, Deployment, Operations, Support, Training, Disposal
- Systems Elements = Hardware, Software, Personnel, Facilities, Data, Material, Services, Techniques

Requirements Analysis
- Analyze Missions and Environments
- Identify Functional Requirements
- Define/Refine Performance and Design Constraint Requirements

System Analysis and Control (Balance)
- Trade-Off Studies
- Effectiveness Analyses
- Risk Management:
  - Configuration Management
  - Interface Management
  - Data Management
  - Performance Measurement
  - SEMS
  - TPM
  - Technical Reviews

Functional Analysis/Allocation
- Decompose to Lower-Level Functions
- Allocate Performance and Other Limiting Requirements to All Functional Levels
- Define/Refine Functional Interfaces (Internal/External)
- Define/Refine/Integrate Functional Architecture

Requirements Loop

Design Loop

Synthesis
- Transform Architecture (Functional to Physical)
- Define Alternative System Concepts, Configuration Items and System Elements
- Select Preferred Product and Process Solutions
- Define/Refine Physical Interfaces (Internal/External)

Verification

Process Output
- Development Level Dependent:
  - Decision Database
  - System/Configuration Item Architecture
  - Specifications and Baselines

Systems Engineering Management: Systems Engineering Process

- Generate requirements

- Develop specifications, traceability, etc.

- Translate specifications into designs

- Control design process with trade-off studies, configuration management, etc.

- Iterate!
# Systems Engineering Management: Establish New VHA System Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Type</th>
<th>Verification Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 HEC ES software shall be able to alert a VHA representative if patient has been in a hold/pending status for more than 30 days</td>
<td>Functional</td>
<td>Demonstration</td>
</tr>
<tr>
<td>2 WRAP shall have security measures to allow restrictive access only to representatives with the proper clearances</td>
<td>Functional</td>
<td>Demonstration</td>
</tr>
<tr>
<td>3 HEC ES software shall be able to alert VHA management if a patient has been in a hold/pending status for more than 90 days</td>
<td>Functional</td>
<td>Demonstration</td>
</tr>
<tr>
<td>4 HEC ES software shall be able to generate reports including patient service history data, application submittal date, and application status</td>
<td>Functional</td>
<td>Demonstration</td>
</tr>
<tr>
<td>5 The customer shall be able to access their account data via the VHA website or telephone call to VHA to check their account status</td>
<td>Customer</td>
<td>Test</td>
</tr>
<tr>
<td>6 Data in WRAP shall be backed up daily</td>
<td>Functional</td>
<td>Demonstration</td>
</tr>
<tr>
<td>7 The HEC ES shall be able to identify a backlog of pending customer applications in WRAP</td>
<td>Functional</td>
<td>Simulation</td>
</tr>
<tr>
<td>8 The VHA shall strive to reduce the waiting time by 20% each year starting with 2016</td>
<td>Qualitative</td>
<td>Test</td>
</tr>
</tbody>
</table>
Systems Engineering Management

Development Phasing

Baselines

Systems Engineering Management

Life Cycle Planning

Integrated Teaming

Life Cycle Integration

Systems Engineering Management: Development Phasing

- Establish the baseline
  - Description of a process or system which serves as a basis for change
- Connect and coordinate disciplines
  - Interdisciplinary planning and brainstorming
  - Allows all parties to work towards common customer requirements
- Control the phasing of the design process
  - Phases, gates, etc. – don’t move forward until changes are proven and agreed upon

Systems Engineering Management

Systems Engineering Management: Life-Cycle Integration

- Consider the entire life of a project/service during design phase

**System Life-Cycle**
- Development
- Design
- Build
- Maintain
- Upgrade
- Retire/transition

**Patient Service Life-Cycle**
- Apply for service
- Accept/reject
- Provide service
- Maintain/iterate
- Close application

Systems Engineering Management Plan (SEMP)

- Master document for program control of Systems Engineering Technical Elements
- The SEMP defines:
  - SE processes and procedures
  - Relationship of SE activities
  - Intermediate products including: specifications and documents, baselines, checklists, databases and other intermediate work elements
Systems Architecting Views

- Operational
  - Describes and interrelates the operational elements tasks, activities, and information flows required to accomplish mission operations

- Systems
  - Describes and associates systems and their interconnections and performance to the operational view and its requirements

- Technical
  - Describes the minimal set of rules governing the arrangements, interaction, and interdependence of system parts or elements
Operational Architectural View: OV-1
System Architectural View: SV-1
## Technical Architectural View

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Service</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEC ES Operating System</td>
<td>Kernel</td>
<td>FIPS Pub 151-1 (POSIX.1)</td>
</tr>
<tr>
<td></td>
<td>Shell and Utilities</td>
<td>IEEE P1003.2</td>
</tr>
<tr>
<td>WRAP Operating System</td>
<td>Kernel</td>
<td>FIPS Pub 151-1 (POSIX.1)</td>
</tr>
<tr>
<td></td>
<td>Shell and Utilities</td>
<td>IEEE P1003.2</td>
</tr>
<tr>
<td>Software Eng. Service</td>
<td>Programming Languages</td>
<td>FIPS Pub 119 (ADA)</td>
</tr>
<tr>
<td>User Interface</td>
<td>Client Server Operations</td>
<td>FIPS Pub 158 (X-Window System)</td>
</tr>
<tr>
<td></td>
<td>Object Definition and Management</td>
<td>DoD Human Computer Interface Style Guide</td>
</tr>
<tr>
<td></td>
<td>Window Management</td>
<td>FIPS Pub 158 (X-Window System)</td>
</tr>
<tr>
<td></td>
<td>Dialogue Support</td>
<td>Project Standard</td>
</tr>
<tr>
<td>Data Management</td>
<td>Data Management</td>
<td>FIPS Pub 127-2 (SQL)</td>
</tr>
<tr>
<td>Data Interchange</td>
<td>Data Interchange</td>
<td>FIPS Pub 152 (SGML)</td>
</tr>
<tr>
<td></td>
<td>Electronic DATA Interchange</td>
<td>FIPS Pub 161 (EDI)</td>
</tr>
<tr>
<td>Data Encryption</td>
<td>Data Security</td>
<td>FIPS Pub 46-3</td>
</tr>
<tr>
<td>Graphics</td>
<td>Graphics</td>
<td>FIPS Pub 153 (PHIGS)</td>
</tr>
</tbody>
</table>
Lean Engineering and Lean Healthcare

- Lean Engineering Principles
- Lean Enablers
- Success Stories from other Healthcare Institutions
Lean Engineering Principles

- Promote value, eliminate waste
- Train employees on process, instill quality
- Foster process improvements through bottom-up development, Kaizen, Six Sigma activities
- Develop culture which strives to process perfection
- Ensure personal accountability

Effective management promoting the principles of Lean is crucial to the achievement of these goals

The Process: Six Lean Principles

1. Value
   Patient health, affordable, more time to care...

2. Value Stream
   Remove waste, including wasted time

3. Flow
   Patients flow efficiently

4. Pull
   Deliver what is needed when needed where needed

5. Perfection
   Make imperfections visible & apply CI

6. Respect
   Teamwork
   No "blaming & shaming"

In health services... patients flow

Adopted from EdNet 2011

Bohdan "Bo" W. Oppenheim, SELP, 2015
Lean Enablers

- **Lean Principle 1: Value**
  - 1.2 Establish the Value of the End Product or System to the Customer
  - **1.3 Frequently Involve the Customer**

- **Lean Principle 2: Map the Value Stream**
  - 2.2 Map the SE and Product Development Value Streams and Eliminate Non-Value Added Elements
  - **2.6 Plan Leading Indicators and Metrics to Manage the Program**

- **Lean Principle 3: Flow**
  - 3.5 Use efficient and effective communication and coordination
  - 3.6 Promote smooth SE flow
  - 3.7 Make program progress visible to all
  - 3.8 Use lean tools

- **Lean Principle 4: Pull**
  - 4.2 Pull tasks and outputs based on need, and reject others as waste

- **Lean Principle 5: Perfection**
  - 5.2 Strive for excellence of SE processes
  - 5.3 Use lessons learned from past programs for future programs
  - 5.4 Develop perfect communication, coordination, and collaboration policy across people and processes
  - **5.7 Promote all three complementary continuous improvement methods (bottom-up suggestions, Kaizen, Six Sigma) to draw best energy and creativity from all employees**

- **Lean Principle 6: Respect for People**
  - 6.2 Build an organization based on respect for people
  - 6.3 Expect and support engineers to strive for technical excellence
  - **6.5 Treat people as most valued assets, not as commodities**

These Lean Enablers can be utilized to correct the flaws within the VHA HEC ES and allow for continual process improvement

Success Stories from Other Healthcare Institutions:
Virginia Mason Medical Center  
(336-bed hospital, 9 loc., 400 phys., 5,000 emp.)

Create a strategic plan with a clear and unequivocal focus on the patient (customer)

- Six areas of focus:
  1. “Patient first”
  2. No-Layoff Policy
  3. Company-wide defect alert system
  4. Encourage innovation
  5. Eliminating waste
  6. Accountable leadership

Results

- Gained capacity in existing programs, no need for planned expansion
  - Saved up to $10 million
- Inventories down 53%, productivity up, lead time down 65%, etc.

Success Stories from Other Healthcare Institutions: ThedaCare, Inc. (3 hospitals, 27 physician clinics, 5,000 employees, 300,000-members)

- Set ambitious goals and make them visible to everyone
  - Recognize that a great deal of waste is putting out fires
    - Need to design better processes to prevent fires
  - Event Weeks
    - Intensive process improvement efforts
    - “What gets designed on Wednesday is implemented on Friday”
  - Results
    - $3.3 million in savings in 2004
    - Reduced phone triage times by 35 percent (from 89 to 58 seconds)
    - Reduced phone triage abandonment rates by 48% (from 11.6% to 6.0%)
    - Reduced completion time for clinical paperwork on admission by 50%

What Is Already Being Done?

- **VA-Center for Applied Systems Engineering**
  - Interdisciplinary Veterans Engineering Resource Center built on partnership between Healthcare Systems Engineering faculty and VHA administrative and clinical management and staff
  - National presence across entire VHA, conducting 600 distinct engagements across all 147 VHA healthcare facilities
  - Mission: "become a catalyst enabling collaboration among clinical, administrative, operations, academic, and research partnerships within VA healthcare at local, regional, and national levels"
  - 6 “AIMS” for FY 12-14 (3 of which are directly applicable)

What Is Already Being Done?

- VA-Center for Applied Systems Engineering
  - AIM 1: Develop/implement education and training programs based in HSE disciplines, methods, and tools
    - 18,000 staff received Lean and Six Sigma training
    - 2,100 Lean certification
    - Lean Enterprise Transformation
  - $17M in cost savings

What Is Already Being Done?

- VA-Center for Applied Systems Engineering
  - AIM 2: Optimize the VHA administrative infrastructure to allow integration of HSE resources into the executive leadership and the operational and clinical management structures of VHA facilities.
    - Hired 80 fully-integrated Industrial and SE to VA-CASE
    - “Significant expansion in the application of SE within executive, operations, and clinical management within VA departments”
  - AIM 3: Deploy rapid implementation strategies, utilizing HSE techniques, such as Lean and Six Sigma, to enhance implementation and spread of transformed delivery processes.
    - Rapid Deployment strategies validated and utilized across VHA

How is this Project Different from What the VA-CASE is Already Doing?

- While the goal of the VA-CASE is to increase efficiency within the entire organization, they need to focus their efforts on improving the enrollment process specifically
  - Public and Government attention is drawn to the enrollment issue
    - This demands immediate and holistic system solutions

- The VA-CASE should work with the OI&T since they are the owner/authority on many new system requirements
  - The VA-CASE can impart Systems and Lean approaches on the OI&T during system redesign
  - Upper Management can enable this cross-organizational effort
## Risk Management

<table>
<thead>
<tr>
<th>#</th>
<th>Risk Item</th>
<th>Prob. of Occurr.</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If Lean Engineering methods cannot be instilled in the VHA work culture due to bureaucratic challenges, then the VHA cannot make the changes necessary to reduce patient pending status times.</td>
<td>C</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>If the issues with the HEC ES reporting patient pending status are not fixed, then the VHA will continue to have gross numbers of patients in a pending status for indeterminate amounts of time.</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>If the VHA cannot generate a SEMP to manage their activity, then the VHA will likely slip schedule and overrun budget.</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>If the VHA cannot generate proper system requirements for the HEC ES and WRAP, then their changes will not address the needs of the customer.</td>
<td>B</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>If the VHA does not generate a culture of accountability for people's work, then the issues within the system and process will not be addressed in a timely manner.</td>
<td>D</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>If engineers cannot find the root cause of the inability of the HEC ES to report correct patient status, then the system rework or redesign may cost more and take longer than expected.</td>
<td>B</td>
<td>3</td>
</tr>
</tbody>
</table>
Cost

- VA-CASE already initiating Systems and Lean training throughout entire organization, focusing heavily on management
  - High cost, yet higher reward

- Create Six Sigma project to correct flaws with HEC ES, WRAP, etc.
Integrated Project Lessons Learned

- Ensure that you have a clear problem definition before attempting to solve the problem

- Gather references from a wide variety of sources (print, internet, school, interview, etc.)

- Plan early and execute towards the plan
  - But don’t be afraid to change the plan if change is needed
Question and Answer