



# MD EXPO

Orlando, FL • October 29-31, 2023

# Continuous Improvement

## Strong Practices for HTM Departments

Kurt Finke  
Greg Fogleman  
Binseng Wang





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## Agenda

- **Continuous Improvement Design**
  - An approach: Balanced Scorecard
  - Metrics
- **Performance Monitoring and Improvement in Veterans Affairs**
  - History
  - Framework
  - Lessons Learned
- **Case Study: Equipment Aging Study**
  - Improving Equipment Maintenance Planning
  - Improving Technology Replacement Planning



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# **Continuous Improvement**

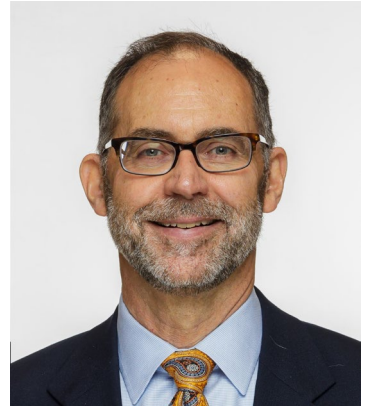
## **Program Improvement Design**

Kurt Finke

Consultant, Finke Clinical Engineering LLC

## About the Speaker: Kurt Finke

- Kurt Finke is President of Finke Clinical Engineering LLC, providing HTM/Clinical Engineering consulting services to Federal Government and Private Sector healthcare delivery organizations, commercial businesses, and medical device manufacturers.
- Mr. Finke served with the U.S. Department of Veterans Affairs for 36 years, working as a biomedical/clinical engineer at several VA Medical Centers, Regional Offices, and culminating as Executive Director of VA's National Healthcare Technology Management Program.
- He received the VA Biomedical Engineer of the Year Award (2010), the AAMI HTM Leadership Award (2020), the ACCE Professional Achievement in Management Award (2012). Mr. Finke currently serves on the AAMI Board of Directors as Vice-Chair for HTM and the Executive Committee.
- Mr. Finke earned a Bachelor of Science in Engineering (BSE) degree in Biomedical Engineering from Tulane University and attained Certified Clinical Engineer (CCE). Mr. Finke is an AAMI Fellow.



**Kurt Finke**



**Continuous performance improvement** is an organized, ongoing approach to identifying and acting upon opportunities to improve products, services, and/or processes to reach strategic goals.

**Establish Objectives**

What You Want to Achieve

**Identify Measures**

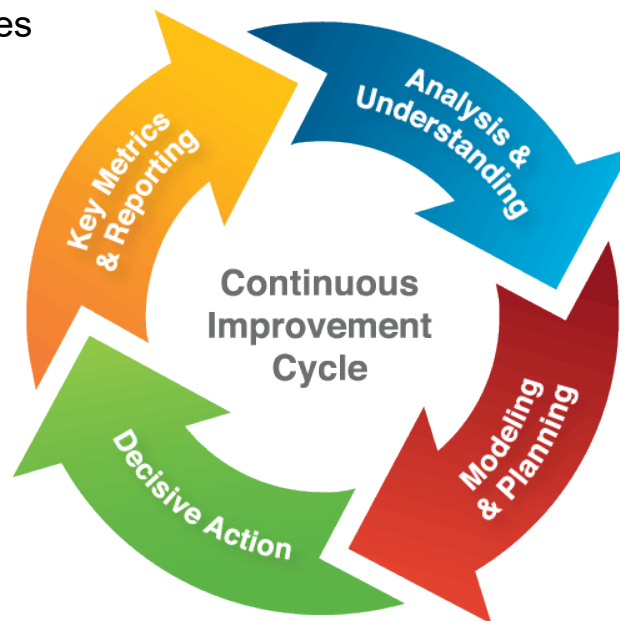
Your Basis for Achievement

**Monitor Performance**

Are You On Track?

**Address Performance**

Actions to Address Performance Gaps

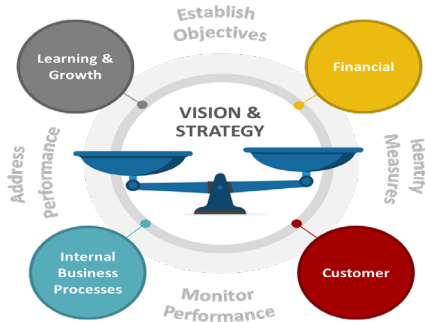


## Balanced Scorecard Approach

### Connecting Improvement with Strategy

Robert Kaplan and David Norton studied organizations that successfully created strategic linkages to improvement.

From these studies, The Balanced Scorecard concept was born, as described by Kaplan and Norton in a 1992 Harvard Business Review article and subsequent books.



### Four Domains of Performance

#### Financial

What must we do to create sustainable economic value?

#### Customer

What do our customers require from us and how are we doing according to those requirements?

#### Internal Business Processes

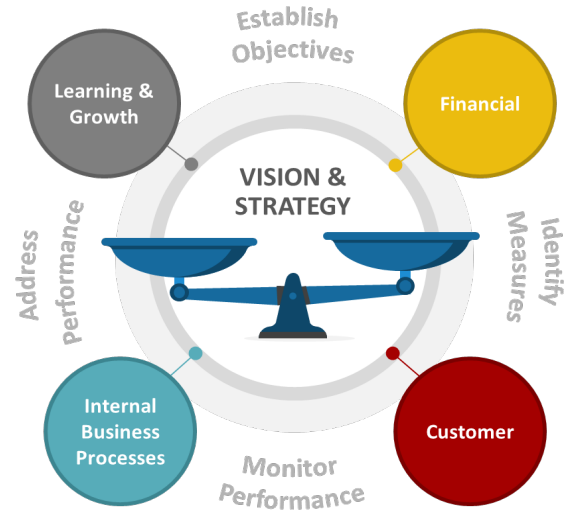
To satisfy our stakeholders, what must be our levels of productivity, efficiency, and quality?

#### Learning and Growth

How does our human capital, infrastructure, technology, and culture support high performance?

## Benefits of the Balanced Scorecard

- Improve organization performance by measuring what matters
- Increase focus on strategy and results
- Align organization strategy with stakeholder perspectives
- Enhance focus on drivers key to future performance
- Improve communication of the organization's vision and strategy
- Prioritize initiatives/projects



- 01 Is Consistent with Organizational Priorities  
reflects the priorities communicated by top executives

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- 02 Demonstrates Face Validity  
clearly defined and easy for users to understand

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- 03 Fits a Logical Process Map  
linkage to the process(es) to be improved is clear

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- 04 Offers Actionable Improvement Opportunities  
links to obvious improvement opportunities that are amenable to change

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- 05 Has Valid Analytic Basis  
relies on high quality data and data systems

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- 06 Allows Benchmarking to a Fixed Standard  
Measures progress toward a specific benchmark

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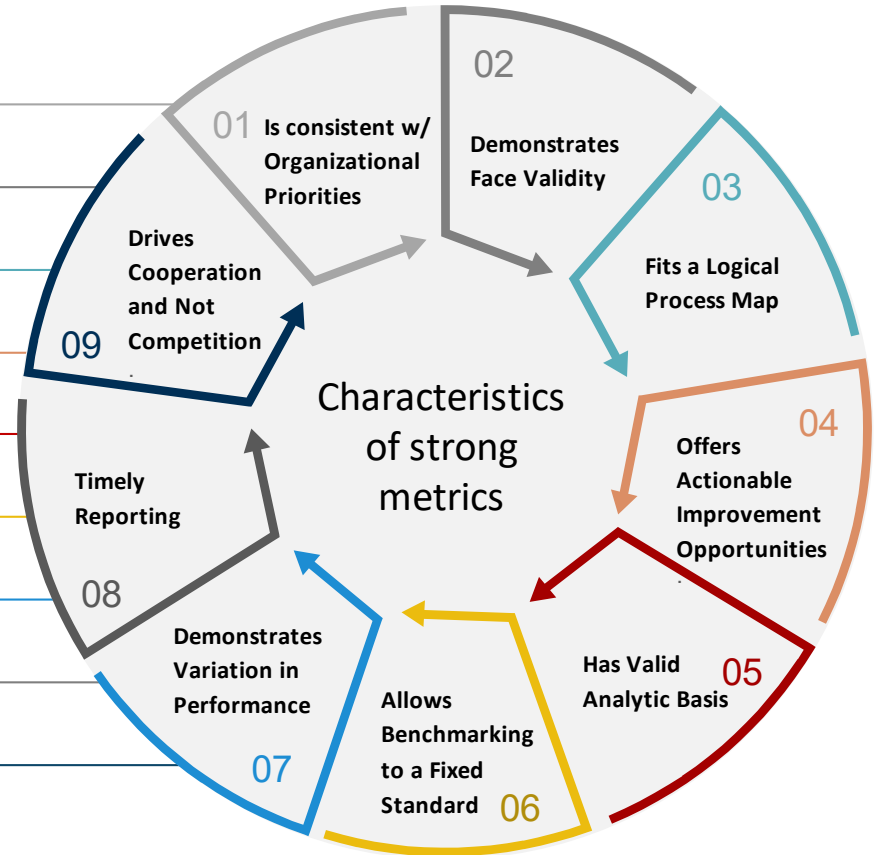
- 07 Demonstrates Variation in Performance  
offers significant opportunities for improvement against benchmarks

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- 08 Timely Reporting  
reported shortly after being collected and be updated frequently

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- 09 Drives Cooperation and Not Competition  
allows teams to achieve a high rating if they improve





## Attack Opportunities to Improve

- Consider Full End-to-End Processes (including activities beyond HTM responsibilities)
- Embrace the Red
- Identify Strong Practices (what you're doing well)
- Celebrate Improvement Successes!





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## **CPI Framework in Veterans Affairs**

Greg Fogleman

VISN 8 Healthcare Technology Manager,  
U.S. Dept of Veterans Affairs



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## About the Speaker: **Greg Fogleman**

- Greg Fogleman is VA Sunshine Healthcare Network (VISN 8) Chief Healthcare Technology Manager. He coordinates comprehensive HTM services across ten (10) VA Medical Centers and more than sixty (60) community-based outpatient clinics.
- Mr. Fogleman's career progression is impressive. He entered the HTM profession as a Biomedical Technician, working at Baptist Hospital in Memphis TN, Greenville Memorial Hospital in Greenville SC, and the Asheville VA Medical Center in Asheville, NC. He progressively advanced within VA, becoming Biomedical Engineering Supervisor, then Biomedical Chief at the Orlando VAMC, then to his current position as VISN 8 Chief HTM in 2012.
- Greg was instrumental in equipping and activating a brand-new VA Medical Center in Orlando, FL. The modern facility provides extraordinary care for Veterans
- Mr. Fogleman earned a Bachelor Degree in Engineering from Western Carolina University and is a Certified Clinical Engineer (CCE). He has participated on a number of AAMI workgroups.



**Greg Fogleman**

## History of HTM Program Performance Monitoring in VA

- **~1980: Biomedical Engineering Resources Survey (BERS)**
  - Annual survey established to monitor Biomedical Engineering resources
  - Personnel quantity and costs, parts costs, service contract costs, non-contract vendor repair costs
  - Other costs- test equipment, space allocation
  - Annual report generated; “Cost of Service Ratio” derived
- **~2005: Enhanced Biomedical Engineering Resources Survey (EBERS)**
  - Added data reporting for counts of repairs, PMS, repair turnaround time, PM completion rate
  - Initiated annual customer satisfaction survey
  - Reports include performance benchmarking
- **~2012: Balanced Scorecard**
  - Incorporated domains of Employee Learning, Process and Quality, Customer Satisfaction, Financial Performance
  - Established Key Performance Indicators (KPIs)
  - Stoplight reports

# VA HTM Program Performance Management Framework

## Data Sources

### EBERS

The Enhanced Biomedical Engineering Resources Survey aggregates BME resources utilized and services provided using both self-reported and automated data.

### NMDD

The Networked Medical Device Database inventories network connected medical devices and their associated technical attributes.

### ARMS

The Alerts and Recalls Management Website tracks repairable medical device safety alerts and recalls from distribution through remediation.

### CMMS

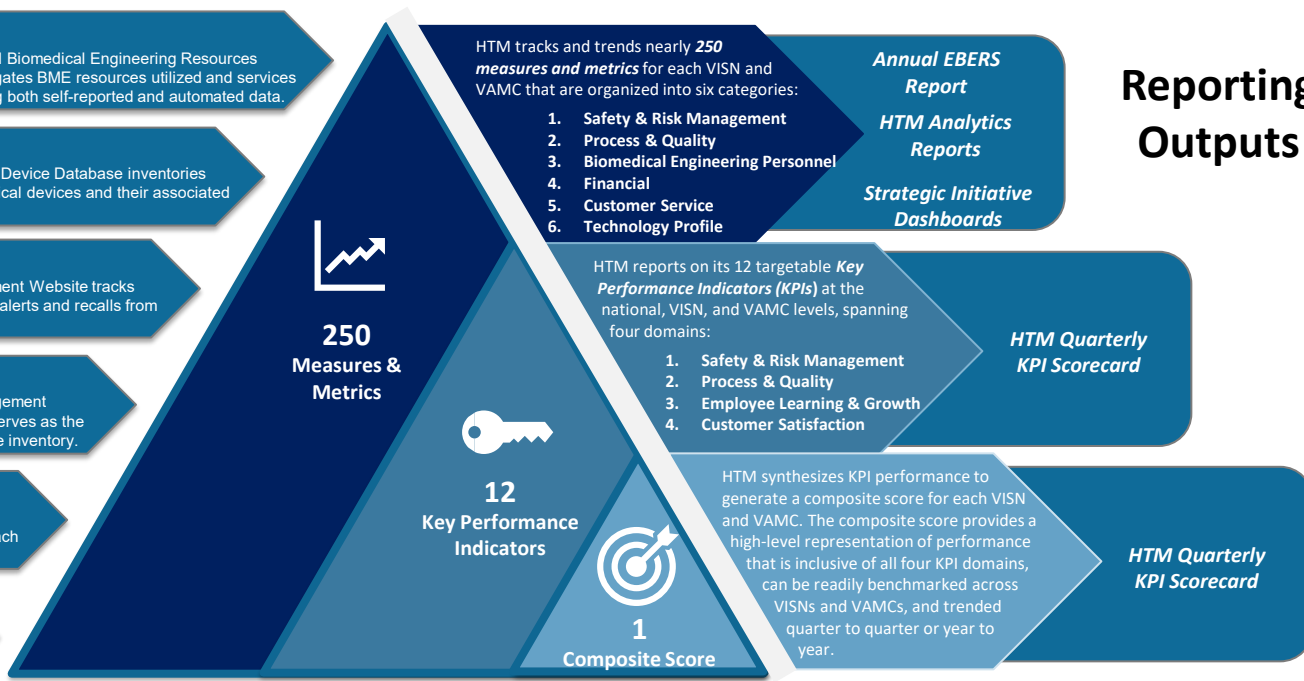
VHA's Computerized Maintenance Management Systems (i.e., AEMS/MERS or Maximo) serves as the system of record for VHA's medical device inventory.

### PM Completion Report

The quarterly aggregation of medical equipment planned maintenance completion as reported by each VAMC.

### Customer Satisfaction Survey

HTM's customer satisfaction surveys collect feedback from its customers transactionally and annually.



## Reporting Outputs

## **KEY PERFORMANCE INDICATORS**

Within each domain, the following KPIs are monitored quarterly and factor into the overall composite score:

### **Patient Safety**

- Compliance - Remediation Action of RMD Safety Alerts (*Monthly Target: 100%*) \*
- Compliance - Cumulative Completion for Remediation Action of RMD Safety Alerts (*Monthly Target: 100%*) \*

### **Medical Device Inventory**

- Conformance to VA-MDNS Naming Standards (*Monthly Target: 97%*)
- Compliance to VA-MDNS Categories (*Monthly Target: 97%*)

## **KEY PERFORMANCE INDICATORS (cont)**

### **Medical Device Security**

- Vulnerability Management (*Quarterly Target: 100%*)
- % Unsupported OS with no plan or expired plan (*Quarterly Target: 0%*)

### **Medical Device Sustainment**

- On-Schedule Completion for High-Risk Medical Devices (*Monthly Target: 100%*)
- On-Schedule Completion for Non-High Risk Medical Devices (*Monthly Target: 100%*)
- Completion Turnaround Time for All CM Services (*Quarterly Target:  $\leq 7$  days*)



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## TIER 2 MONITORS

*Note:* there are no associated targets for these metrics.

### Equipment Planning

- HC-HT Source Selections on Time
- % Timely HC-HT deployments

### Technology Innovation & Modernization

- Tele-CC Health Indicator
- Tele-CC Go-Live Site Status
- Somnoware Phase

### Resources & Operations

- Number of Certifications per Employee
- Transactional Customer Satisfaction Survey Responses
- Work orders open over 30 days
- Overall Value of HTM

### Medical Device Security

- NMDD Conformance
- NMDD Compliance
- VLAN Compliance
- % Unsupported OS at VAMC



## Performance Improvement In Action: Some Best Practices

Sites that have consistently been top performers in KPIs...

- Are organized with HTM as an **independent service** (NOT a section of Facilities Management or IT or Supply Chain).
- Apply **deliberate management attention**. One site improved their overall KPI performance from 30% to 80% by conducting weekly meetings expressly focused on each KPI domain.
- Analyze **full cycle processes**; not just HTM responsibilities. One site improved their CM TAT by collaborating with Procurement to shorten lead time to purchase replacement parts.
- **Engage all stakeholders** who are involved in process. Our sites have improved imaging equipment deployment time by leaning workflows and reducing wait states in HTM, Procurement, Construction Planning, IT connections, Clinical Requirements, and Vendor partners.
- **Leverage executive leadership**. A site received extra overtime budget to work down overdue safety recall remediations. The KPI result quickly increased (and patient safety improved!).



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# **Continuous Improvement**

**Improving Maintenance and Replacement Plannings  
Using Equipment Aging Studies**

Binseng Wang  
Vice President, Program Management  
Sodexo HTM



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## About the Speaker: **Binseng Wang**

- Binseng Wang is a vice-president with Sodexo HTM, an independent medical equipment service organization located in the USA.
- Previously, Dr. Wang was Director, Quality & Regulatory Affairs for Greenwood Marketing LLC, Vice President, Quality & Regulatory Affairs, for Sundance Enterprises, Aramark Healthcare Technologies, and MEDIQ/PRN. He also worked as a Visiting Scientist at NIH, Adjunct Professor at the Milwaukee School of Engineering, and Associate Professor at Univ. of Campinas, Brazil.
- He is a fellow of ACCE and AIMBE. He received the 2010 AAMI CE Achievement Award, the 2015 ACCE Lifetime Achievement Award and the 2019 AAMI-TRIMEDX Iconoclast award. He was inducted into the Clinical Engineering Hall of Fame by ACCE in 2017 and granted the title of Honorary Life Member by the Int'l Federation of Medical & Biological Eng. (IFMBE) in 2022. He was chair of ACCE International Committee 2018-2023.
- He earned a Doctor of Science (ScD) degree from MIT and is a Certified Clinical Engineer (CCE).



**Binseng Wang, ScD, CCE**



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## CONTENTS

- INTRODUCTION
- AGING STUDY
  - METHODOLOGY
    - Data source
    - Equipment age
    - Maintenance and disposal data
  - RESULTS
    - Aging impact of on maintenance
    - Aging Impact on lifespan
  - DISCUSSION
- AGING RESULTS APPLICATION
  - Application to equipment maintenance
  - Application to equipment replacement
- CONCLUSIONS



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## INTRODUCTION

- Human beings (and other living organisms) exhibit clear signs of aging (increasing need of “repairs” with age)
- If medical equipment has the same behavior, shouldn't we plan its maintenance and replacement accordingly?
  - Maintenance: plan for more repairs as the equipment ages
  - Replacement: plan for replacing the equipment as it become less reliable (impacting patient safety and timely care)
- Aging study: determine whether medical equipment exhibits aging
- Application: define different maintenance and replacement strategies for
  - Equipment with clear impact of aging (CIA)
  - Equipment with no impact of aging (NIA)
- Contributions to HDOs:
  - Smarter maintenance
  - Reduce/delay capital investments for replacements

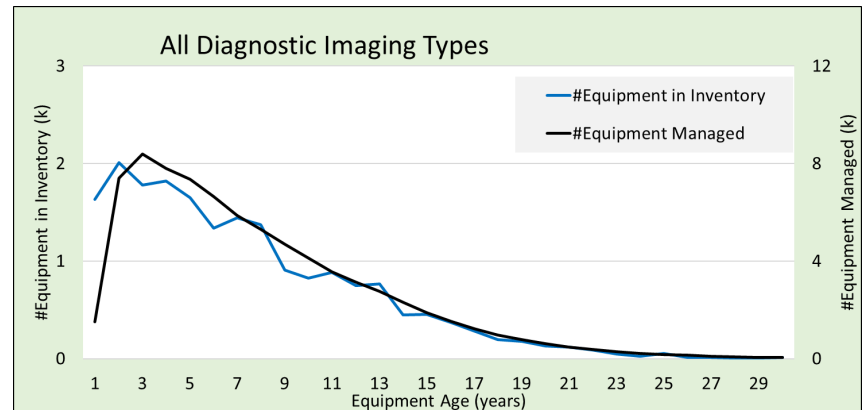
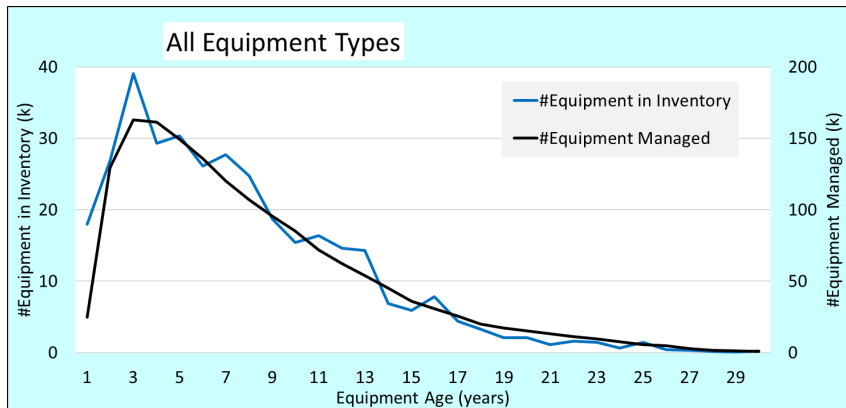


## STUDY METHODOLOGY

- **Data Source**: Sodexo HTM's MinuteMan (MM) CMMS database with ~520,000 pieces of equipment belonging to >100 hospital clients managed in the last 25+ years. However, **only a portion (~65%) of the inventory and service history could be analyzed due to data quality issues.**
- **Equipment Age**: year manufactured or purchased (contract start date otherwise)
  - **Equipment Age (When Managed)**: equipment age at which time we managed it, i.e., performed a service (PM, CM, recall, etc.) or controlled it as an asset, regardless when the coverage started and whether it is still in use or not.
  - **#Equipment Managed**: number of pieces of equipment at a certain age when they were under our management coverage.
- **Outliers**, typically caused by low fractional #Equipment Managed, were excluded.

## STUDY METHODOLOGY (CONT.)

- CAUTION:** *#Equipment Managed*  $\neq$  *#equipment within active inventory, either currently or at a particular date.* Some equipment may have since been disposed and some were used for several years before or after the *Equipment Age (When Managed)*. Typically, *#Equipment Serviced*  $\gg$  Inventory count by age (by a factor of 10), as each piece is counted during all the years it was being managed.





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## STUDY METHODOLOGY (CONT.)

- **Aging Impact on Equipment Reliability/Maintenance**
  - Number of PM and CM workorders performed in each *Equipment Age* divided by the *#Equipment Managed* in that age period, for a certain equipment type. Each equipment type may have **multiple** brands and models.
    - Repair (aka CM): restore equipment to original specifications
    - Planned Maintenance (PM aka SM): preventive maintenance (replacement of wearable parts) and/or safety & performance inspections (SPI)
- **Aging Impact on Equipment Disposal/Replacement/Storage**
  - Number of equipment removed from active inventory (aka "retired") at each *Equipment Age* for a certain equipment type due to:
    - Replacement: replaced by another equipment with identical or similar function
    - Disposal: discarded, traded-in, cannibalized, etc.
    - Storage: equipment stored for reactivation whenever needed (back ups)





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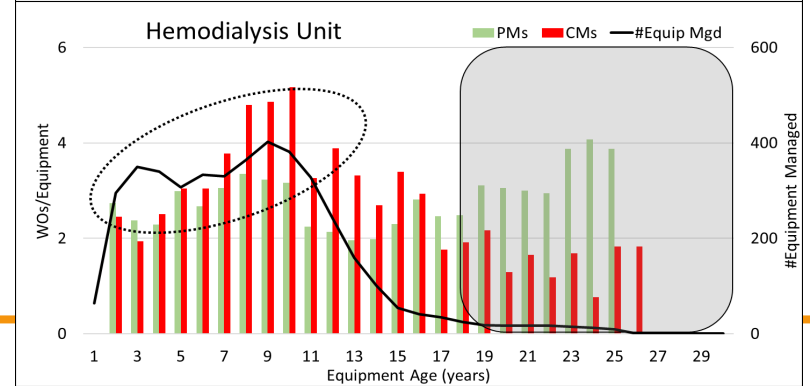
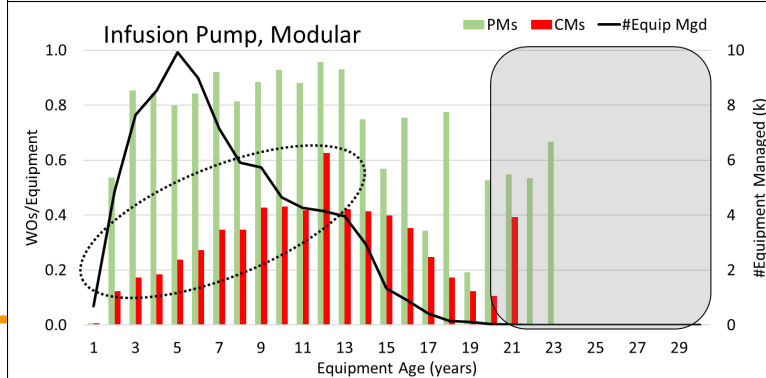
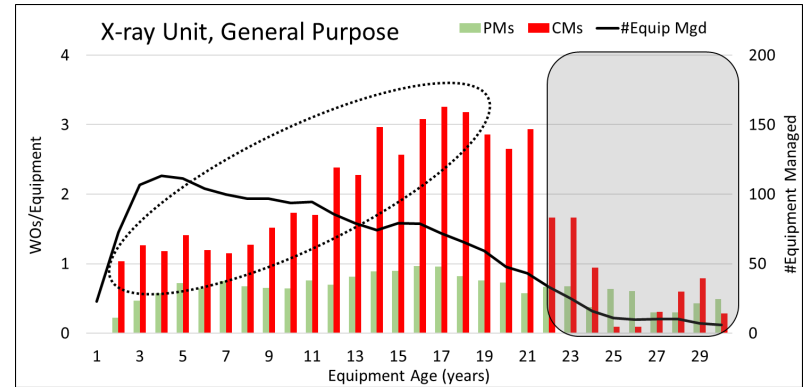
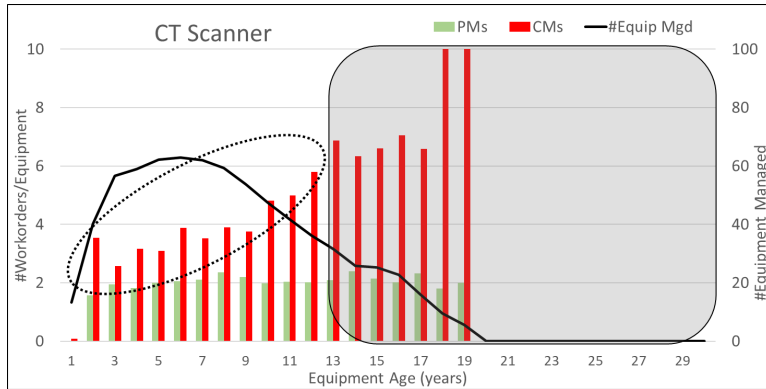
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## STUDY RESULTS – (1) Aging impact of on maintenance

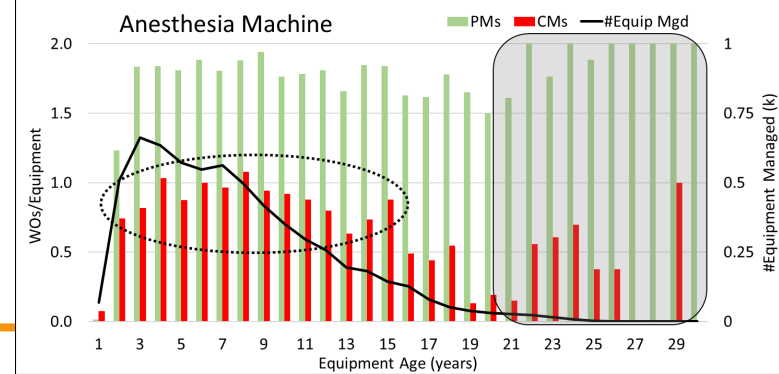
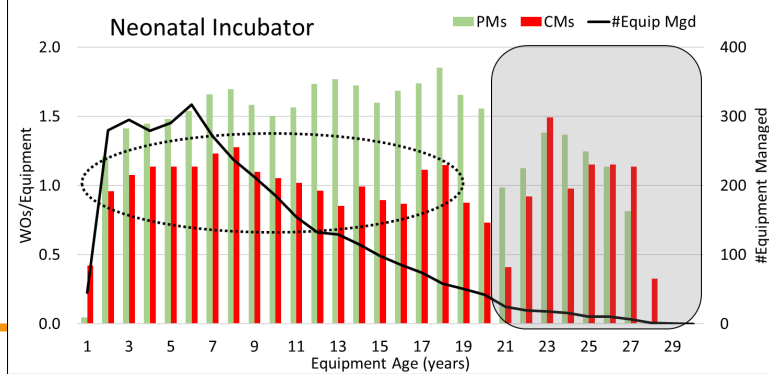
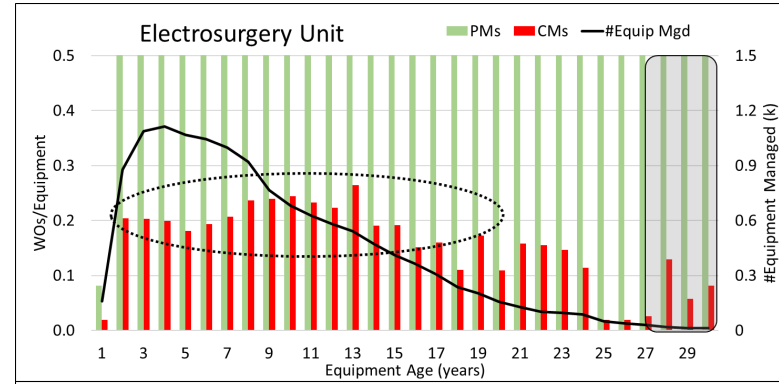
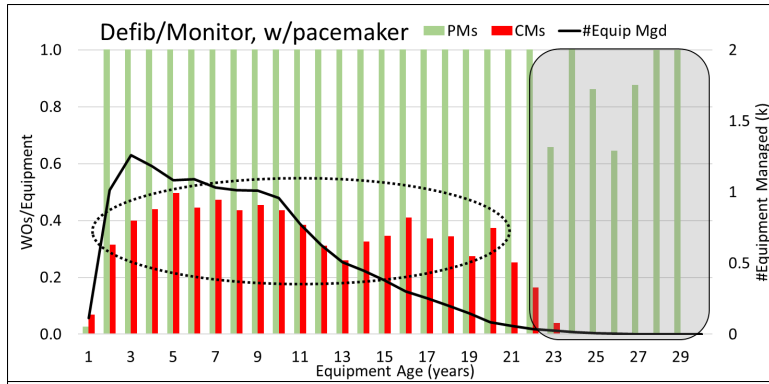
- Aging impact of on maintenance:
  - **Clear** impact of aging (**CIA**): visible increase of CMs/equipment with age
  - **No** impact of aging (**NIA**): invisible increase of CMs/equipment with age
  - **Inconclusive** impact of aging (**IIA**): unclear increase of CMs/equipment with age => further study needed to reclassify into CIA or NIA.



## STUDY RESULTS – Clear Impact of Aging (CIA) – AHA-EUL = 5, 5, 10, 5y

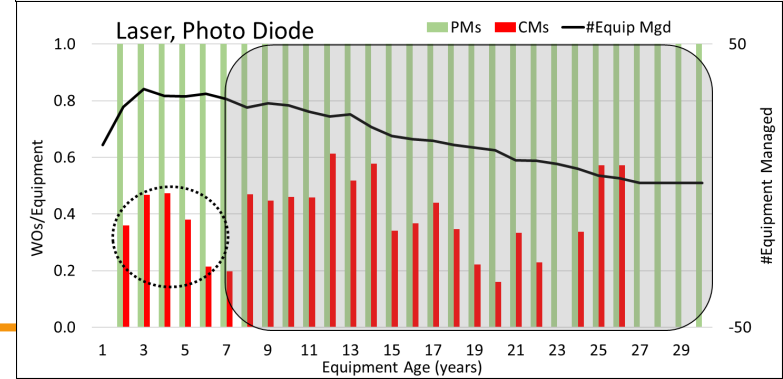
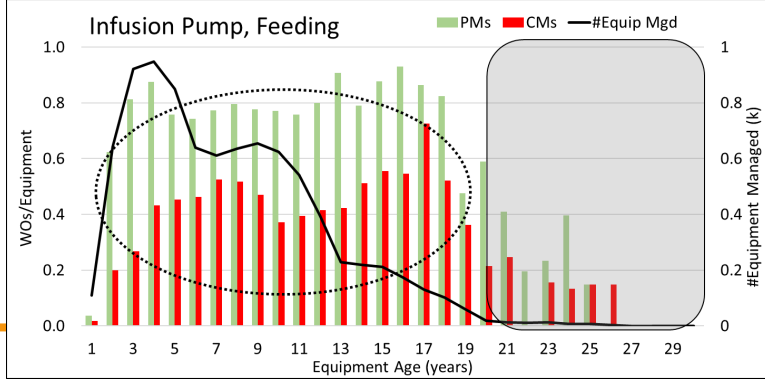
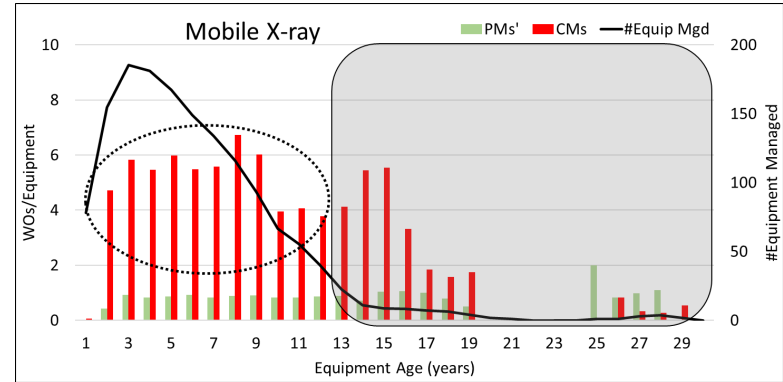
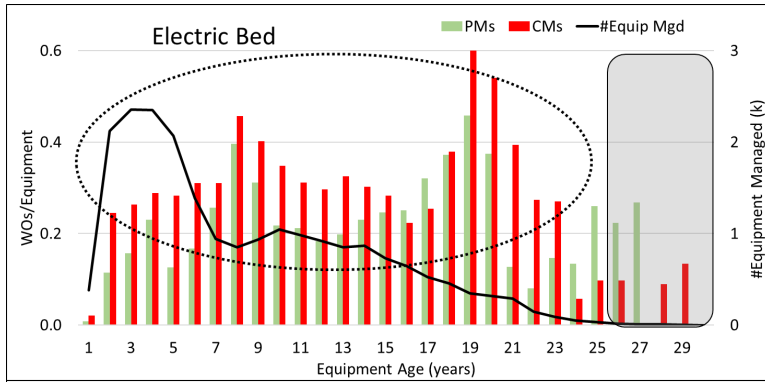


## STUDY RESULTS – No Impact of Aging (NIA) – AHA-EUL = 5, 7, 10 & 7y



PMs/Equipment (green bar) CMs/Equipment (red bar) #Equipment Managed (black line)

## STUDY RESULTS – Inconclusive Impact of Aging (IIA) - AHA-EUL = 12, 7, 10 & 5y



PMs/Equipment (green bar) CMs/Equipment (red bar) #Equipment Managed (black line)



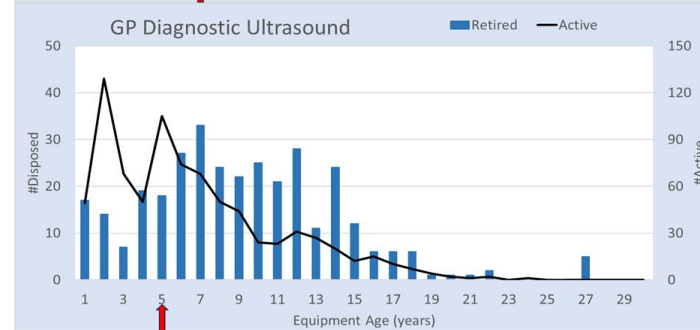
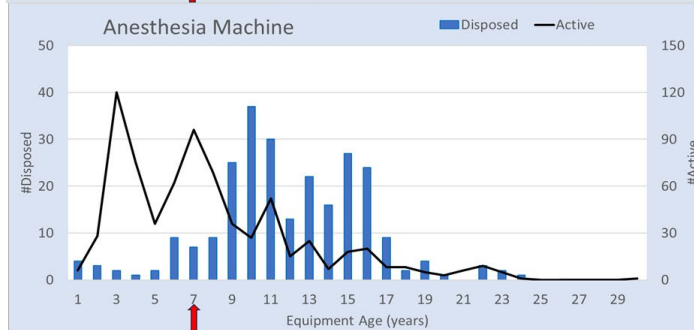
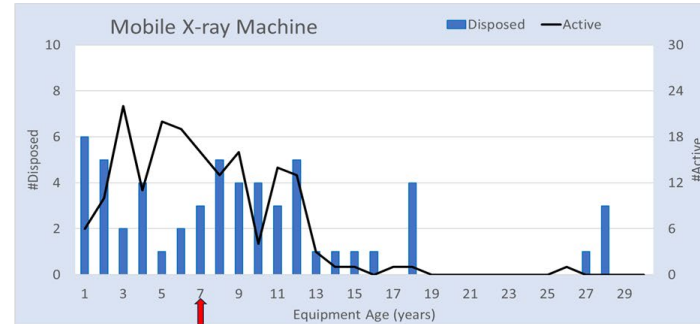
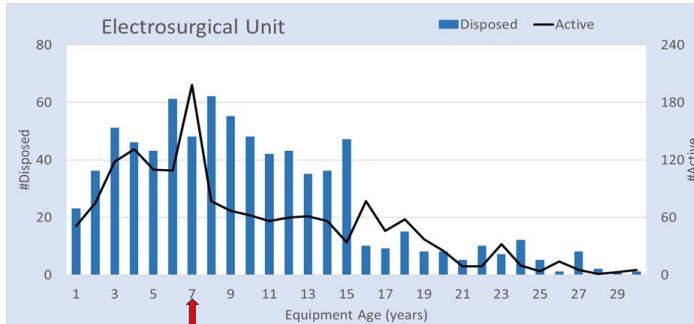
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## STUDY RESULTS – (2) Aging impact on lifespan

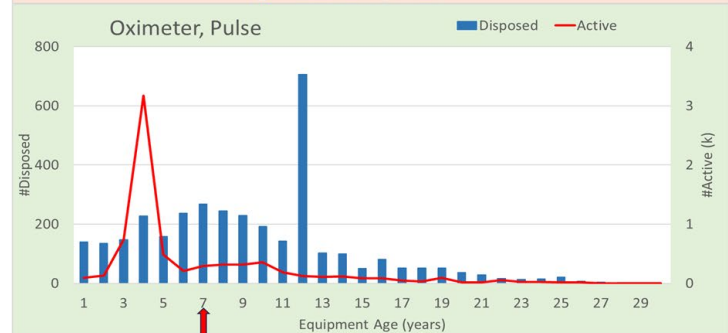
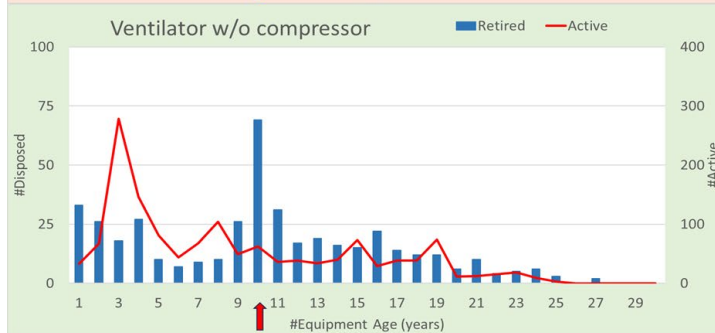
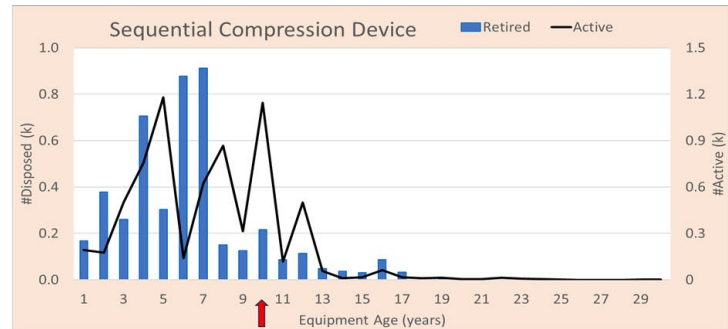
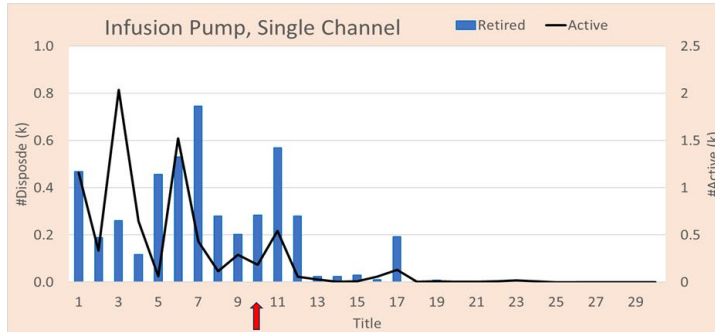
- Aging impact of on lifespan:
  - **Gradual (as needed) disposal**: disposal/replacement of individual pieces whenever needed (repair cost > X% replacement cost/fair market value) => typically normal (Gaussian) distribution over time with occasional spike for various reasons
  - **Group (lumped) disposal (& acquisition)**: wholesale disposal/replacement (or acquisition) of a particular brand/model for recall/upgrade and other reason(s)

# STUDY RESULTS – Gradual disposal





# STUDY RESULTS – Group disposal & acquisition





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## STUDY DISCUSSION – Challenges

- Unfortunately, **failure causes** were NOT identified in the older workorders
- Equipment **grouping** by type assumes that all (brands/models) have similar utilization and durability
- Some likely **confounding** factors that contributed to the **paradox of apparent increasing reliability (i.e., reduced CMs) with age** detected:
- Disposal/retirement/storage **reasons** are not specified in the CMMS
- Some likely **confounding** factors that contributed to the high **early disposals** (years 1-3):
  - Loss (transferred out with patients, etc.)
  - Trade-in's (warranty/depot repairs, supply lease agreements, recalls, etc.)
  - Accidents/disasters





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## RESULTS APPLICATION – (1) Maintenance Planning

- **Not all equipment suffer from aging** => some have clear wear-out with age while others don't. So maintenance should be planned accordingly.
- **Maintenance strategy** considering **aging impact**:
  - 1) **Equipment with clear aging impact (CIA):**
    - **PMs:** focus on **parts replacement** when wear-out is detected (“potential failure” or “**condition-based maintenance**”) or predictable (**preventive** maintenance)
    - **Repairs:** **plan for increasing labor and parts cost with age**
  - 2) **Equipment with no aging impact (NIA):**
    - **PM Strategy:** AEM with PM frequency and/or tasks reduction, including run-to-failure (RTF)
    - **Repairs:** only as needed and cost effective (<XX% of replacement cost and/or fair market value)



## RESULTS APPLICATION – (2) Replacement Planning

- **Most equipment is deployed far longer than depreciation period** => age is clearly not the primary or only determining factor for disposal/replacement or storage.
- **Replacement strategy** considering **aging impact**:
  - 1) **Equipment with clear aging impact (CIA)**:
    - Analyze each piece or group of equipment to create a multi-year replacement plan & budget using a combination of these criteria:
      - Clinical impact
      - Safety
      - Condition
      - Supportability
  - 2) **Equipment with no aging impact (NIA)**:
    - Use prior service history to create an annual "**contingency fund**" for replacement on an as needed basis, i.e., replace if >XX% of replacement cost and/or fair market value; otherwise, repair it.



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## Research Team (in alphabetic order by last name)

- Morgan Ayers-Comegys, BBA, MHA – Director of Capital Equipment Planning
- Jason Gibson, BBA – Director, Compliance
- Torgeir Rui, SivIng – Lead Data Analyst
- Scott Skinner, MBA, PhD - Director of Capital Equipment Planning
- Kevin Steward, AS, CBET – Director, Mobilization
- Binseng Wang, ScD, CCE – VP, Program Management
- Steve Williams – Internal Quality Auditor



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## THANK YOU!

- Questions & suggestions are most welcome!
- Contact information:
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  - **Greg Fogleman**
  - Email: [Gregory.Fogleman@va.gov](mailto:Gregory.Fogleman@va.gov)
  - **Kurt Finke**
  - Email: [Kurt@FinkeCE.com](mailto:Kurt@FinkeCE.com)
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