Medical Device Cybersecurity Workforce Development

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NICE Conference

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Agenda

- **Bottom line up front**
- **Challenge**
- **The project**
  - Approach
  - Status

Bottom Line Up Front

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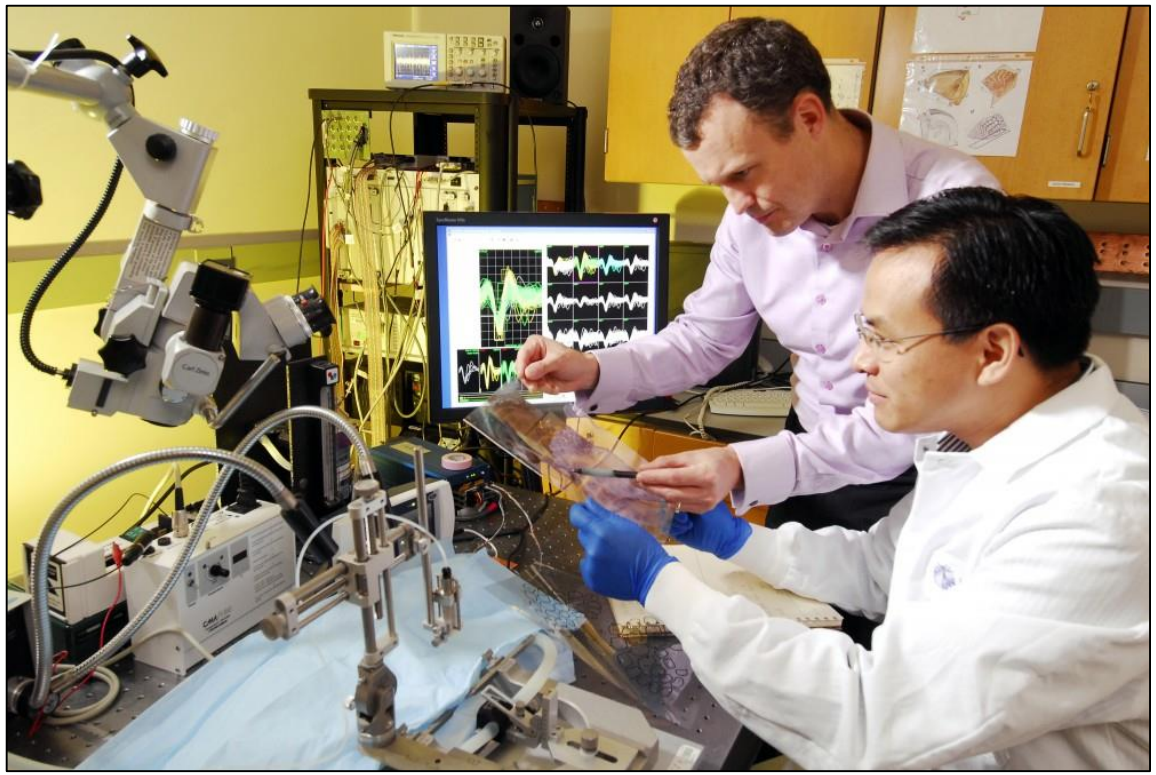
Bottom Line Up Front

MITRE is developing a Medical Device Cybersecurity training model for VA* to help raise the cybersecurity competency of Healthcare Technology Management (HTM) professionals who manage and maintain networked medical devices

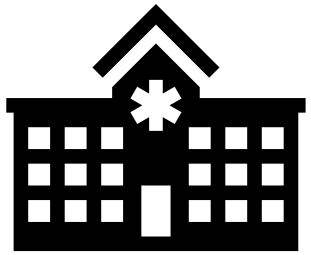


Source: http://www.industrytap.com/biomedical-engineering-revolutionizing-medicine-creating-opportunity/37543

*for VA but applicable to others in the government/healthcare community

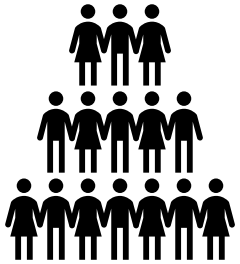
Bottom Line Up Front: U.S. Veterans Administration (VA)

- **The largest integrated health care system in the United States**
- **Current snapshot:**



1,255

Health Care Facilities

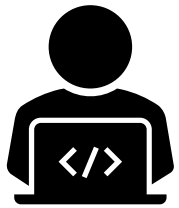


9+

Million Veterans Enrolled

55,000

Networked medical devices* (*as of 2017*)



1,300+

Healthcare Technology Management (HTM) Professionals Employed

Sources: National Center for Veterans Analysis and Statistics, www.va.gov/vetdata; *Strengthening medical device cybersecurity across the healthcare ecosystem* report, https://connect.ul.com/rs/365-LEA-623/images/LHS-UL-VA-Research-Report-StrengtheningMedicalDeviceCybersecurityAcrosstheHealthcareEcosystem.pdf; *American College of Clinical Engineering (ACCE) News,* Volume 29 Issue 3: May—June 2019

*55,000 networked medical devices within VA medical centers and clinics; there are an additional 55K++ networked, implantable or wearable medical devices on or in VA patients

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Bottom Line Up Front: The MITRE Corporation

- **Not-for-profit, trusted third party, working in the public interest**
- **Cybersecurity expertise**
- **Since 2014, has been partnering with the U.S. Food & Drug Administration (FDA) and others to improve medical device cybersecurity**

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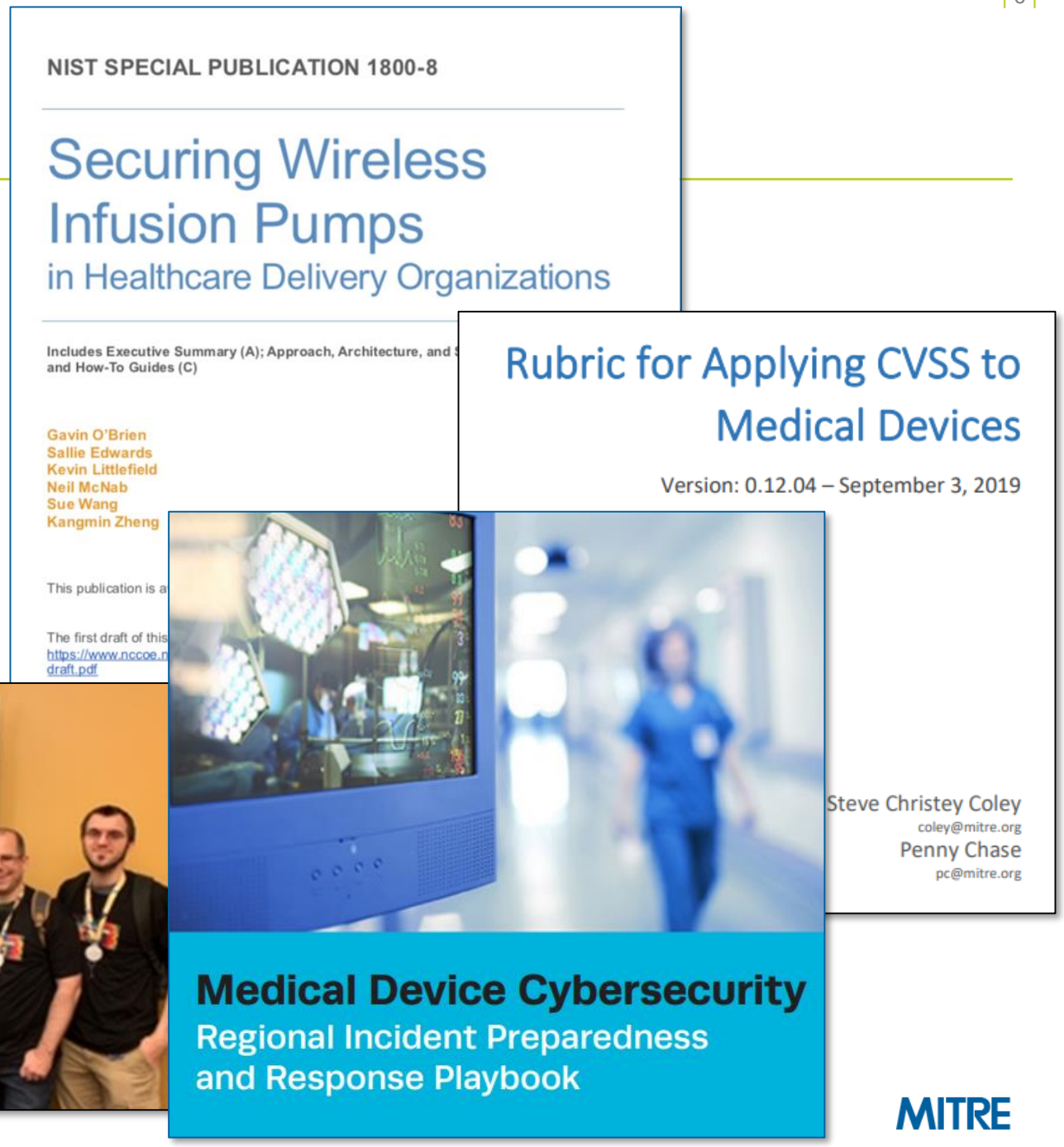

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Challenge

Historical Workforce Development: Different Trajectories

Medical Devices

- **Managed by HTM professionals**
  - Biomedical engineering degree, and/or
  - Biomedical equipment technician
- **Unique hardware and function**
- **Different technologies & subspecialties**
  - Sterilization
  - Medical air
  - Imaging

- **Clinical expertise**
- **Patient safety focus**
- **Different vocabulary**
- **Organizationally within clinical organization**

IT Systems and Networks

- **Managed by IT, system, software, hardware, and network specialists**
  - Computer science, computer engineering, information systems degree, and/or
  - Systems administration
- **More commoditized hardware and software**
  - Servers
  - Operating systems
  - Laptops
  - Applications
  - EHR

- **Availability and confidentiality focus**
  - HIPAA
- **Organizationally under CIO**

https://www.securityinformed.com/insights/adapting-servers-ip-video-surveillance-systems-co-10265-ga-sb.1547618266.html

Medical Device Risks

- **Medical devices are increasingly networked**
- **Incidents with medical devices can impact patient safety**
- **Medical devices can serve as an access point to sensitive healthcare data**

The Challenge

- **Expand the scope of training for HTM professionals to include cybersecurity—tailored to medical device uses—that is designed to meet the specific needs and organization of the VA, *such as those noted in the VA HTM job description excerpts below***
  - HTMs know number/location of medical devices; understand criticality, lifecycle, and supportability issues
  - Limited applied cybersecurity competency
  - Geographically-dispersed workforce

"[illegible] guidance in [illegible] medical [illegible] ACL development."

Some Examples of Cybersecurity Risks to Networked Medical Devices[1]

Risk Description	C	A	I	PS
Failure to provide timely security software updates and patches to medical devices and networks and address related vulnerabilities in older medical devices (legacy devices)	X	X	X	X
Malware which alters data on a diagnostic device			X	X
Device reprogramming which alters device function (by unauthorized users, malware, etc.)	X	X	X	X
Denial of service attacks which make a device unavailable		X		X
Exfiltration of patient data or PHI from the network	X			

C: Confidentiality, A: Availability, I: Integrity, PS: Patient Safety

[1] *Adapted from "Health Care Industry Cybersecurity Task Force Report," June 2017*

Challenges to Securing Medical Devices

- **Medical device inventories are often incomplete**
- **Vulnerability scanning may adversely impact medical device operation**
- **Legacy devices and platforms inhibit patching of devices**
- **Medical device cybersecurity responsibilities shared among**
  - IT staff
  - Healthcare technology management (HTM) staff
  - Device manufacturers
  - Clinicians

The Project

The Approach

Bridging the Gap Between Knowledge and Competency

Training Needs Analysis

Learning Objectives

Instructional Design Methods

Learning Assessment and Evaluation

Project Status

- **Training Needs Analysis**
  - Multiple interviews
    - VA/VHA staff
    - Other government (e.g., Food and Drug Administration (FDA), Defense Health Agency (DHA), and the NIST National Cybersecurity Center of Excellence
    - Medical device manufacturers
    - Private hospitals/HDOs
    - Academia, trade associations, non-profits
  - Extensive literature survey
    - 90+ articles, books, course curricula, etc.
  - Training platform reviews
    - VA, Department of Defense, Department of Homeland Security, Coursera, SANS, MITRE Institute, university-sponsored, Biohacking Village, OpenICE, etc.

Competency Gaps Identified (partial list)*

- **Infrastructure Design:** Basic and advanced networking; configuration management
- **Threat Analysis:** Knowledge of threats and skill in identifying them
- **Vulnerabilities Assessment:** Ability to conduct vulnerability scans and recognize vulnerabilities in security systems
- **Data Privacy and Protection:** Knowledge of, and ability to apply, PHI data security standards
- **Risk Management:** HTMs as FISMA system owners and security controls assessors; RMF knowledge; system provisioning/procurement
- **Incident Management:** VA-specific incident response procedures

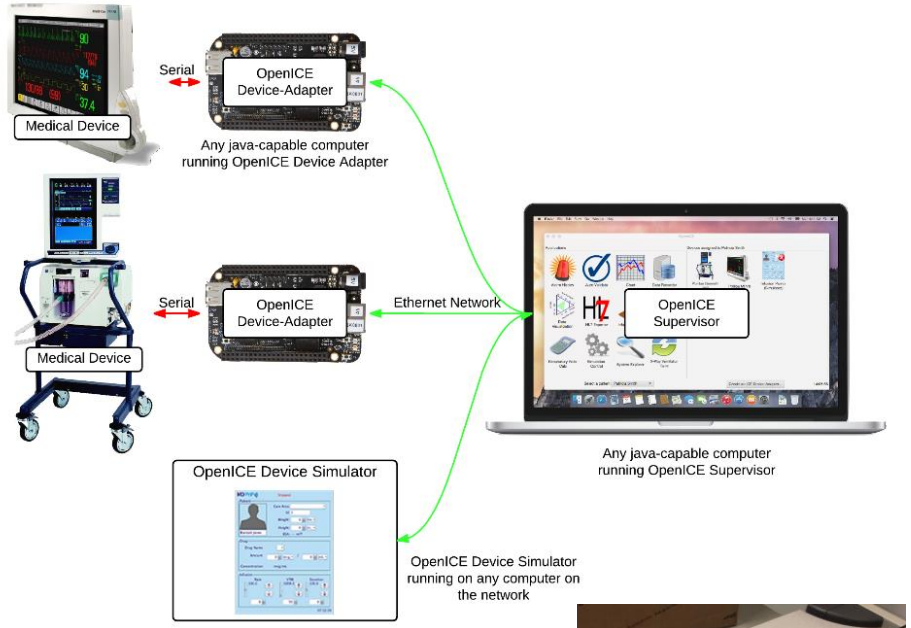
** A partial list from preliminary findings aligned to NICE competencies*

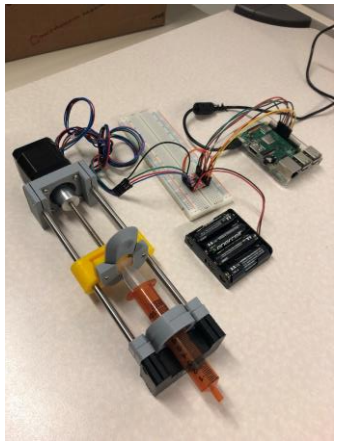
Training Needs Analysis

- **Shorter, continuous trainings**
  - Reinforce cybersecurity behavior/culture among HTMs
  - Build skills, not just awareness/compliance and information dissemination
- **Training for large, geographically dispersed workforce**
- **Desire for medical device cybersecurity certification for HTMs**
- **Build cybersecurity into Biomedical Engineering curriculum**
- **Hands-on, experiential learning is key**

Experiential Learning Approach

- **Hands-on skills training**
- **Remote access to real medical devices**
- **Remote access to virtual devices**
- **Cloud-based training**
  - Prototype on MITRE cloud
  - Evolve to VA Cloud
- **Facility Kits**
  - Prepare kits that VA admins can install at VA Medical Center (VAMCs)
- **Device Learning Kits**
  - Low-cost open source medical devices bundled with lab exercises





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Looking Ahead

- **Finalize training design document**
- **Provide recommendations and roadmap for VA HTM cybersecurity training model**
- **Parallel efforts to support training model**
  - **Continue collaboration with** U.S. Food and Drug Administration (FDA) and Defense Health Agency (DHA) and **broader health/cyber community**
  - Continue medical device cybersecurity hands-on testing, collaboration, and demonstration, within MITRE and with external partners

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