ACCE
AMERICAN COLLEGE OF CLINICAL ENGINEERING

Managing Medical Device Vulnerabilities Efficiently

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About the Moderator

Angelina Chiaracane, MS, CABT

Kaiser Permanente

Clinical System Engineer

Member, ACCE Education Committee

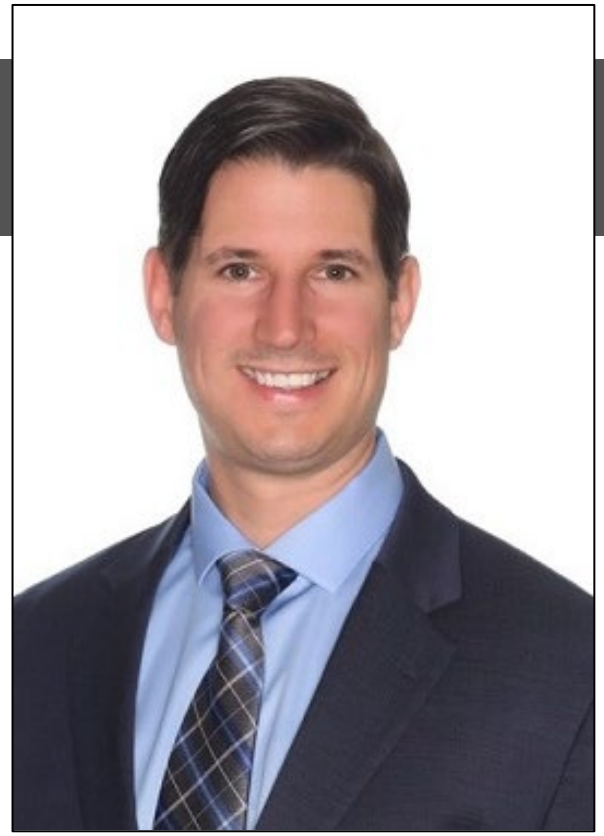
Angelina is a Clinical System Engineer at Kaiser Permanente in Northern California responsible for the implementation of equipment and capital projects. She is actively working on converting the entire fleet of large volume infusion pumps for the Region. Previously she has served as a Clinical Technology Manager and developed standardization practices and documentation for service delivery.

Angelina received her Bachelor's in Bioengineer from Florida Gulf Coast University, received her Master's Degree in Clinical Engineering from the University of Connecticut.

Logistics

- All attendees have their microphones muted during the presentation.
- Questions to the panelists must be submitted via the “Q&A” feature (not chat) in Zoom at any time.
- We will try to ask Matt and Jessica to answer questions not addressed during the webinar and distribute them to participants via email or post them to ACCE website.
- Please remember to complete the webinar evaluation after attending. A link will be provided at the end.

About the speaker



Matt Dimino
EVP & Chief Security Officer
Clinical & Operational Technology

FIRST HEALTH ADVISORY

Matt brings a wide range of technical, security, and HTM knowledge to this role. Matt has over 15 years' experience in various HTM roles from senior technical to leadership roles and 5 of those years as a practitioner in medical device security. Throughout his career he has developed multiple security programs, integrated complex architectures, performed security consulting, as well as developed IoMT risk assessment methodologies.

About the speaker

Jessica Pitterka
Clinical Asset Defense Engineer

HONOR HEALTH

Jessica Pitterka is tenured Medical Device Security Engineer currently working at HonorHealth with over five years of security experience with the healthcare industry. As a Clinical Asset Defense Engineer, she is pivotal in driving medical device security initiatives, managing security projects, and provides guidance to healthcare technology procurements and assessments.
Jessica is a Certified Scrum Product Owner and ScrumMaster.

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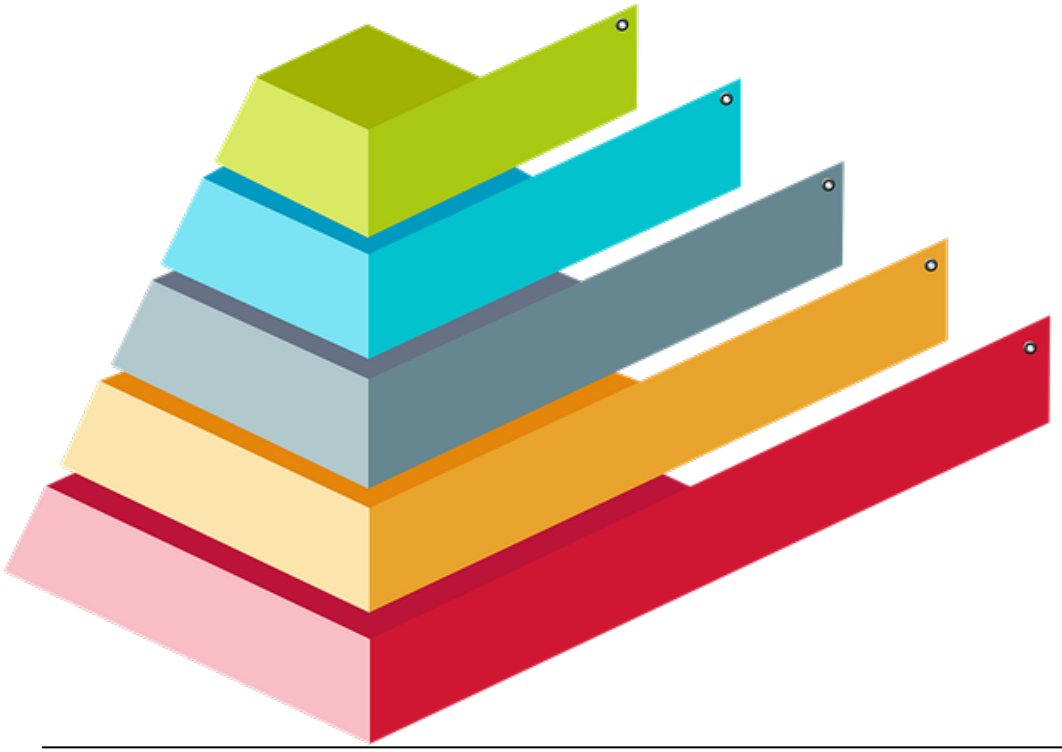
Session Description

Effective vulnerability management for medical devices requires organizations to understand how to assess risk and prioritize their mitigation activities within the context of the threats to the devices in their specific environment. Organizations must first understand their environment by having high fidelity visibility, assets appropriately identified and fingerprinted, and an understanding of device criticality and sensitivity from a business and patient impact perspective.

Efficient vulnerability management works when teams utilize more than just security tools to identify and triage applicable vulnerabilities, they have a collaborative, well-documented risk management approach, track their efforts, and prioritize based on defined factors conducive to their program.

Why Vulnerability Management?



- Increased organizational risk
- Safety – patients & organization
- Compliance – regulatory requirements and internal policies
- To understand the impacts of breaches and security incidents
- Increase in HDO targeted attacks

Understanding the risk

IoMT Risk

Your Challenge

- CISA notifications, industry alerts, and IoMT passive scanning tools are revealing an overwhelming amount of vulnerabilities
- Increases in organizational risk, and it's unclear how to manage
- Organizations are struggling with how to prioritize vulnerabilities for remediation

Common Obstacles

- Patches are rarely an applicable solution
- Many don't understand that vulnerabilities for IoMT devices exist beyond CVE's
- Organizations are unaware of the risk implications and lack the insight to remediation options

Approach

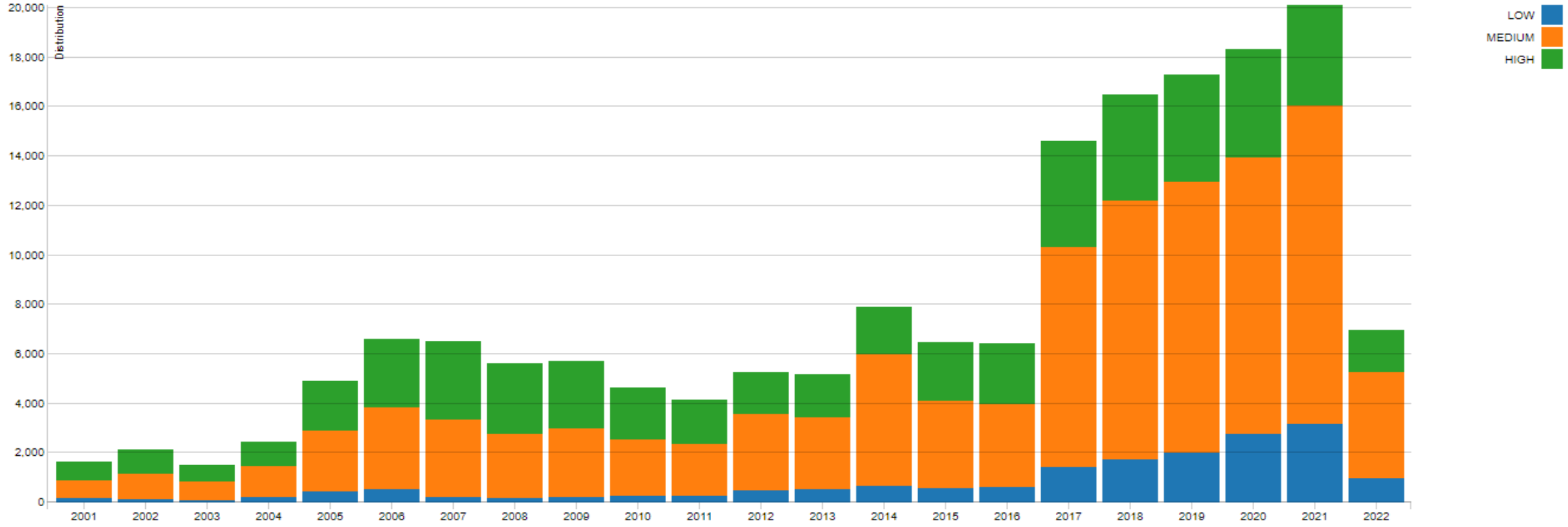
- Design and implement a risk management program
- Understand all factors when implementing remediation options
- Build a strategy from a framework

Vulnerability Management  Patch Management

Your Challenge

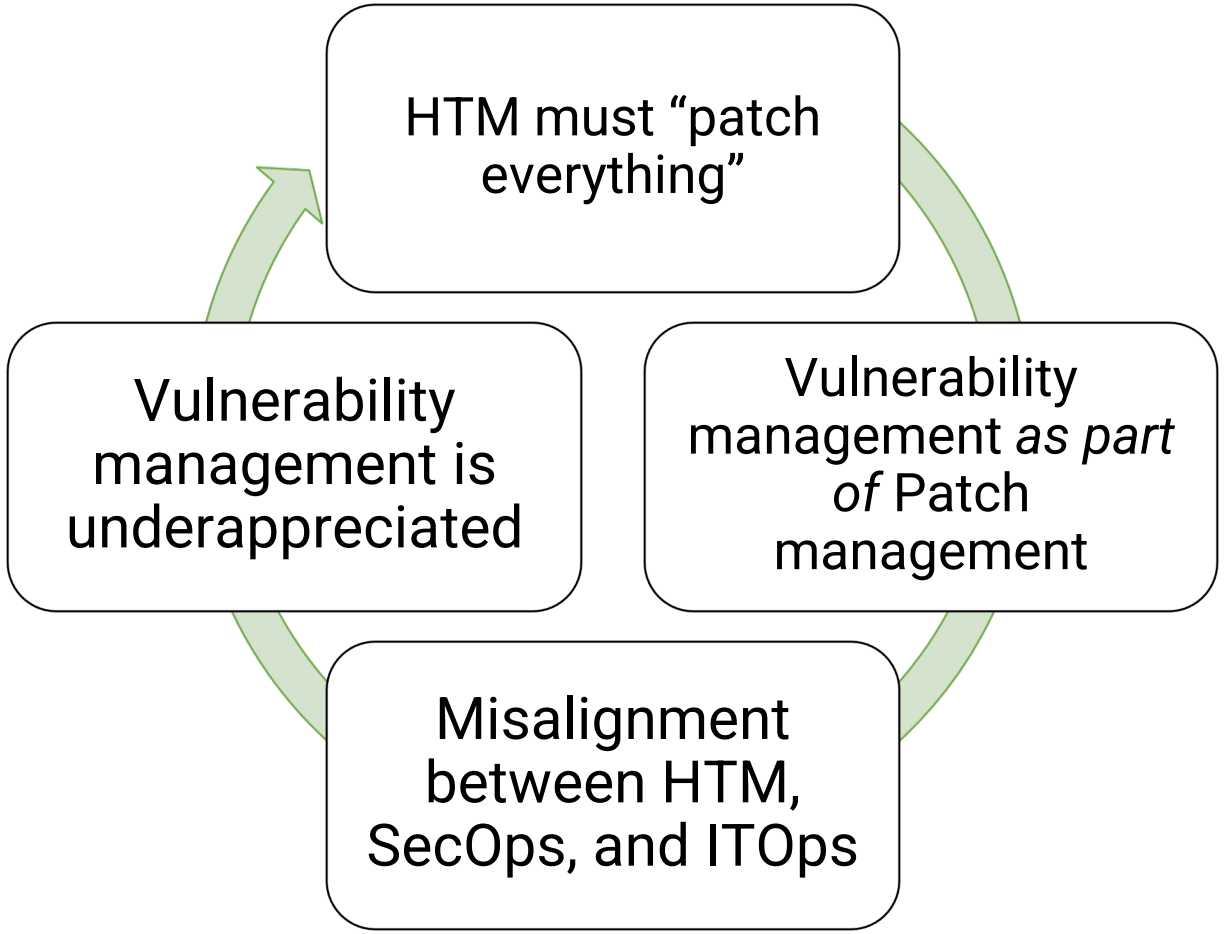
CVSS Severity Distribution Over Time

This visualization is a simple graph which shows the distribution of vulnerabilities by severity over time. The choice of LOW, MEDIUM and HIGH is based upon the CVSS V2 Base score. For more information on how this data was constructed please see the NVD CVSS page .



https://nvd.nist.gov/general/visualizations/vulnerability-visualizations/cvss-severity-distribution-over-time

Common Obstacles and Misconceptions



Approach

Identify Vulnerability Sources

Identify Inventory & know your vulnerability threat intelligence data sources.

Define roles & responsibilities ahead of time.

Triage & Prioritize

Contextualize vulnerabilities based on your security posture.

Identify and assign risk

Vendor Contact (workflow and process) approval & Cadence

Remediate Vulnerabilities

Address the vulnerabilities based on their level of risk.

Patching isn't the only option

Reduce the risk down to medium/low levels and engage your regular operational processes to deal with the latter

Measure & Formalize

Measure with metrics to ensure that the program is successful.

Track your efforts within the CMMS/CMDB & IoMT tool

Ensure continuous improvement.

Vulnerability Management: A Risk-Based Approach

1 Identify

Identify vulnerabilities from IoMT passive scanning tool & external threat sources (US-Cert, vendor alerts, Mitre, NIST

Vulnerability information feeds:
- IoMT passive scanning tool
- External threat intel
- Internal threat intel

2 Analyze

Assign risk (impact x urgency) to the organization based on current security posture

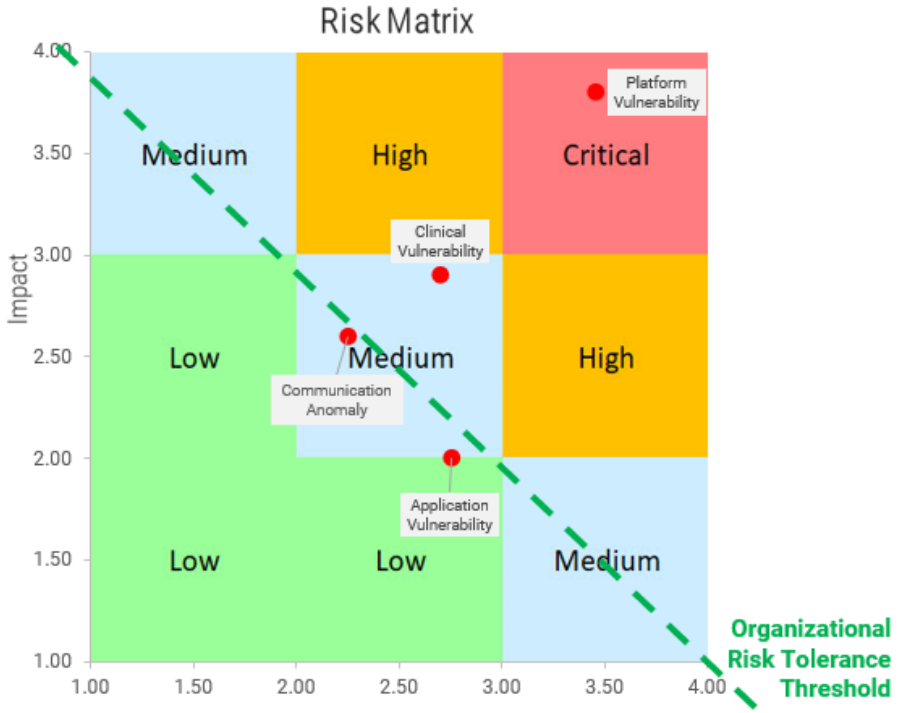
Triage based on risk →

3 Assess

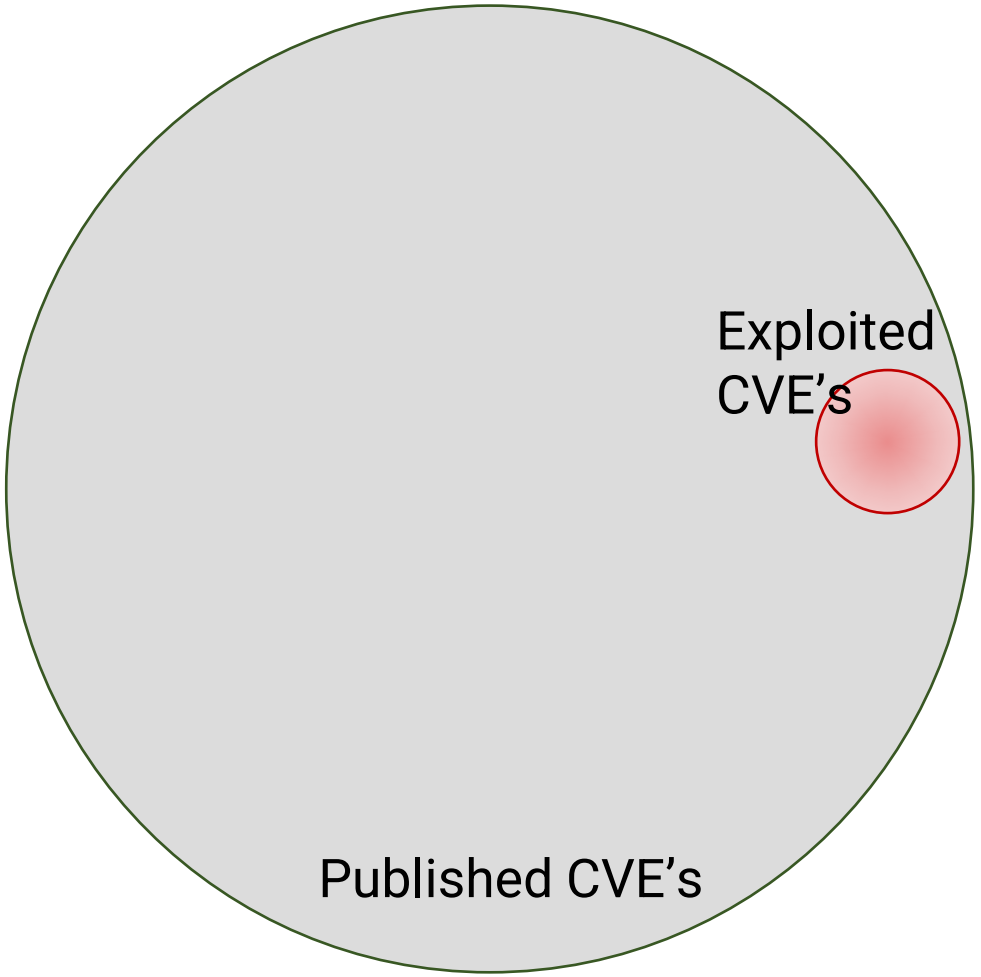
Plan risk mitigation strategy →

Consider:
- Risk tolerance
- Patient impact
- Business impact
- Compensating controls

A risk matrix is useful in calculating a risk rating for vulnerabilities.

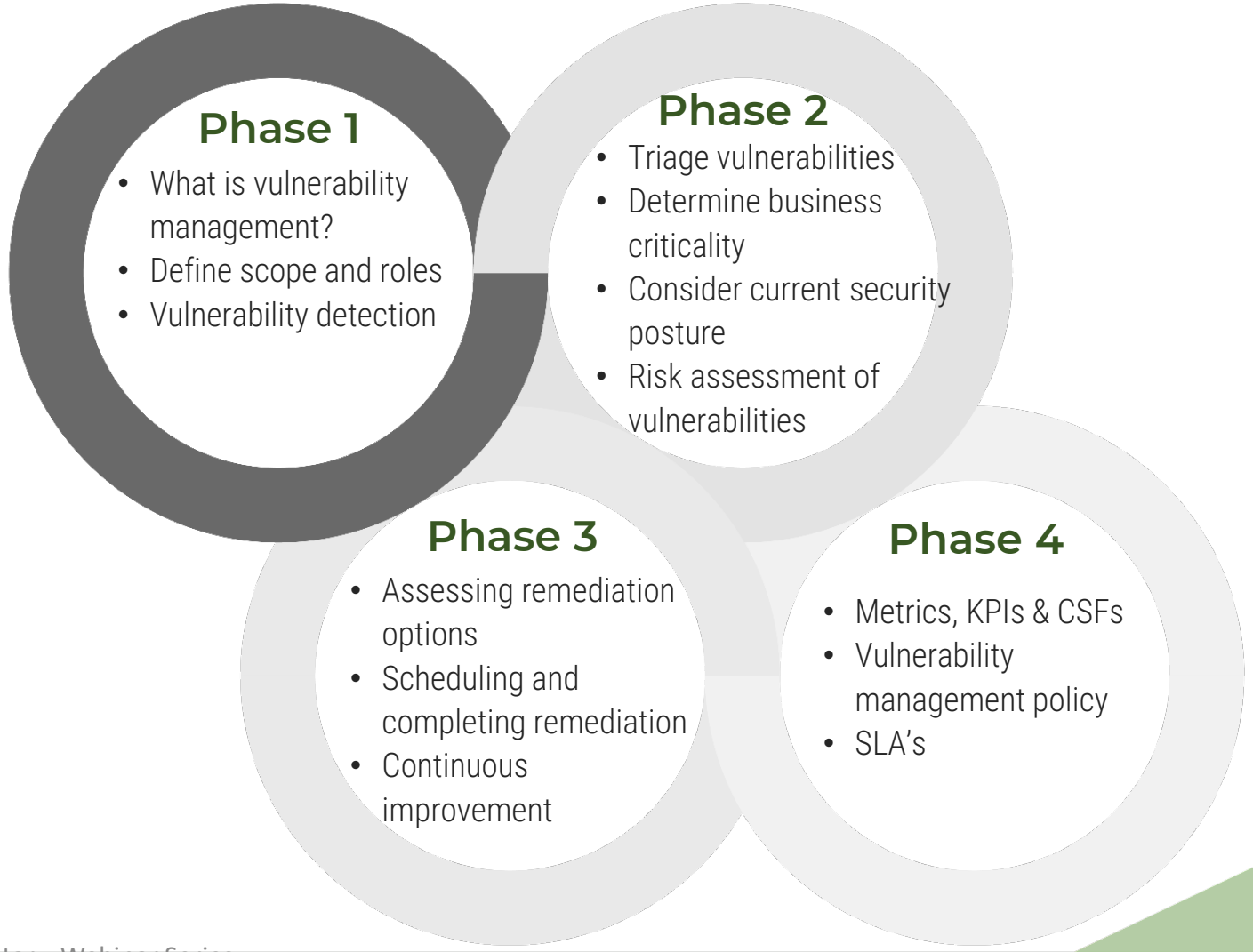


The Truth:



77% of CVE’s have no
published or observed exploit

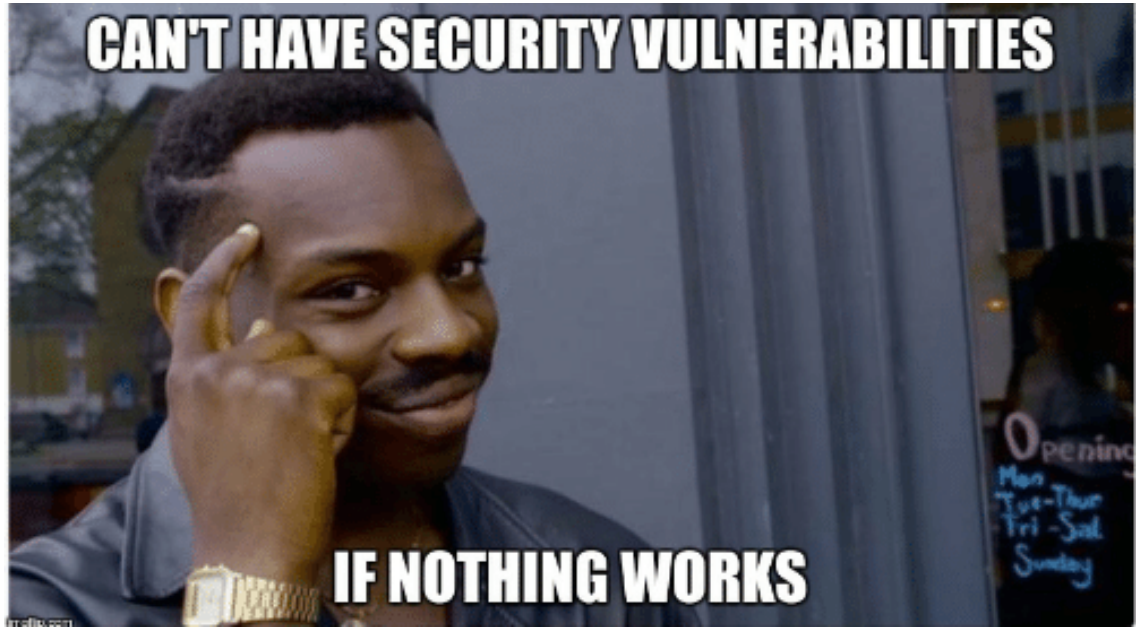
Phase 1: Identify Vulnerability Sources



What is Vulnerability Management?

- Vulnerability management in IoMT is the ongoing practice of passively scanning your environment of care to uncover vulnerabilities:
  - Outdated applications
  - Unpatched operating systems and software
  - Open/unnecessary ports
  - Obsolete hardware
  - Anomalies and poor habits

Effective Vulnerability Management



- Effectiveness requires a formal process
- Patching isn't the only solution, but it's the one that often draws focus
- Responsibilities need to be defined
- Identifying new threats without proper passive scanning tools can be a near-impossible task
- Determining which vulnerabilities are most urgent is necessary for effectiveness
- Measuring the effectiveness of your vulnerability remediation activities can help you better manage resources

Determine Scope of Your VM Program

- Scope can be defined along with four aspects:
  - Asset Scope
  - Physical Scope
  - Organizational Scope
  - CE/HTM/IT/IS Scope

IoMT Assets Within Scope

- An up-to-date and comprehensive asset inventory for vulnerability management is critical
  - Vulnerabilities need to be compared to an inventory to determine if the organization has any relevant systems or versions.
  - It indicates where IoMT assets can be found both physically and logically.
  - Asset inventories typically have owners assigned to the assets and systems whose responsibility is to carry out remediations for vulnerabilities.

Inventory Must Include Software & Applications

- All connected device asset attributes should be accounted for
- Not all vulnerabilities are specific to a device/platform, they can be specific to a software library associated with a device (Java, Adobe, etc)

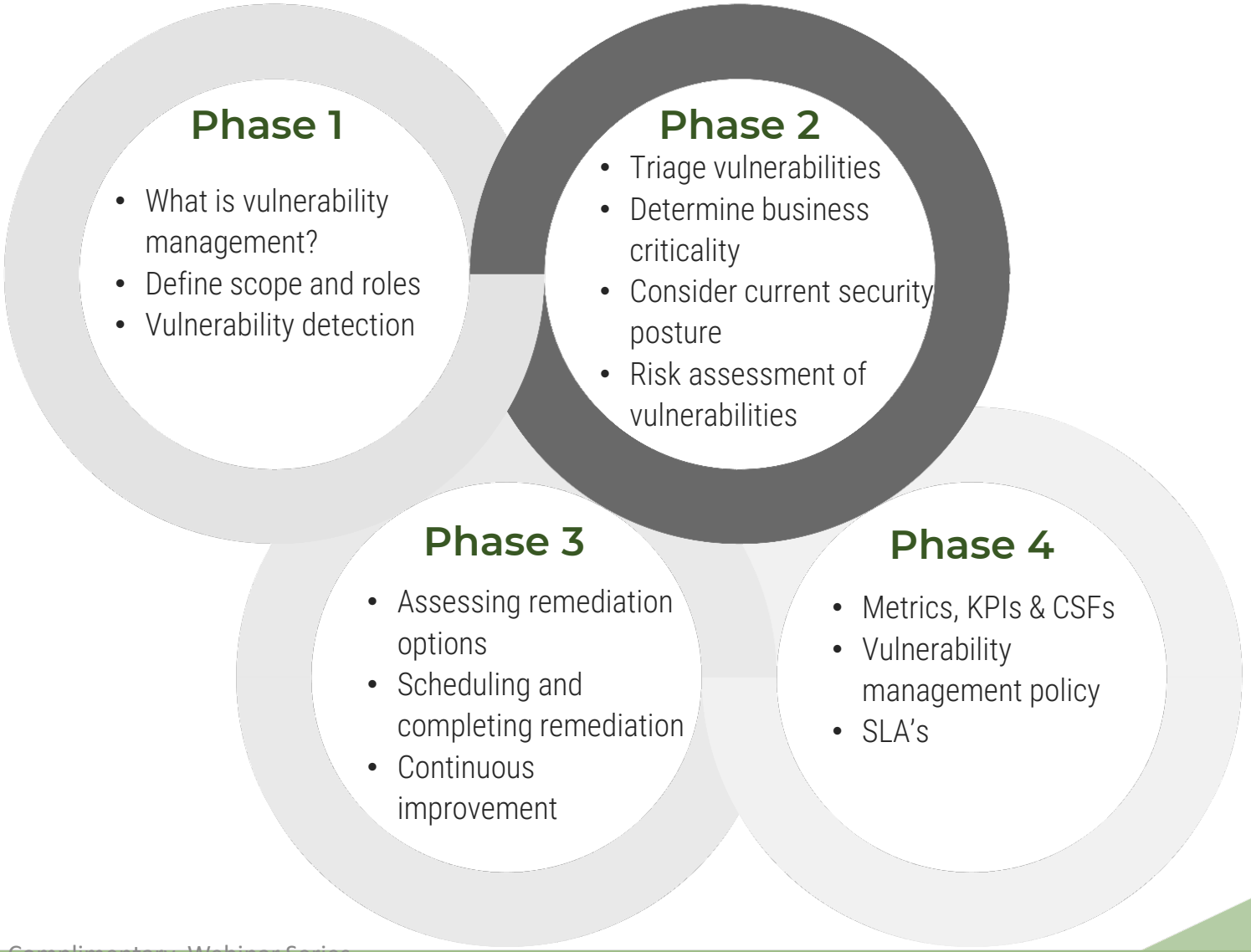
Tactical Insight

Requesting SBOM to identify the libraries associated with your device inventory

Assign Roles and Responsibilities for VM

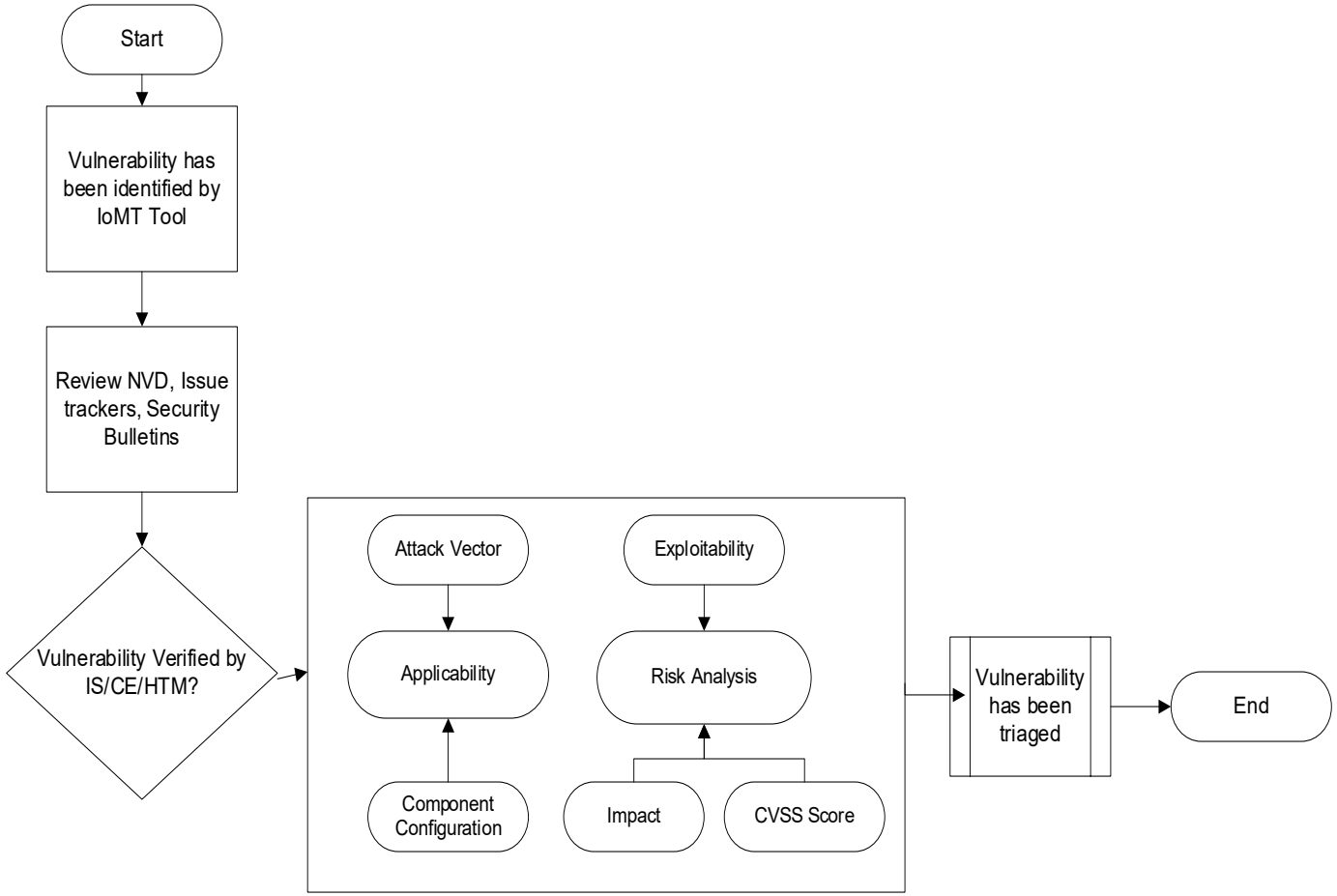
- IS/Risk Mgmt to identify the true organizational risk
- Remediation can include implementing compensating controls, system and application hardening, or segmentation.
  - Who carries out each of these activities? Who coordinates the activities and tracks them to ensure completion?
- The people involved may be IT Ops, infrastructure, and Apps

Phase 2: Triage and Prioritize



Triage Vulnerabilities

- Triaging is an important step in vulnerability management
- IoMT passive scanning tools provide threat intel and cross-reference vulnerabilities with your inventory



Tactical Insight

IoMT security tool needs to be tuned, validated, and configured correctly

Determine Urgency

- Is there an exploit in the wild?
- What is the CVSS base score?
- Is there potential for significant lateral movement?
- Is their potential for patient harm?
- What is the impact to the organization

Determine Business Criticality

- Could the risk cause significant business disruption?
- Could the risk cause significant financial loss?
- Could the risk cause reputational damage?
- Would the organization go on diversion with the loss of the asset?

Review Current Security Posture

- Your IoMT scanning tool alone may not have the context needed for your security posture
- Enterprise architecture (firewalls, ACLS, VLANS) should be factored into determining risk of a vulnerability
- Current security posture will contribute to the assessment and remediation/mitigation options

Vulnerability Prioritization Example

EternalBlue CVSS – 8.1 v3
Actively being exploited
Remote execution
Business critical
Life critical assets affected

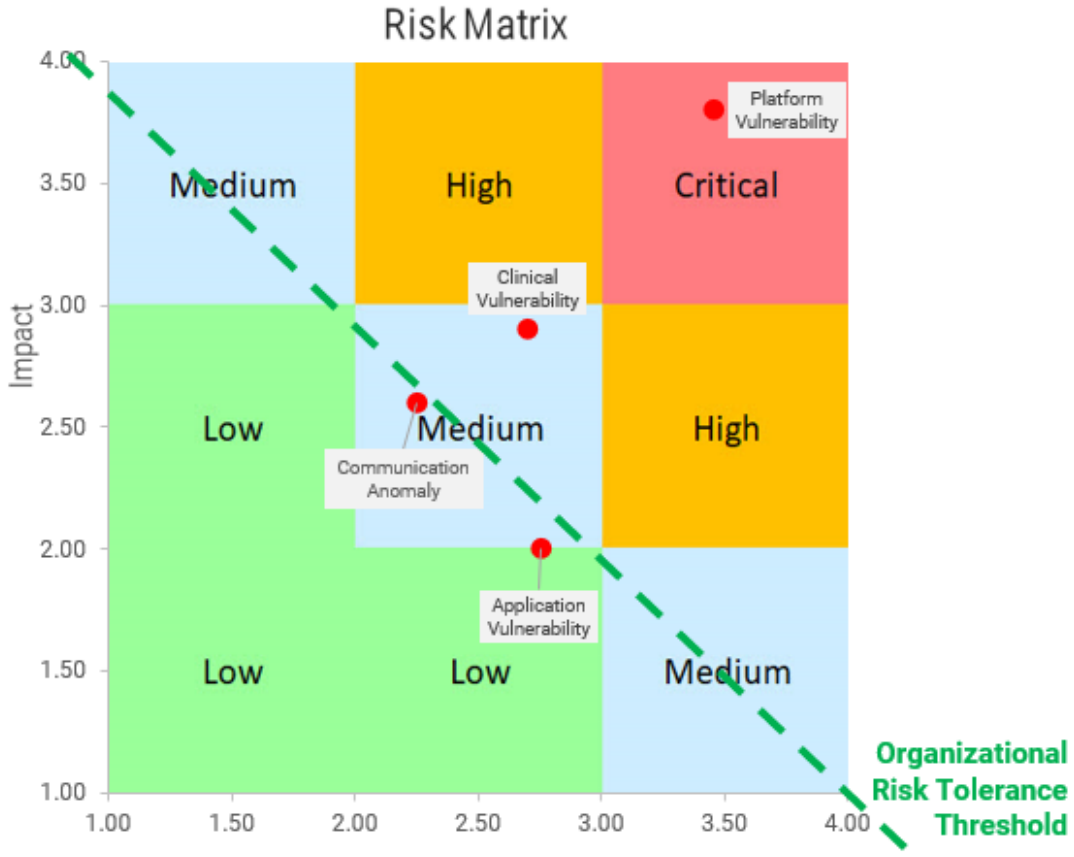
Real score: 9

Urgent/11 CVSS – 9.8 v3
Not actively being Exploited
Remote/Local execution
Business critical
Life critical assets affected

Real Score: 4

Vulnerabilities and Risk

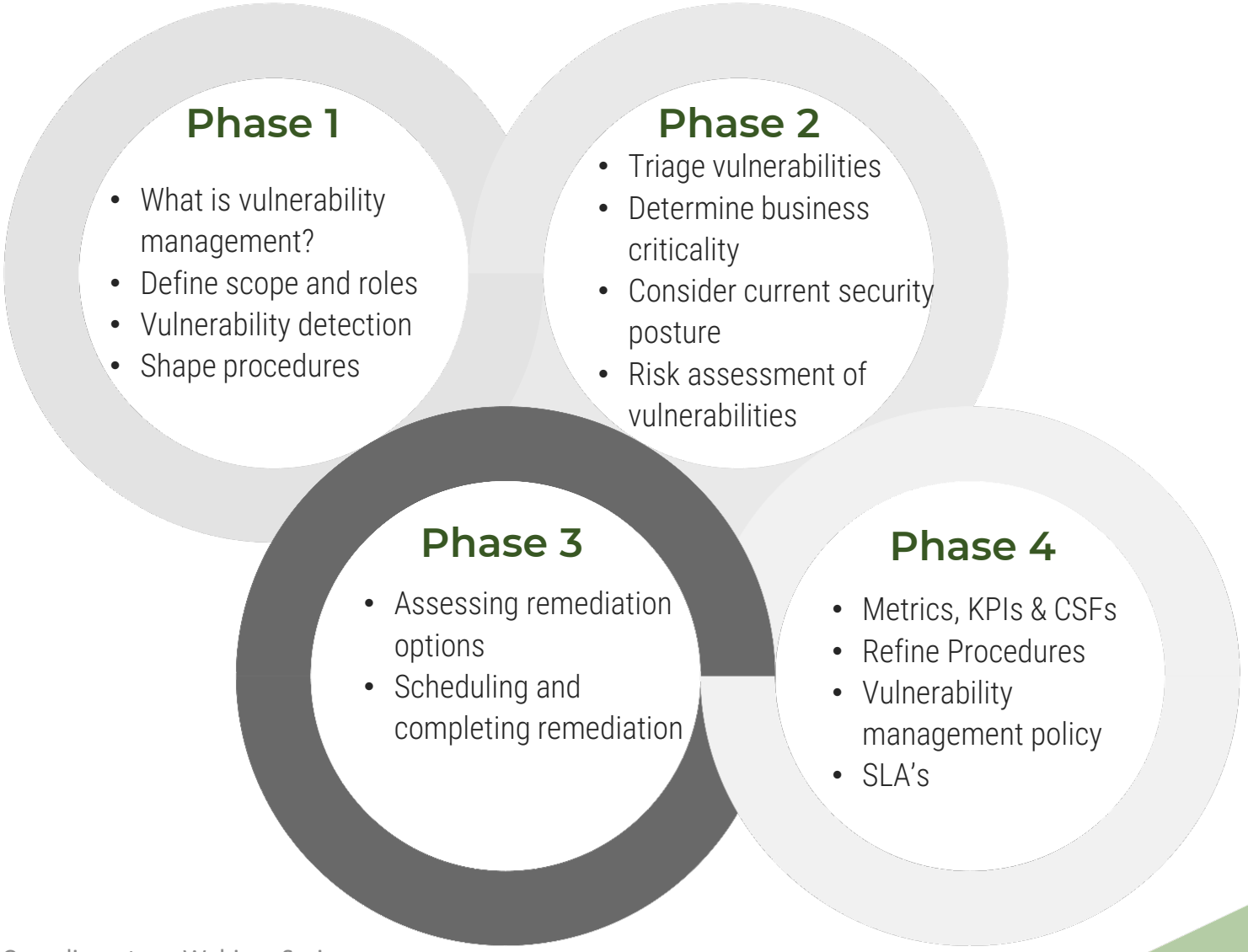
- Vulnerabilities are a risk to patients and the business
- Your organization likely has a risk tolerance level that defines the organization's risk appetite (measure of dollars, patient safety, productivity, down-time, etc)
- The risk of a vulnerability can be determined by impact and likelihood.



A Risk-based Approach to Vulnerability Management

- Vulnerabilities are never-ending
- You won't be able to resolve all vulnerabilities
- IoMT security tools share CVSS scores but do not understand all of the controls you may have in place (compensating controls, device hardening)
- Determining actual risk is a crucial step

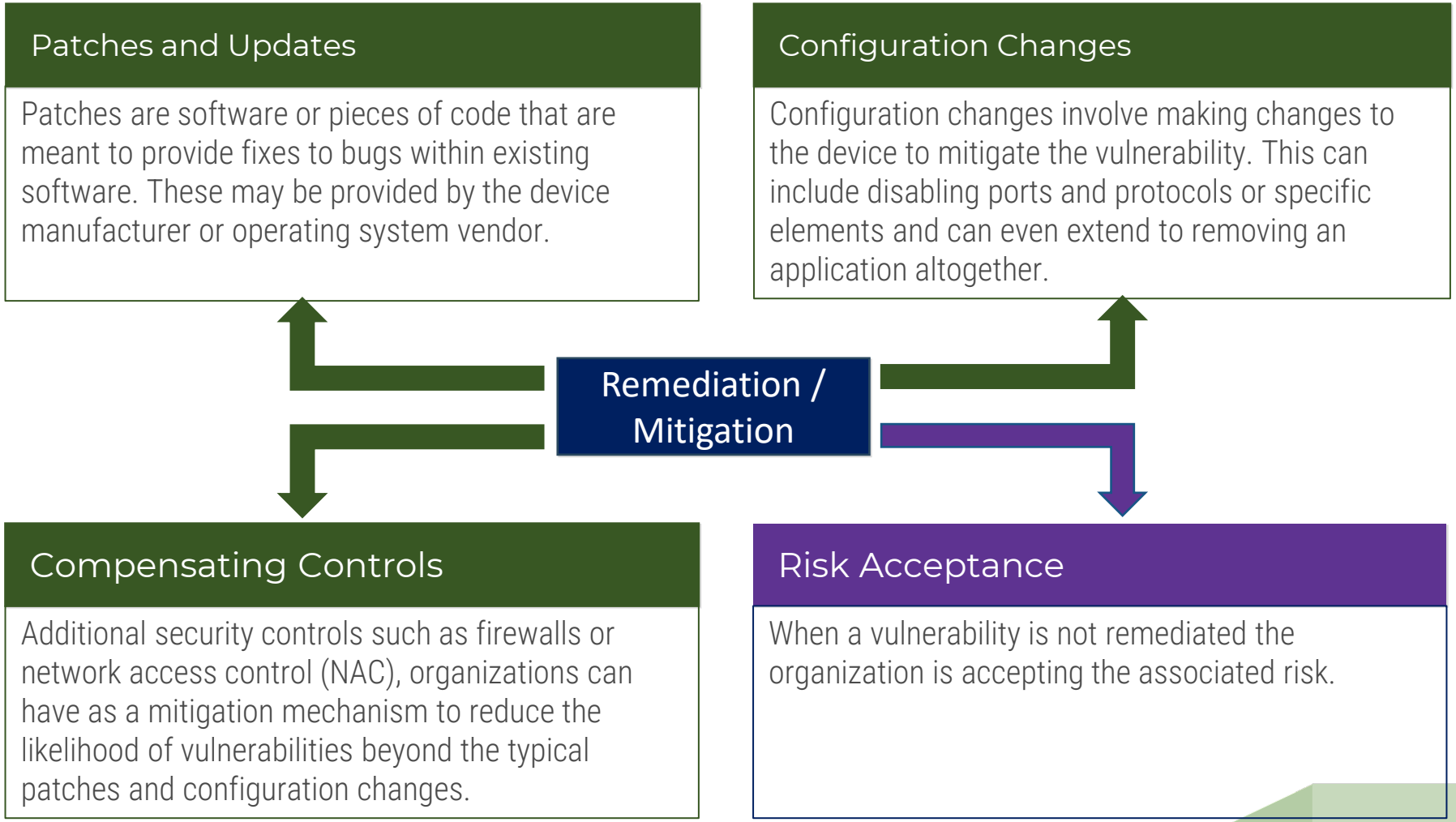
Phase 3


Phase 1
What is vulnerability management?
Define scope and roles
Vulnerability detection
Shape procedures
Phase 2
Triage vulnerabilities
Determine business criticality
Consider current security posture
Risk assessment of vulnerabilities
Phase 3
Assessing remediation options
Scheduling and completing remediation
Phase 4
Metrics, KPIs & CSFs
Refine Procedures
Vulnerability management policy
SLA's

Assessing Remediation Options

- Build out the specific processes for remediating vulnerabilities.
  - Determining what to do when a patch or update is not available.
  - Scheduling and executing the remediation activity.
  - Continuous improvement.
- Each remediation option carries a different level of risk that the organization needs to consider and accept by building out this program.

Identify Remediation/Mitigation Options



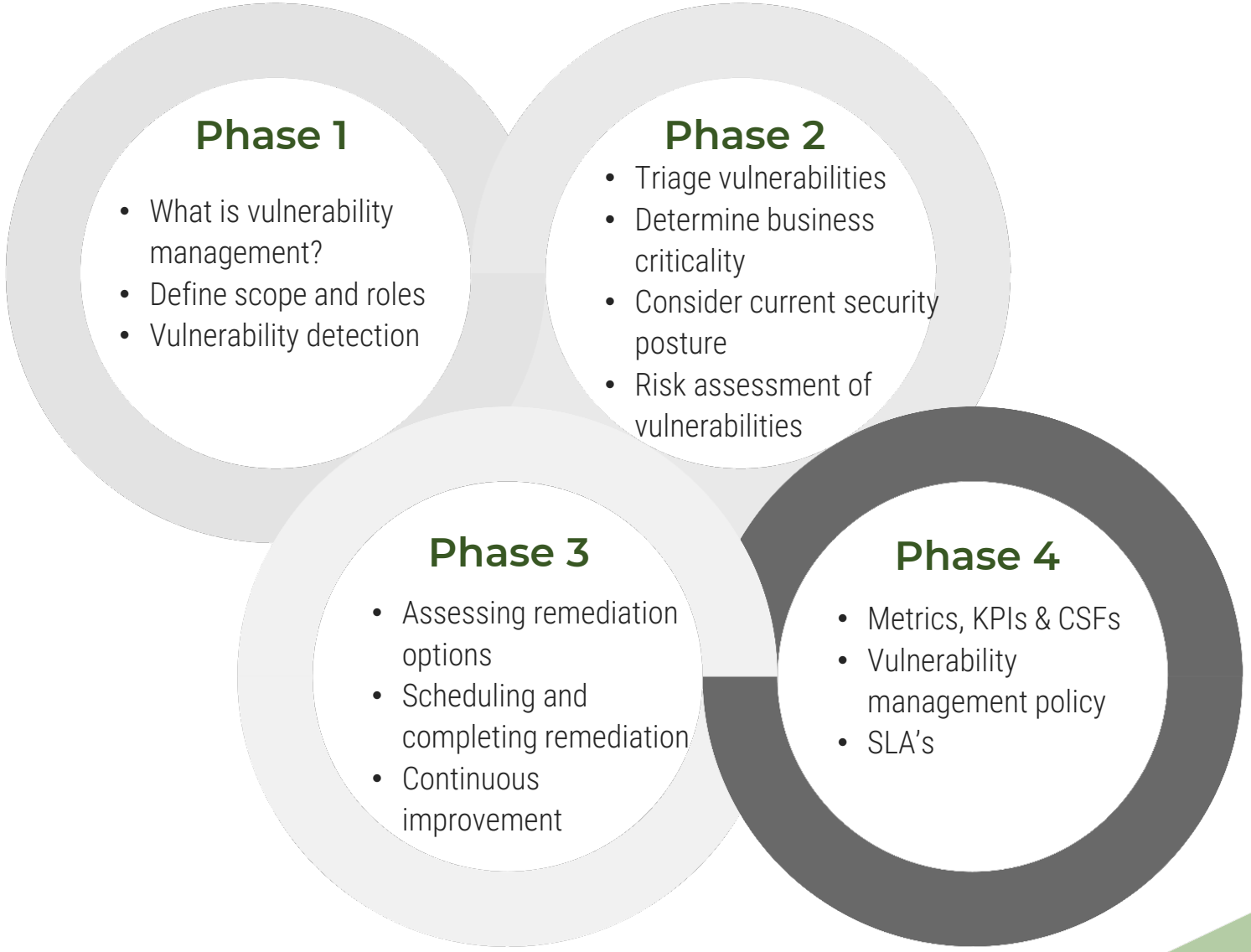
Scheduling and Completing

- High and Critical should be completed in a timely manner
- Understand clinical downtime communication and procedures
- Work with clinical staff on scheduling and completing
- Medium to low-risk vulnerabilities can be remediated during PM’s/CM’s

Implementing the Remediation

- Have a rollback plan
- Change control may be necessary
- Understand and document the dependencies
- Is remediation manual or automatic? Evaluate your options for cadence

Phase 4: Post-implementation Activities



Metrics, KPI's and CSFs

- Capture within CMMS/CMDB by creating work orders or tickets

Business Goal	Critical Success Factor	Key Performance Indicator	Metric to track
Minimize overall risk exposure	Reduce overall risk due to vulnerabilities	Reduction in the number of vulnerabilities	The number of vulnerabilities year after year.
Proper allocation of resources	Proper prioritization of mitigation activities	Reduction of critical and high vulnerabilities	The number of critical and high vulnerabilities.
Consistent & measurable remediation of threats to the organization	Reduce risk when vulnerabilities are detected	Remediate vulnerabilities efficiently within SLA's	The average time between the identification to remediation.

Tracking Relevant Information

- Not every asset needs a work order for every vulnerability
- KB's and other documentation should be tracked
- Tracking should take place in all tools (CMMS, active & passive scanning systems)

Key Takeaways

- Invest in IoMT Solution
  - Have a strategy, business case, and integration priority
- Staff to be successful
- Document, track, and record
- Know your devices, environment, and expected outcomes
- Drive policies and procedures along the way and keep refining

Thank You

Please complete the online evaluation/attendance form at
https://www.surveymonkey.com/r/ACCE_05-05-22