

Competency Development of Biomedical Engineers for Innovative Technology Lifecycle Management Towards High Quality of Patient Care

Parallel workshop 02

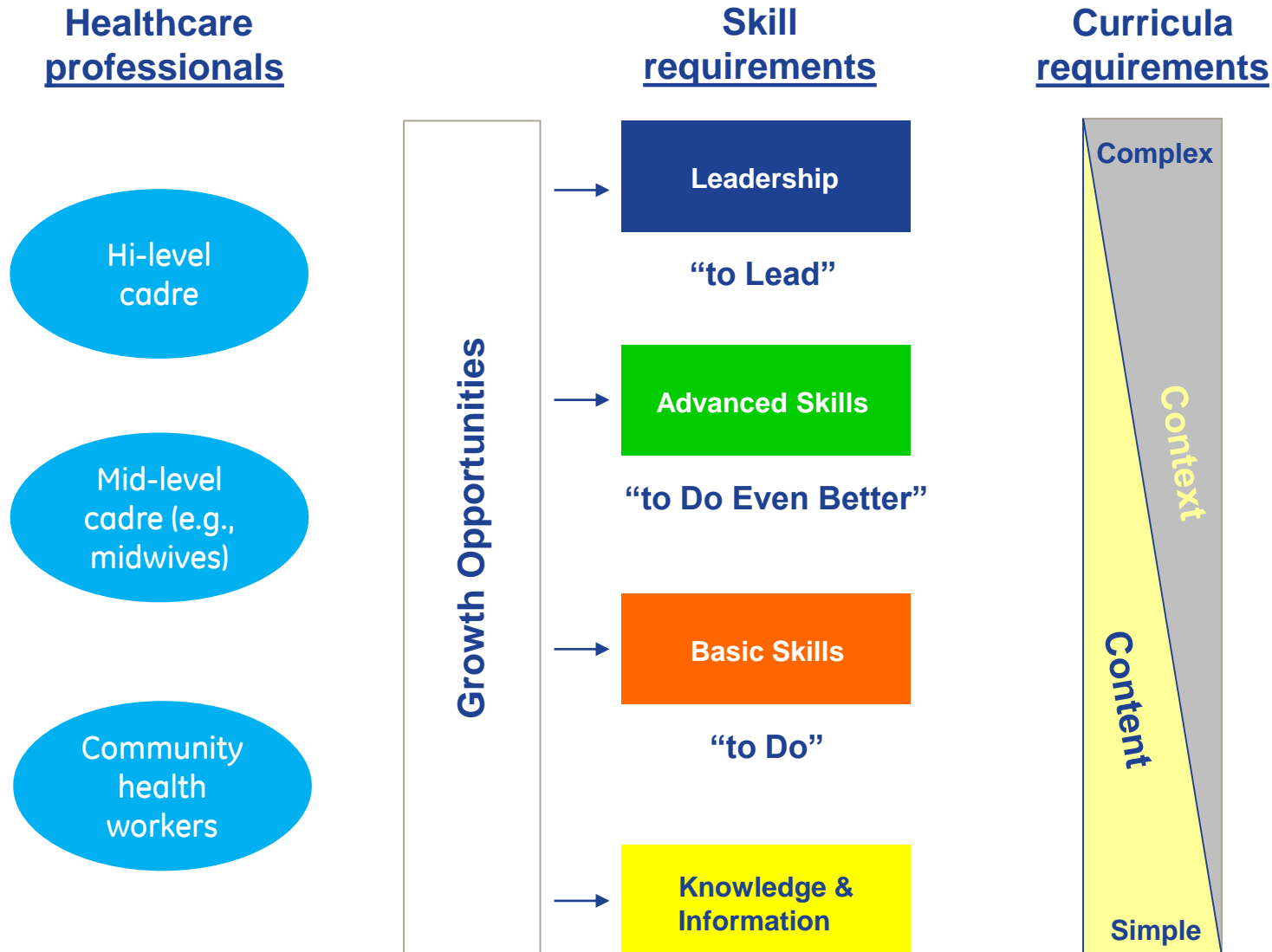
12:00 – 2:00 pm, Oct 25th , 2017

Iyad Mobarek Malkawi, GM GE Healthcare education Solutions

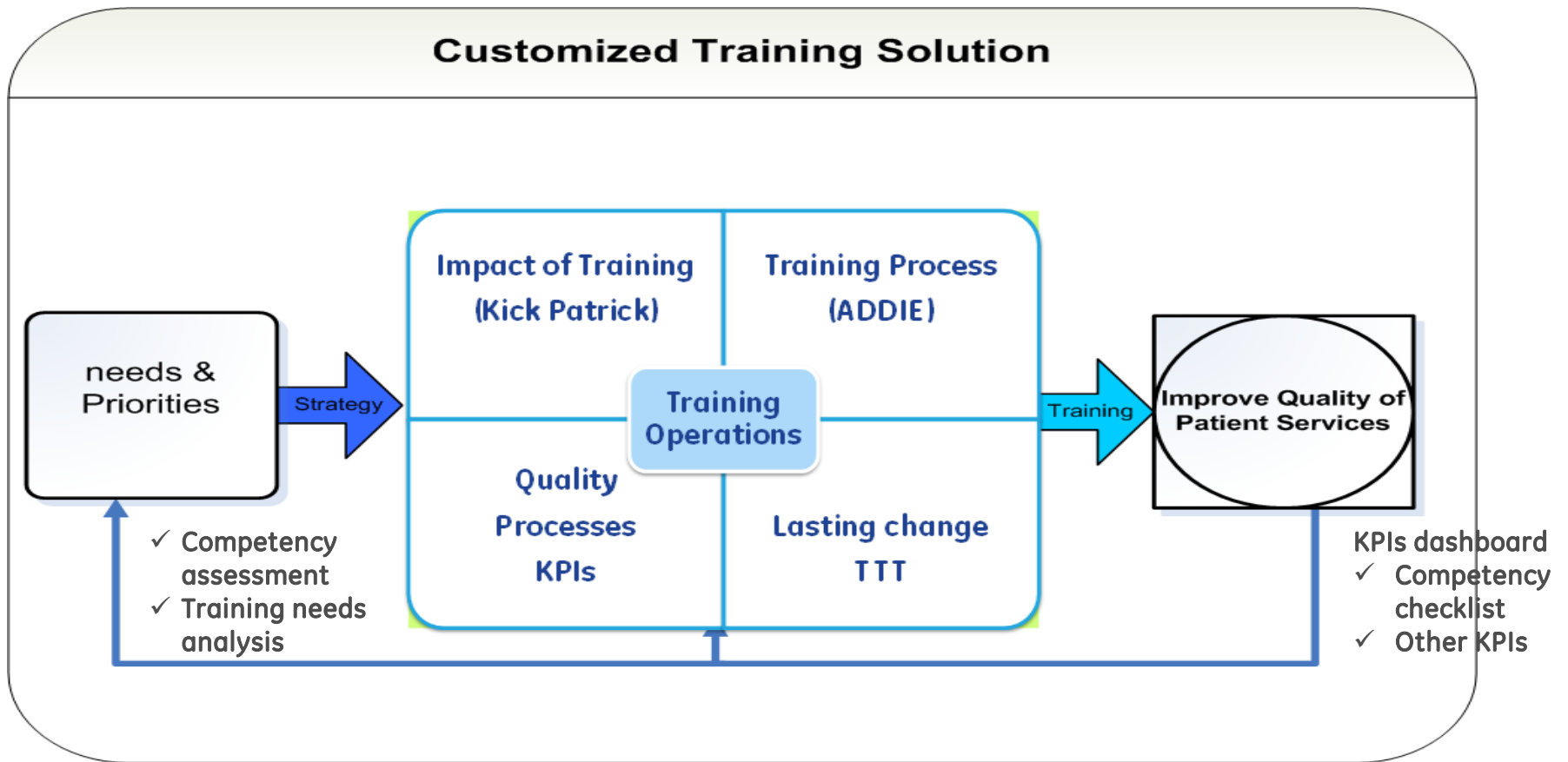


Introduction and background

Healthcare learning & development



Outcome based competency development



✓ classroom

✓ coaching

✓ mentoring

✓ Learning by doing

✓ Online

✓ On the job training

Quality in Healthcare

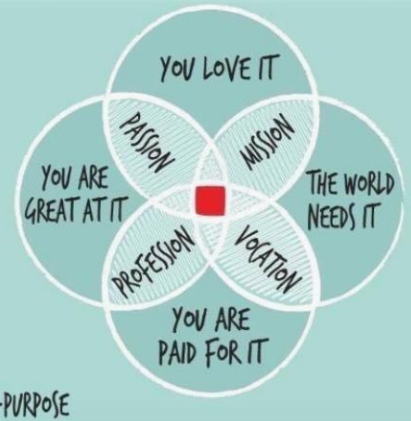
What contributes to poor quality in healthcare?

Sample list

1. Medical errors
2. Underutilization or overuse of services
3. Communication problems
4. Lack of evidence based decision making

How to improve quality?

1. **Education and training**
2. Policies, inspection, punishment, reward
3. Comprehensive approach to Quality Assurance



Improve quality of patient care

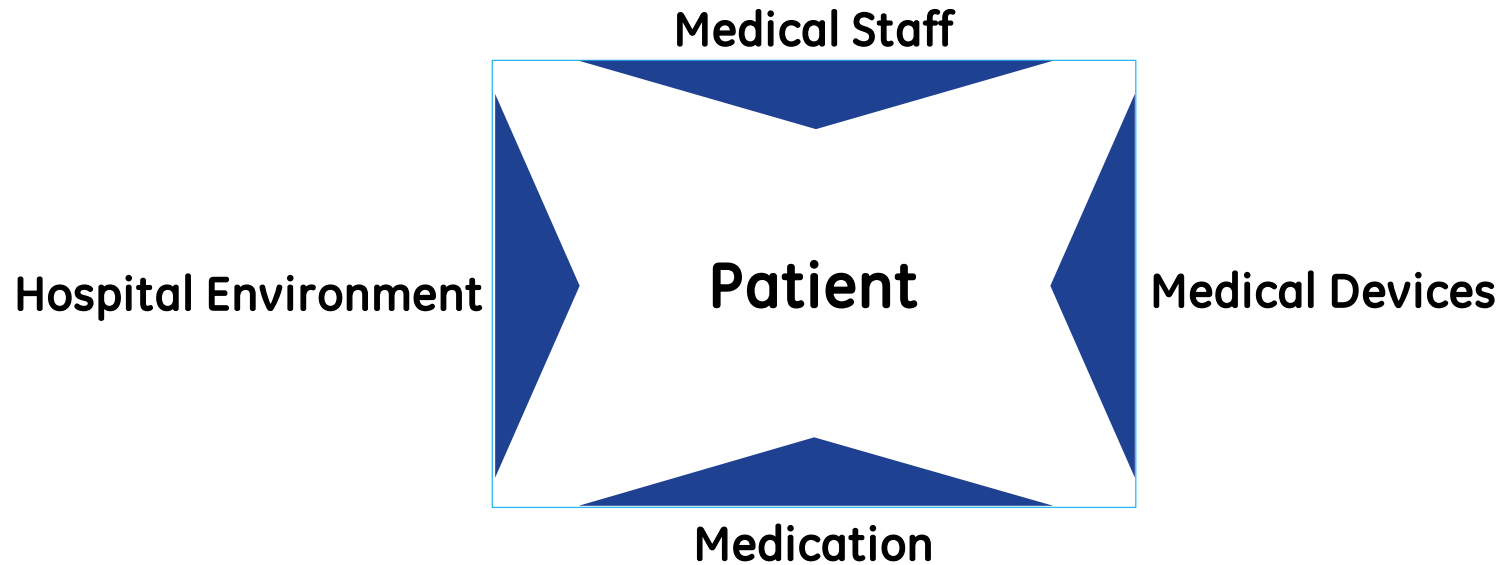
Scope of work to be targeted by training plan

Main Duties of Clinical Engineering Department

- Inventory control and equipment history
- Scheduled Preventive Maintenance and Corrective maintenance
- Pre-purchase Evaluations and Purchasing related issues
- Contract Management (Service), negotiations and administration
- Equipment Installations and acceptance check
- **User Error Tracking and user training**
- **Safety of health technology for patients and users**
- **Recalls and Alerts**
- **Hospital planning – Medical equipment planning**
- **Incidents investigation and reporting**
- **HTA, ... etc**



Development must address all health technology related interactions with patients

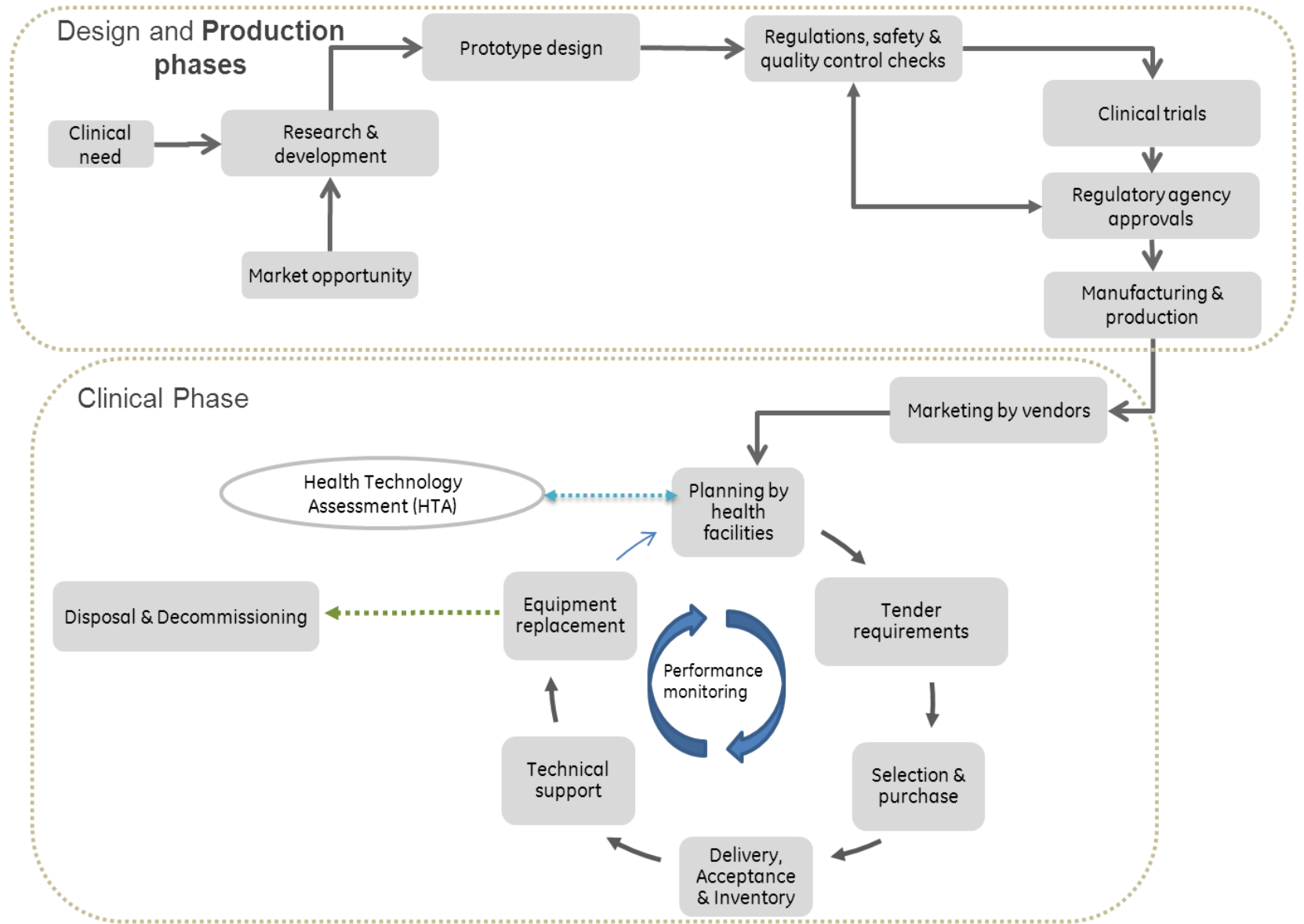


Skillful biomedical engineers

- ▶ Device failure
- ▶ Device interaction
- ▶ User error
- ▶ Maintenance error
- ▶ Packaging error



Medical Equipment Lifecycle *



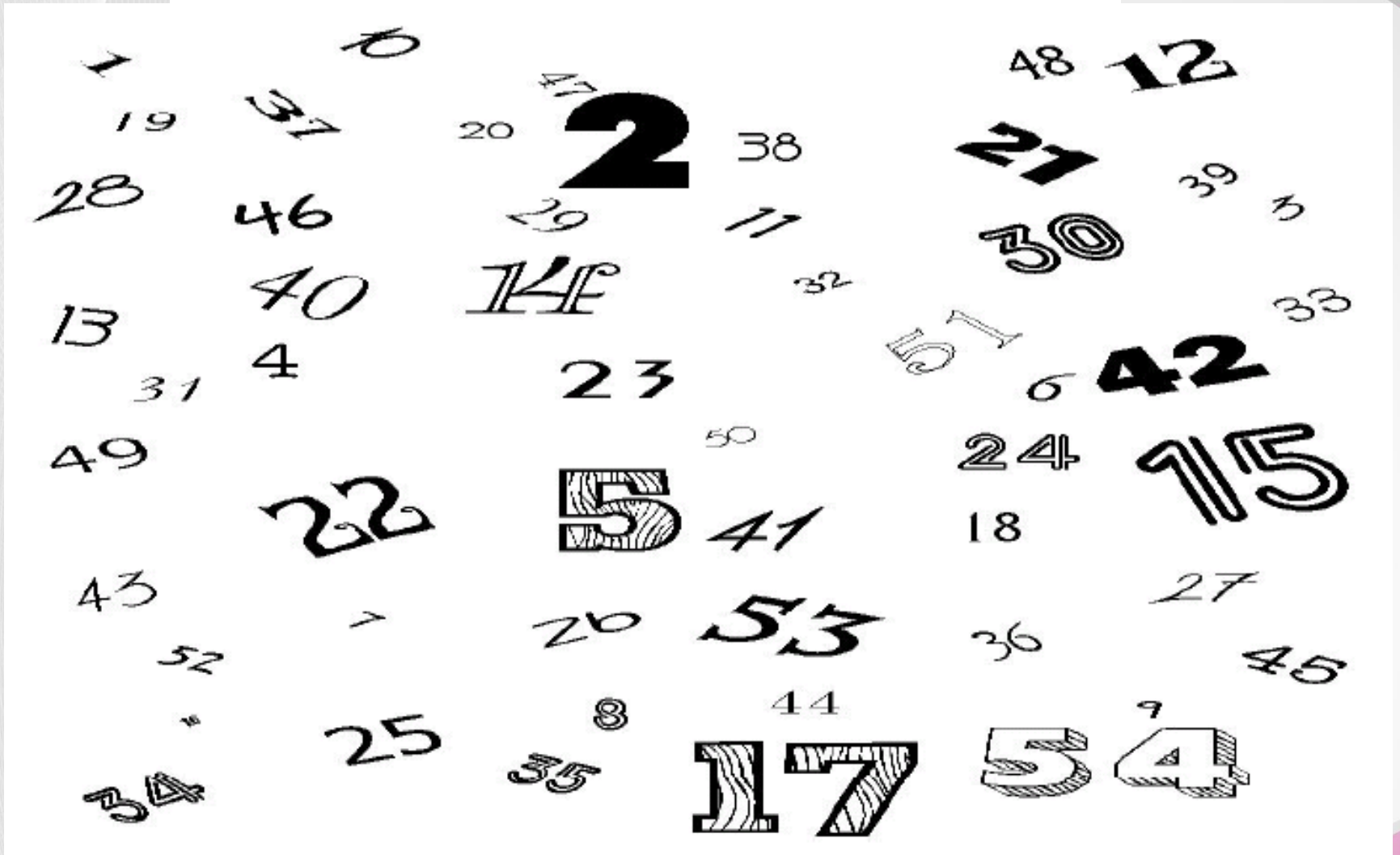
OEM Scope

Biomedical COE Scope

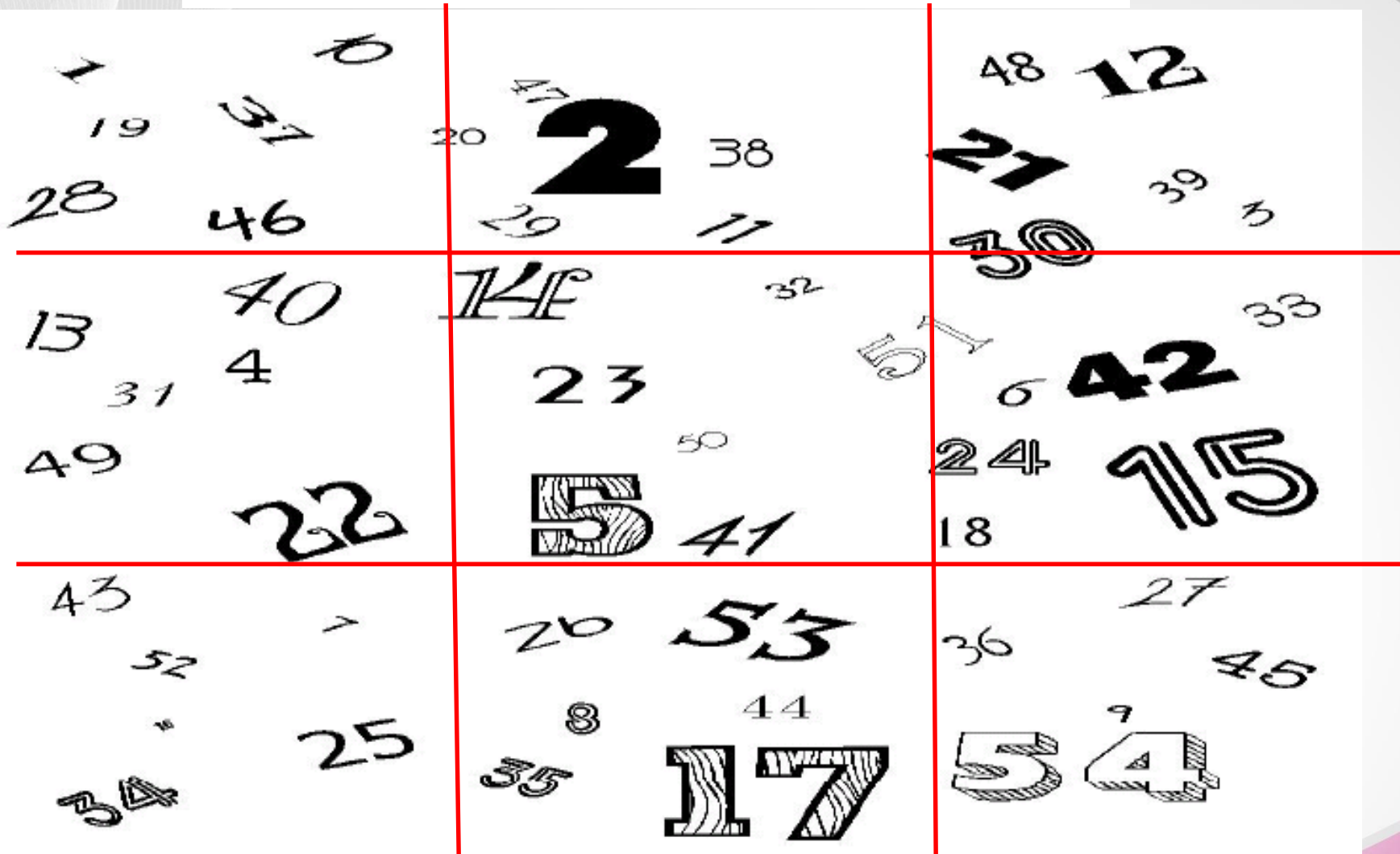


Energizer

Game



The Value of Pattern



Competency development and biomed training curricula

Competency based Development

competency model



Sample

Leadership

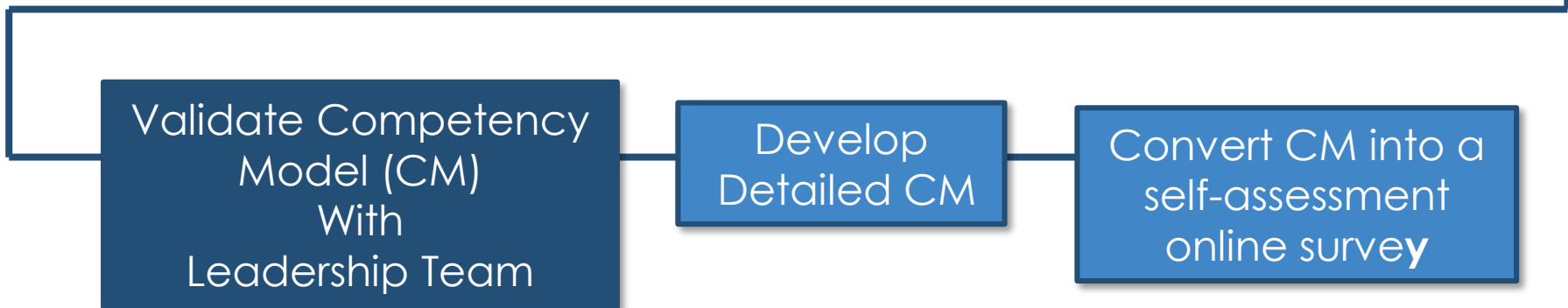
- Facilitate effective meeting
- Networking skills
- Influencing skills
- Strategic planning

Technical

- Technology specific
 - PPM, CM and calibration
- Technology related
 - IT skills, database, test equipment

Clinical skills

- basic medical physics related to technology; MRI, CT, patient monitoring, ventilators, ...
- clinical terminologies
- Basic clinical procedures



Biomedical Engineering Training Curriculum

Vision

Provide training to support knowledge and skills of biomedical engineers ultimately enhancing quality of patient care

Clinical



Purpose

Bridge the knowledge gap with clinical gap

Sample courses

- Clinical applications on imaging, monitoring, Laboratory ...etc.
- Hands on experience in clinical departments

Technical



Purpose

Improve technical & e health knowledge & skills

Sample courses

- Basic & advanced technology specific; CT, MRI, x-ray, US, PET CT, patient monitoring, life support courses, HCIT, Big data, HL7..etc.
- Certified training; AAMI, HTM, AACI,...

Leadership



Purpose

Improve leadership, & management skills

Sample courses

- Change Acceleration Process (CAP)
- Lean / Six Sigma
- Communications skills
- presentation & influencing skills

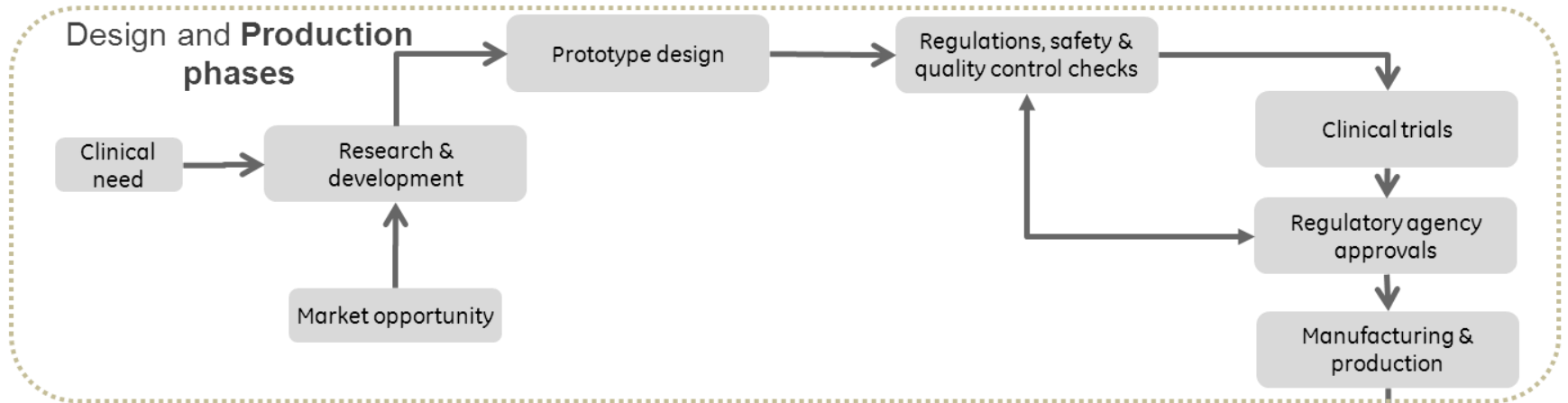
Biomedical Engineering Training Curriculum

Sample course

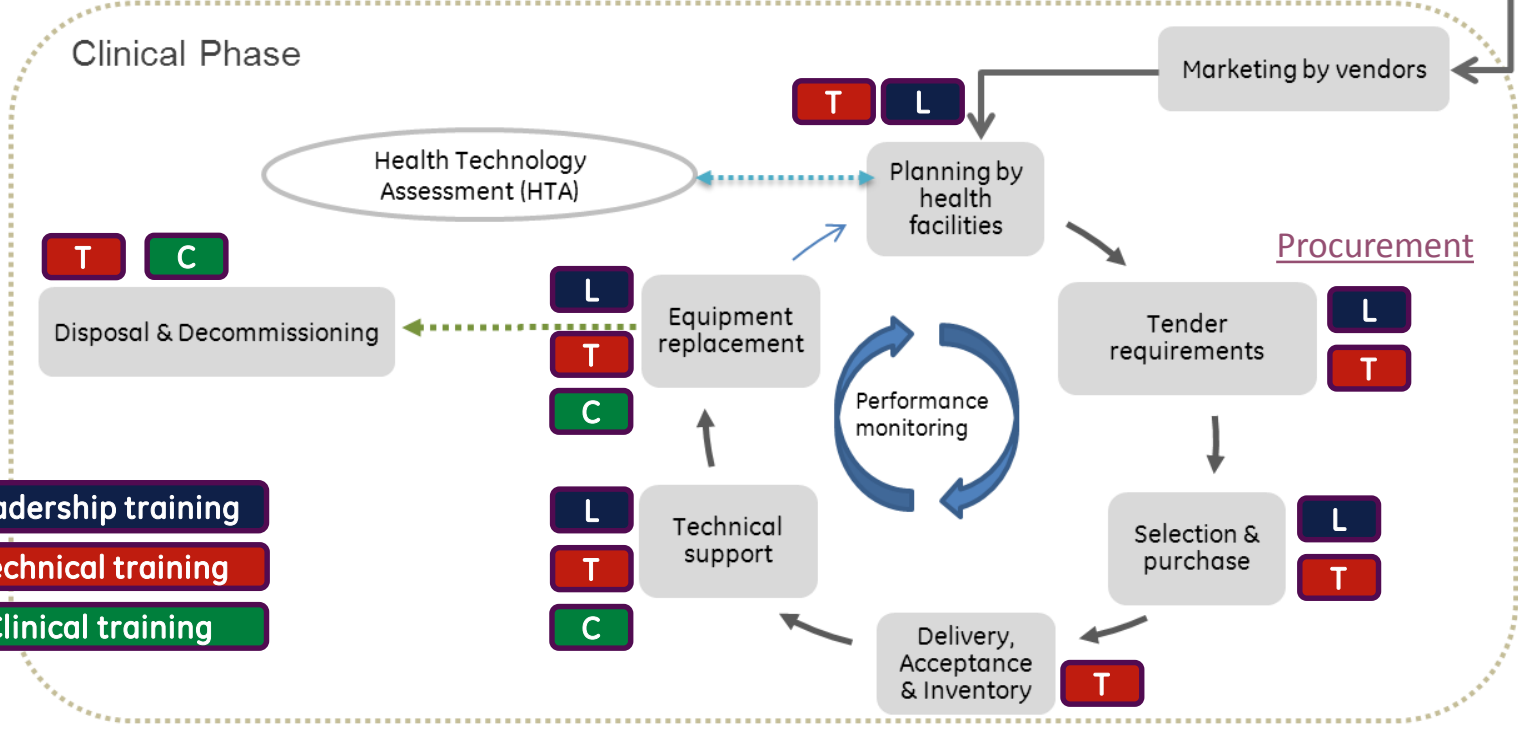
	Biomedical Engineer/ Biomedical technician	Supervisor	Head of Department	Executive Director of Biomed
Leadership Essentials			Time and conflict management	
			Presentation skills	
			Stress Management	
			Communication Skills	
			Lean 6 Sigma	
Leadership			Building High Performance teams	
			Presentation Developing leadership skills	
			Influencing skills	
			Change Acceleration Process	
Technical			CT , MRI courses for biomed	
	Medical equipment specific courses - HCI Waukesha			
			Automated HTM	
			Effective medical equipment lifecycle management	
Related Disciplines			Project management	
			Health Technology Assessment	
			Hospital planning	
			Project management	
			HL7 & DICOM	
			HCIT courses	



Medical Equipment Lifecycle Training



OEM Scope



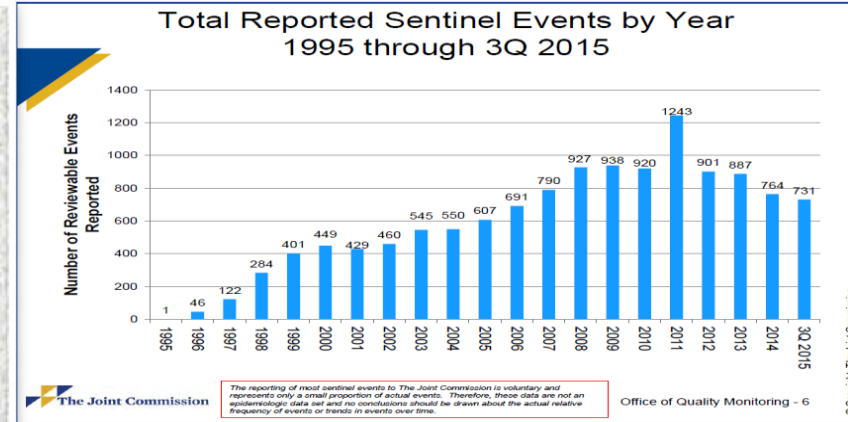
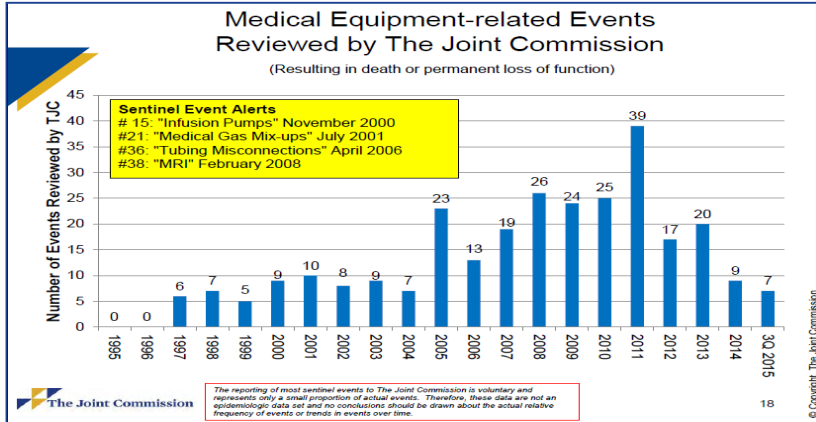
Biomedical Scope



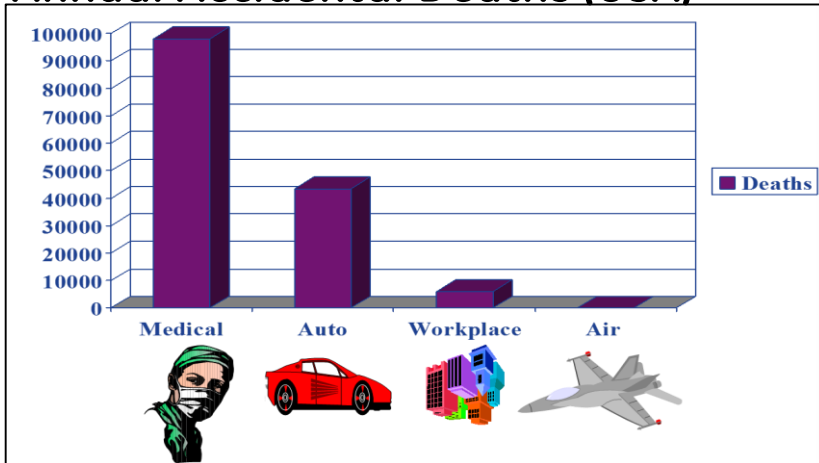
Examples of training impact on patient safety

Preventable Medical Errors

Up to 440,000 Americans are dying annually from preventable medical errors*



Annual Accidental Deaths (USA)



- Healthcare is way behind aviation industry in terms of safety, incidents, errors and regulation
- Operating hospitals similar to airplanes ?
- Turkey MOH benefited from military for their PPP evaluation formula

* <http://www.hospitalsafetyscore.org/newsroom/display/hospitalerrors-thirdleading-causeofdeathinus-improvementstooslow>

Sentinel Event Alert # 25 Ventilator-related deaths

Staffing

- Inadequate training 87%
- Insufficient staff 35%

Communication breakdown

- Among staff 70%
- With patient /family 9 %

Incomplete patient assessment

- Room design limits observation 30%
- Delayed /no response to alarm 22%
- Monitor change not recognized 13%

Equipment

- Alarm off or set incorrectly 22%
- No alarm for certain disconnects 22%
- Alarm no audible in all areas 22%
- No testing of alarms 13%
- Restraint failure (escape) 13 %

Distraction

- environmental noise 22%

Cultural

- (hierarchy/intimidation) 13 %

[..\ref\Empathy The Human Connection to Patient Care.mp4](#)

Sentinel Event Alert # 50

Medical device alarm safety in hospitals

- **98 reported events 80 resulted in death and 13 in permanent loss of function**

Example: Patient with head injury died because of failing to respond to oxygen loss alarm – brain damage

- **Major contributing factors**
- Absent or inadequate alarm system (30)
- Improper alarm settings (21)
- Alarm signals not audible in all areas (25)
- Alarm signals inappropriately turned off (36)

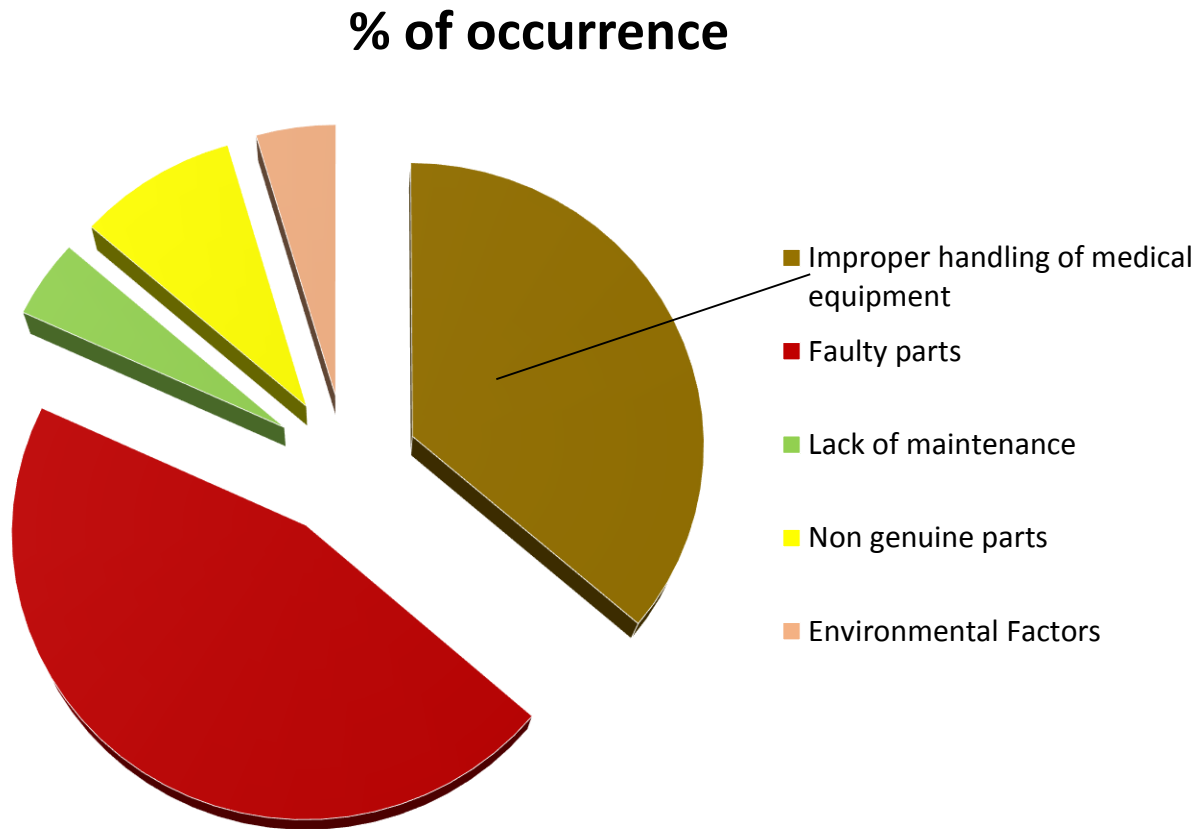
- **Other factors**
- Alarm fatigue –most common
- Alarm settings not customized to individual patient or patient population
- Inadequate staff training
- Inadequate staffing to support or respond to alarm signals
- Alarm conditions and settings that are not integrated with other medical devices
- Equipment malfunctions and failures
-

http://www.jointcommission.org/assets/1/18/SEA_50_alarms_4_5_13_FINAL1

User Training

a Key component for successful Healthcare Technology Management

Studies on aspects that contribute to equipment breakdown



Source: ECRI Institute

Resources

1. American Collage of Clinical Engineering (ACCE) www.accenet.org
2. World Health Organization www.who.int
3. Association for the Advancement of Medical Instrumentation (AAMI) www.AAMI.org
4. Emergency Research Institute documentations and website www.ecri.org
5. Health Information and Management System Society (HIMSS) www.himss.org
6. IEEE Engineering in Medicine and Biology www.ieee.org/embs/index.html
7. Iyad Mobarek, Computerized maintenance management system, WHO Medical device technical series, WHO 2011 www.who.int
8. Iyad Mobarek, et al, Fully Automated Clinical Engineering Technical Management System, Journal of Clinical Engineering: January/March 2006 - Volume 31 - Issue 1 - pp 46-60
9. Iyad Mobarek, et al, Fully Automated Downtime Protocol, Journal of Clinical Engineering: October/December 2010 - Volume 35 - Issue 4 - pp 195-214



Thank You



Appendix 1- sample courses



Effective Health Technology Management

Summary

This 1-day instructor-led course introduces participants to the different phases of medical equipment lifecycle. It also introduces them to the different mechanisms and procedures needed to manage effectively the contribution of medical equipment to contemporary healthcare systems.

Course Objectives

Improve awareness on role of biomed within today's healthcare systems

Enhance technical management skills of biomedical engineers for medical equipment lifecycle

Introduce participants to the main elements and procedures to establish their biomedical center of excellence

Enhance out of the box thinking

Target Audience

Biomedical engineers



Change Acceleration Process (CAP)

Summary

This 3-day course is designed to focus on building change management and influencing skills and applying learning principles to lead projects within the workplace. Working individually and in groups, participants undergo a 3-day, in-classroom training which includes applied work and report-out sessions.



Course Objectives

- Key components of managing change initiatives for successful results
- Understand GE Change Acceleration Process (CAP) Model for managing change and influencing others
- Apply GE CAP tools to prepare for change, shape a change vision, create a shared need for change, mobilize change commitment, sustain change activity and monitor change progress.
- Understand the key leadership behaviors and skills for managing the change process, utilizing the CAP tools and effectively influencing others.

Target Audience

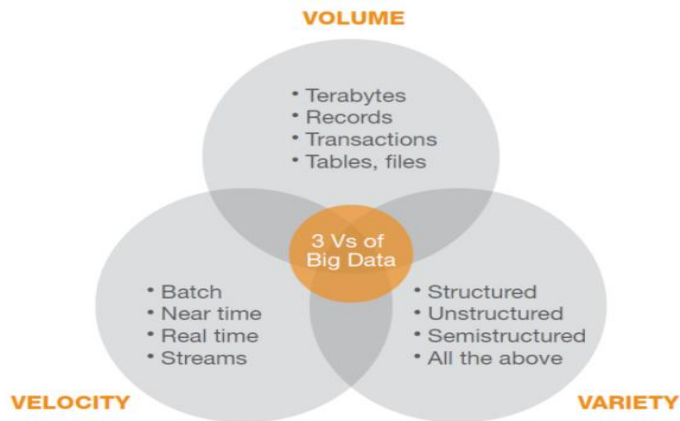
Managers and executives across all departments, as well as employees with present or future responsibility over people, units, departments, functions.



Introduction to Big Data in Healthcare

Background

Big Data can have a great impact on healthcare contemporary systems by improving the accessibility, efficiency and productivity, and providing better healthcare quality at lower cost.

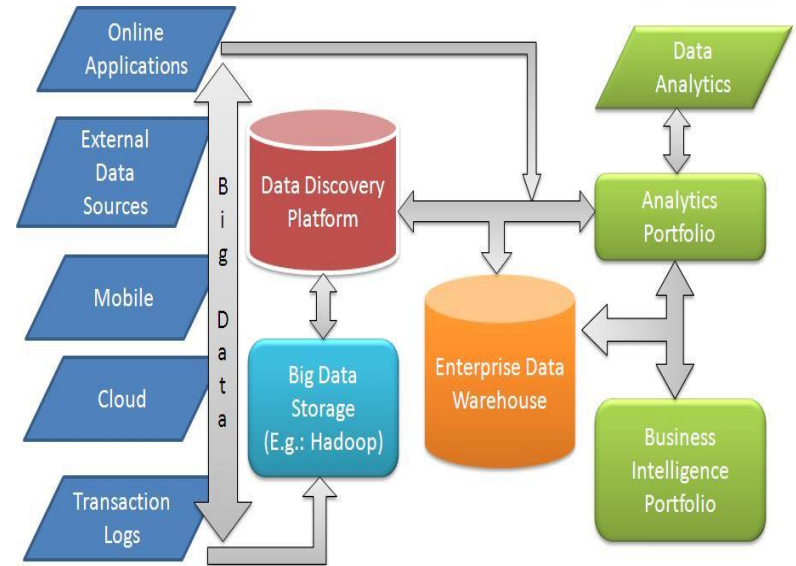


Objectives

- Explore current technologies and their limitation in terms of capacity, velocity and structure.
- Introduce Big Data and its solutions to the limitation of the current technologies
- Explain with high level details the technologies that Big Data is based on
- Give several case studies on how Big Data technologies can help businesses to remove obstacles and problems.
- Focus on the applications of Big Data to healthcare to resolve issues and overcome challenges

Target Audience

Healthcare leaders including senior executives, vice presidents, directors, managers, project managers, management engineers, clinicians in the hospital and the ambulatory setting, vendors, and consultants in both the hospital and ambulatory settings



Duration (Days)	Price (SAR)/ course	Max number of attendees
1		25

Basic Ultrasound for Field Engineers

Summary

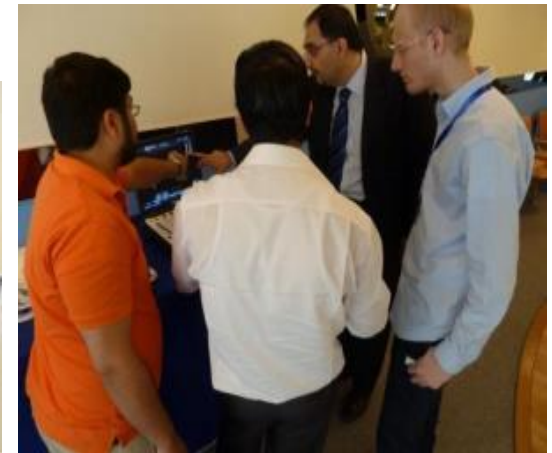
This two-day course provides a solid grounding in human physiology, coupled with a review of Ultrasound physics, the Aspire and Doppler systems, and hands-on demonstrations for heart, carotid, thyroid, liver and kidney imaging.

Objectives

The objective of this course is to bridge the gap between biomedical engineers and physicians providing them with the basic knowledge and clinical procedures involved in US imaging

Target Audience

Biomedical Engineers



[close](#)



Appendix 2– Exercise



Presenting Group- () Details

No.	Participant Name
1	
2	
3	
4	
5	
6	

Exercise

Matrix for Health Technology (Medical equipment) Analysis

- Please answer the following questions by **Yes, No or In progress** whenever appropriate as indicated in the slides
- For questions with rating
 1. Extremely satisfied
 2. Satisfied
 3. Neutral
 4. Not satisfied
 5. Extremely not satisfied
- Please briefly explain your conclusion based on this exercise

HTM-Exercise ...cont

Think of any hospital you practiced in

1	2	3	4	5
No of Biomedical Engineers and Technicians in your department	Training need compared to job requirement	Availability of documented & transparent training plan	relation with Medical staff	Relation with Administration and team work of the biomedical department
() Eng. () Tech.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5

HTM – Exercise

6	7	8	9	10
<p>Is there any documented / accredited HT or medical devices Policy biomedical engineers need to follow in their daily work ?</p>	<p>Is there a National standard (or recommended) listings of medical equipment per health care facility, per disease or per level of care?</p>	<p>Are there national procurement guidelines for medical devices? If yes are they enforced by law ?</p>	<p>Are there National, generic and standard technical specifications for procurement of medical devices? If yes is there a process to update them</p>	<p>Is there a national nomenclature system for medical devices ? If yes please specify</p>