The Role of The RT in Alarm Management

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Objectives

- Identify the Problems and Barriers
- Discuss Alarm Safety vs Alarm Fatigue
- Highlight National Patient Safety Goal for Alarm Management
- Focus on How RT's Can Get Involved

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The “Alarming” Problem

- More and More Devices and Alarms
- More patients connected to alarms or alarm based devices
- Overwhelming number of alarms in patient care areas
- Alarm Based Devices are not Standardized in Most Institutions “ No connectivity”
- Limited Evidence exists to make data driven decisions

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Alarm Fatigue

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Noise Fatigue

- Flight or Fight response
- Sleep disruption
- Increased HR
- Increased RR
- Increased BP
- Fatigue/Exhaustion
- Anger
- Aggression
- Pain

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Ventilators/Respiratory Devices

- Common source of alarms
- More respiratory devices now expanding to acute care areas
- Several different types of machines with different alarm standards
- No standards in nomenclature
- Different ranges and thresholds

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Patient Safety

- In 2002, JCAHO reported deaths or injury related to mechanical ventilation
- Among these, 65% were related to alarms

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Types of Ventilators

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Subacute Ventilators

Trilogy

LTV

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Evaluation Of the Role of Tubing Compensation in PRVC Mode on the Servoi Ventilator in a Simulated Infant Lung Model

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Introduction:

- Tubing compensation is available on most critical care ventilators to account for compressible volume loss in ventilator circuitry during mechanical ventilation
- Use of this feature requires that the ventilator circuit be calibrated and volume loss corrected during a circuit test.
- Compressible volume loss is generally a higher percentage of total delivered volume (VT) during neonatal and pediatric mechanical ventilation in comparison to adults.
- Leaks are also more prevalent in this population resulting in more ventilator nuisance alarms.
- Due to limitations in lower alarm adjustment ability, the tubing compensation occasionally gets turned off in this fragile population.
- In PC ventilation, this results in unreliable display of VT without a proximal flow sensor.
- Recent increase in use of PRVC in the NICU resulted in two instances where the tubing compensation was turned off in PRVC mode due to leaks and nuisance alarms.
- There was a noticeable drop in peak Inspiratory Pressure (PIP) and patient decompensation after the tubing compensation was turned off. (Figure 2 &3)
- We conducted a bench test to test the hypothesis that there was no difference in PIP and tidal volume delivered to the patient in PRVC mode with the tubing compensation turned on compared to with the tubing compensation turned off.

Figure 1: Infant Lung Model

Methods:

- A Servo i ventilator was calibrated according to manufacturer's recommendations using an infant Evaqua circuit and connected to the infant lung on a TTL lung model 560li (Michigan Instruments, Grand Rapids, MI). (Figure 1)
- Compliance and resistance were adjusted to achieve designated set VT.
- A Hans Rudolph pneumotachometer (Hans Rudolph, Shawnee, KS) was calibrated and placed at the wye to measure delivered pressure and volume. (Figure 1)
- Ventilator settings: PRVC mode, RR-30BPM, I-time-0.5seconds, PEEP-5.
- Three tidal volume VT conditions were tested with set a set VT of 15mL, 30mL, and 100mL.
- All V_T conditions were tested with both the tubing compensation turned on and the tubing compensation turned off.
- VT and PIP measurements were recorded from pneumotach and Servoi monitor for twenty consecutive breaths at each testing condition.
- Statistical Analysis was performed in SPSS version 18. Mean and SD were recorded for each testing condition and a paired t test was performed to evaluate pre and post conditions.
- Significance was set at p<.05.

Figure 2: PRVC Graphics with Tubing Compensation On

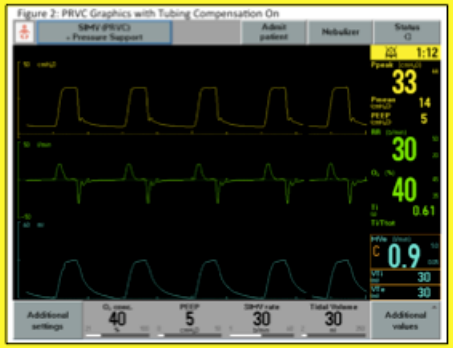


Figure 3: PRVC Graphics with Tubing Compensation Off

Results: Reported in Mean (SD)

Set VT	VT Comp On (mL)	VT Comp Off (mL)	P value
15mL	15(.46)	4.9(.64)	<.01
30mL	27.6(5.2)	14.9(.75)	<.01
100 mL	98.7(1.4)	75.7(1.5)	<.01
	PIP Comp On (CmH_20)	**PIP Comp Off(CmH_20)**	**P Value**
15mL	19.85(.37)	17.6(.39)	0.02
30mL	22.1(.31)	14.05(.39)	<.01
100 mL	28.1(.45)	22(.65)	<.01

Figure: 4

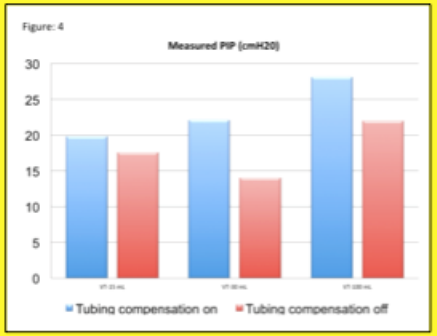
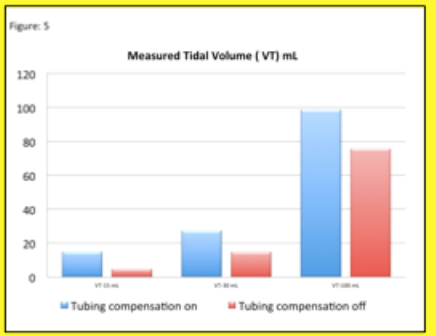


Figure: 5



Discussion:

- On some ventilators,turning off tubing compensation in PRVC mode may significantly impact delivered pressure and volume in infants and pediatric patients with VT less than 100 mL.

Impact of Resistance and Deadspace

Omniflex®

Extended Trach

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Respiratory Monitoring

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National Patient Safety Goal on Alarm Management

- Phase I- Effective January 1, 2014
- Leaders establish alarm safety as a hospital priority

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2014- Identify Most Important Alarms

- Input from medical and clinical staff
  - Risk to patients
  - Safety reports & History
  - Published Best Practices and Guidelines
  - Alarm noise and fatigue

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January 1, 2016- Phase II

- Establish policies and procedures for managing alarms
  - Clinically appropriate settings
- When alarm signals can be disabled
- When alarm signals can be changed

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What's in It for Us?

- Improve patient Safety for Clinical Alarms
- Identify Important Alarms For Us to Manage
- We need Data Driven Change!

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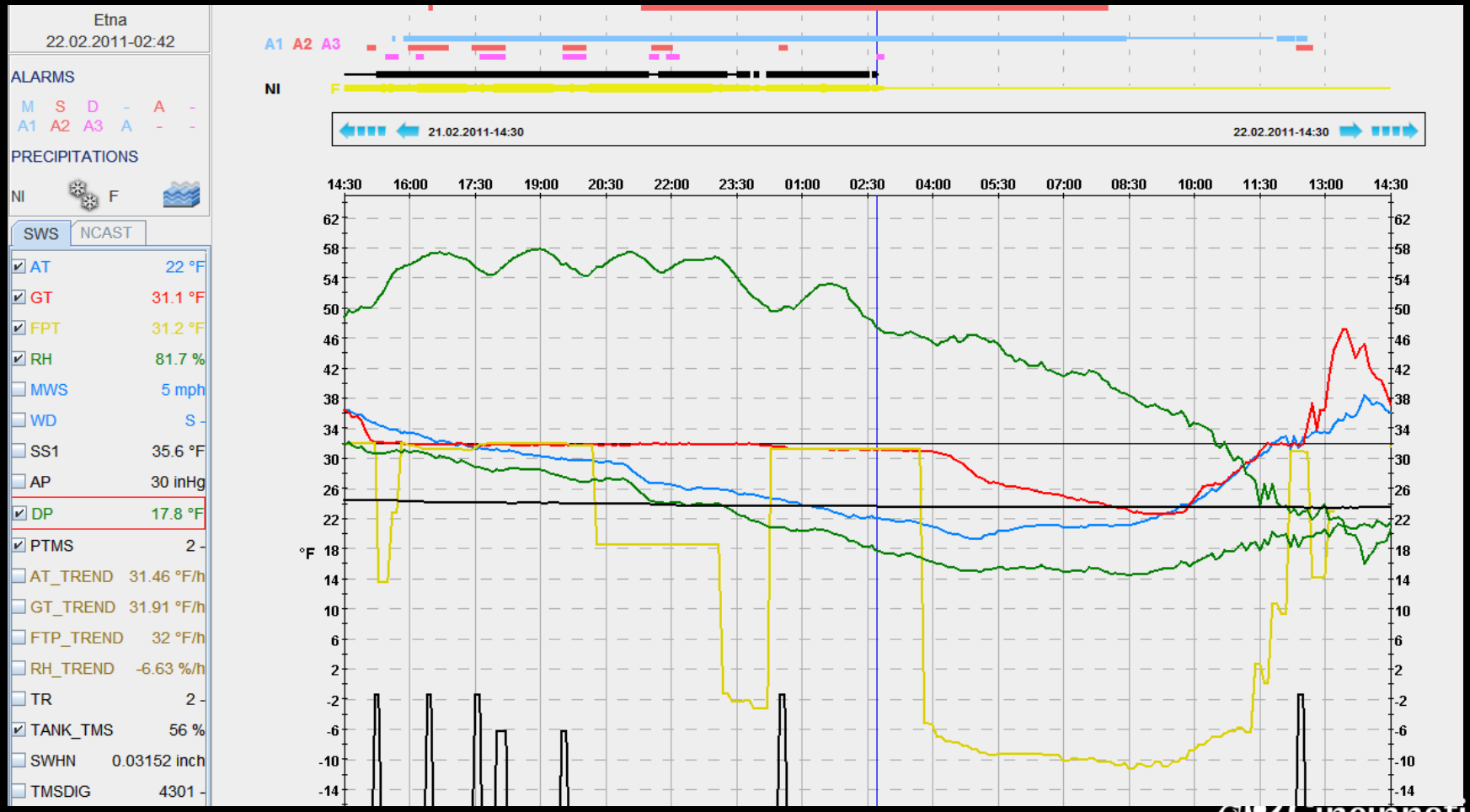
Data Collection



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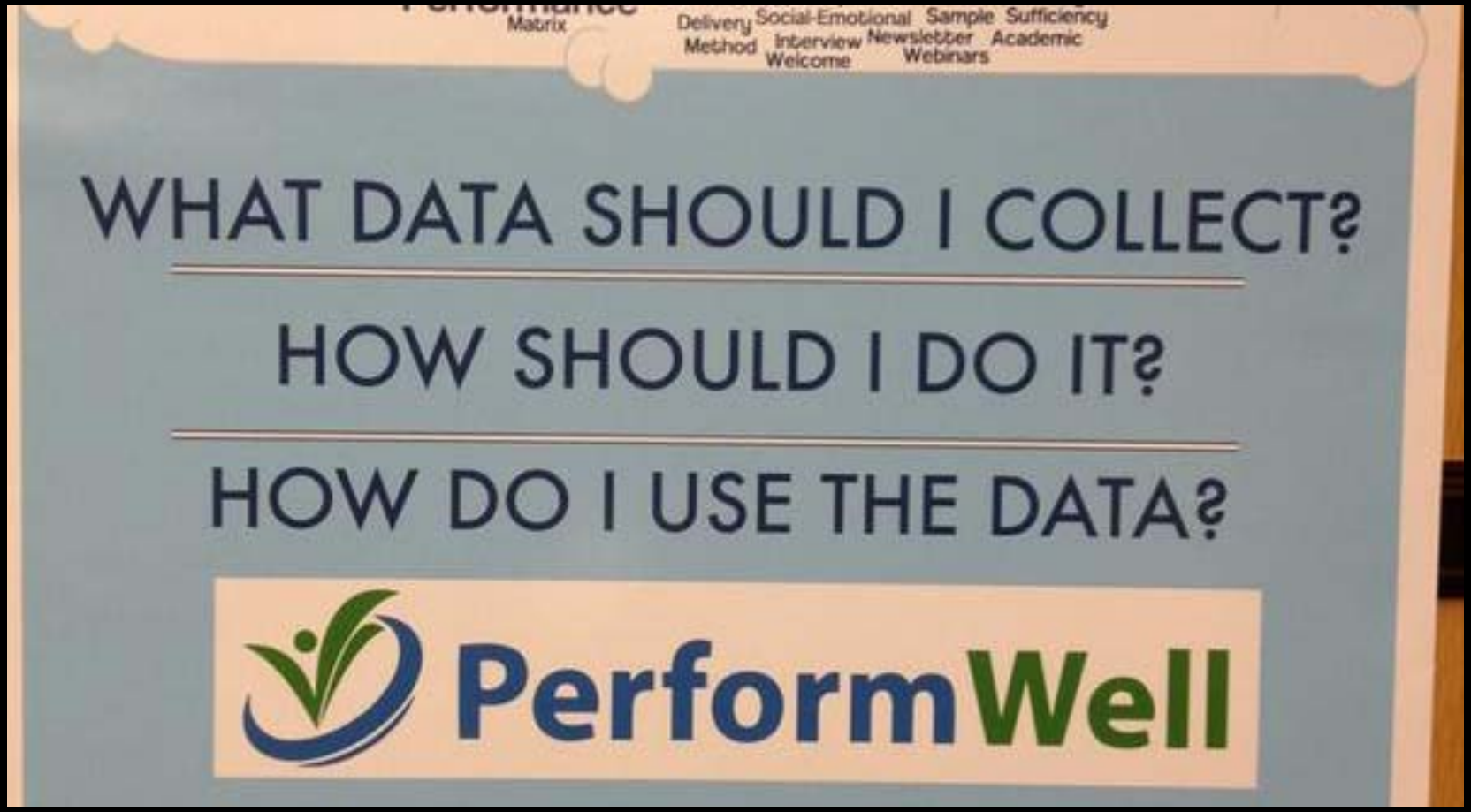
Barriers to Data Collection



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Examples of Data Collection

- Look at Current Process Problems
- Evaluate Change
- Collect Baseline Data Prior To Change
- Look at Raw Data to Determine Alarm Frequency
- Low Priority vs High Priority?
- Actionable vs Non-Actionable?
- When are the Alarms Occuring?

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John Hopkins Data

- Average 173 per unit
- Average Duration was 4.32 seconds
- 91% were less than 10 seconds in Duration
- Actionable?
- Spikes during the Day at Change of Shift
- Evaluating fixed thresholds vs % Change

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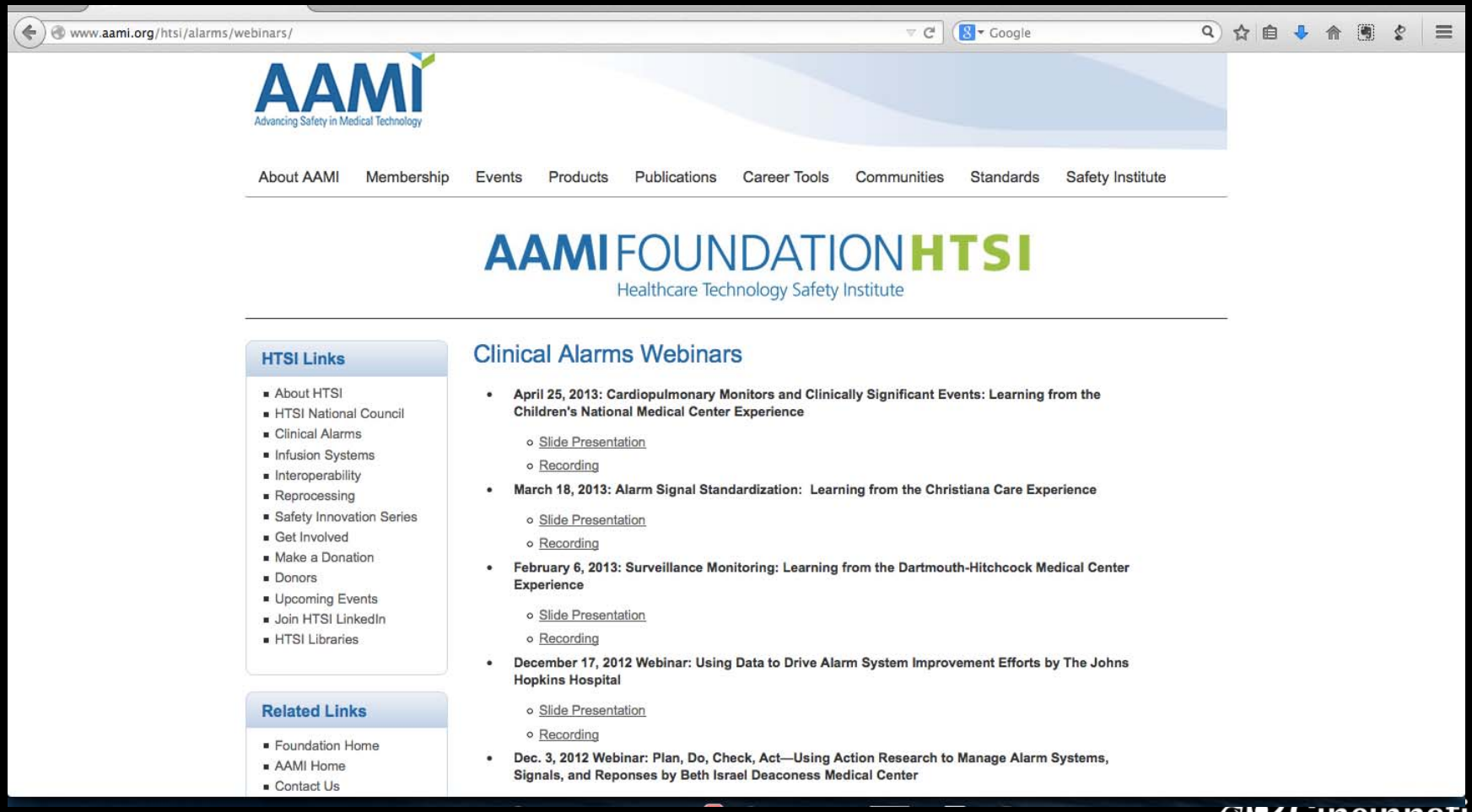
Health Care Technology Safety Institute (HTSI)



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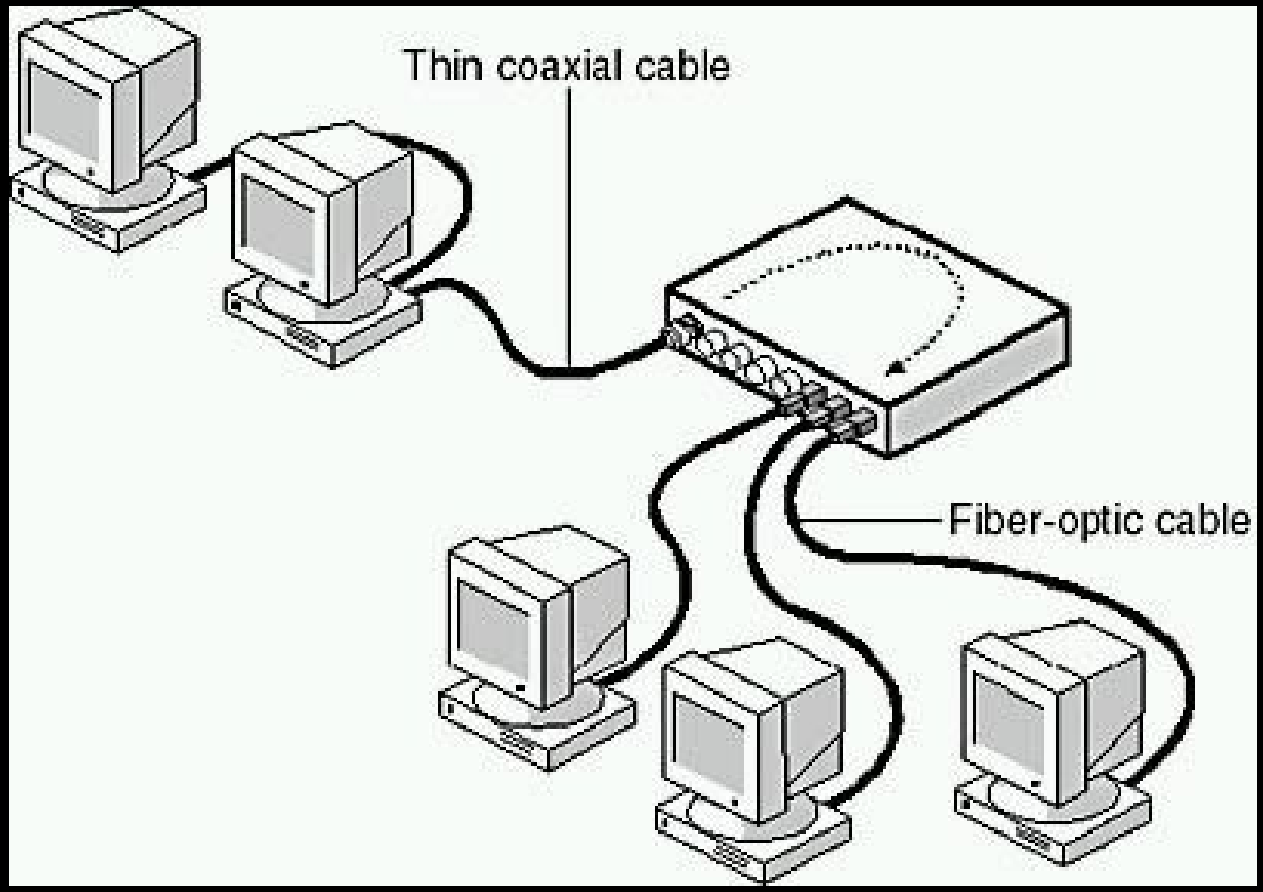
Connectivity



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Nurse Call

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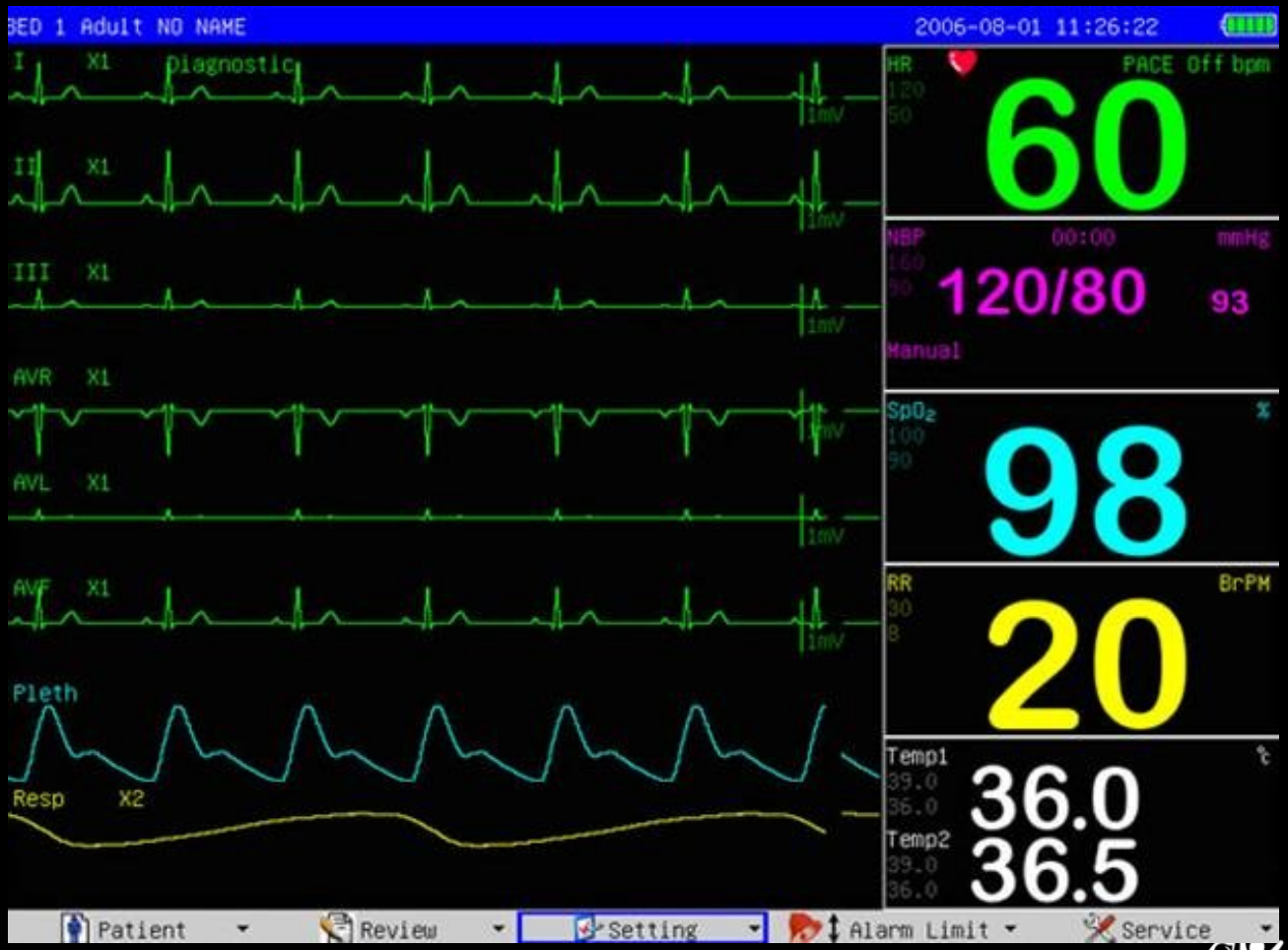
Direct to Monitor



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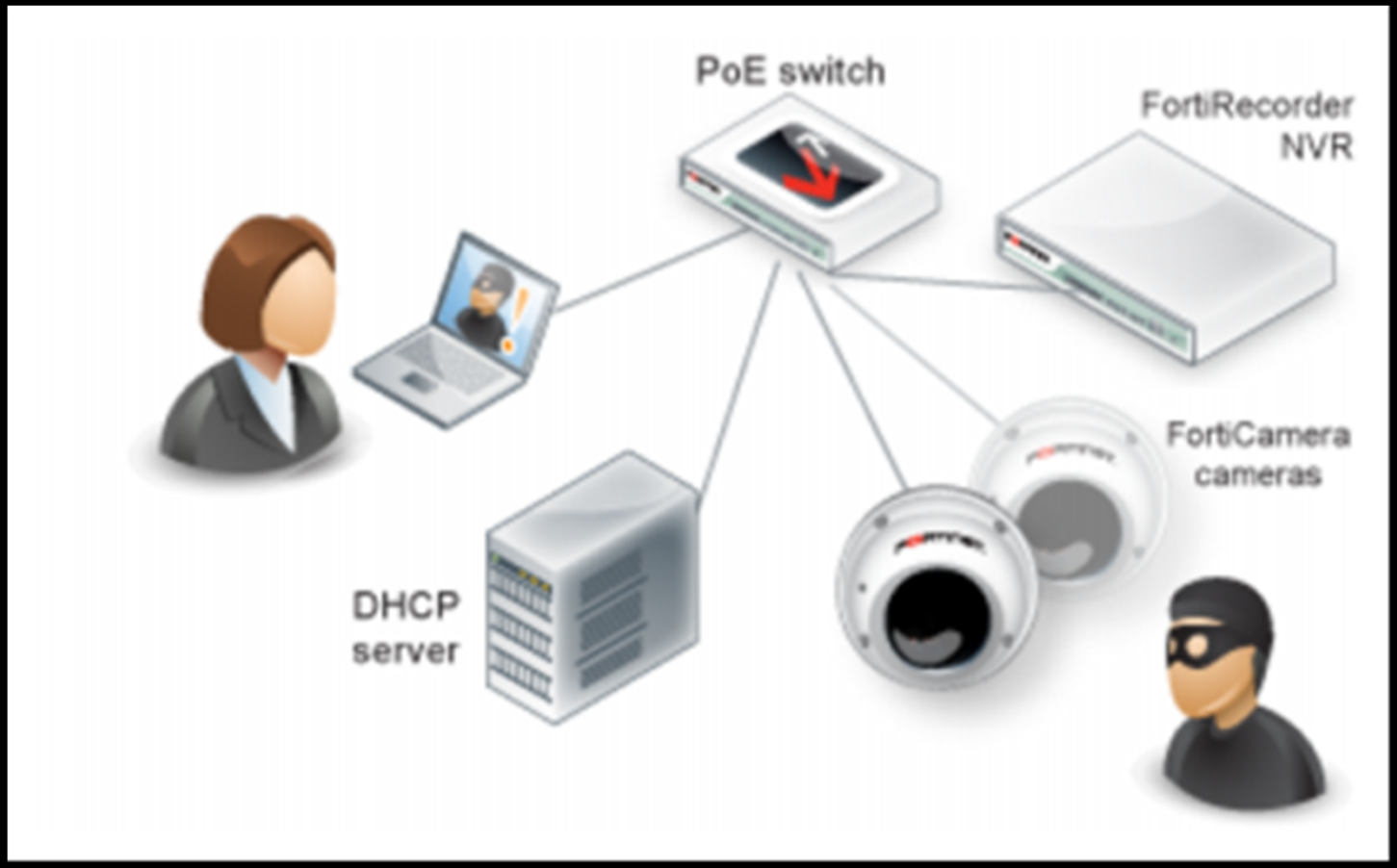
Third Party Solutions



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Future?

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Mobile Devices

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Who Are Key Stakeholders?

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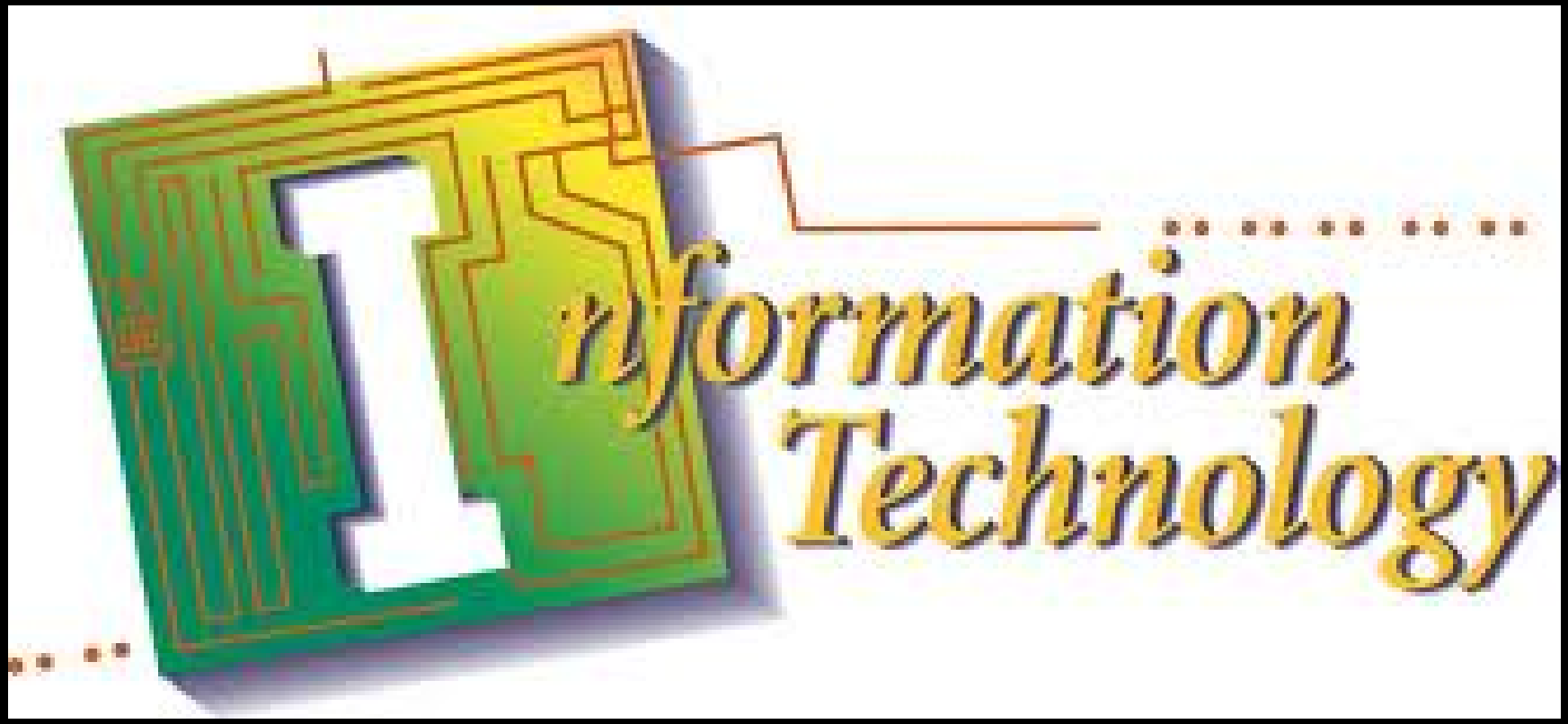
IT



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Clinical Engineering

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Hospital Leadership

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Bedside Staff

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Role of Industry?

- Risk assessment during device development
- International Standards
- Priorities set by Industry Can Sometimes not be changed by Clinicians

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Field of Future Research and Development

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Collaboration Needs

- Nomenclature Standards
- Range Adaptabilities for Various Patient Conditions
- Focus on Needs of Pediatric Patients

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Our Focus

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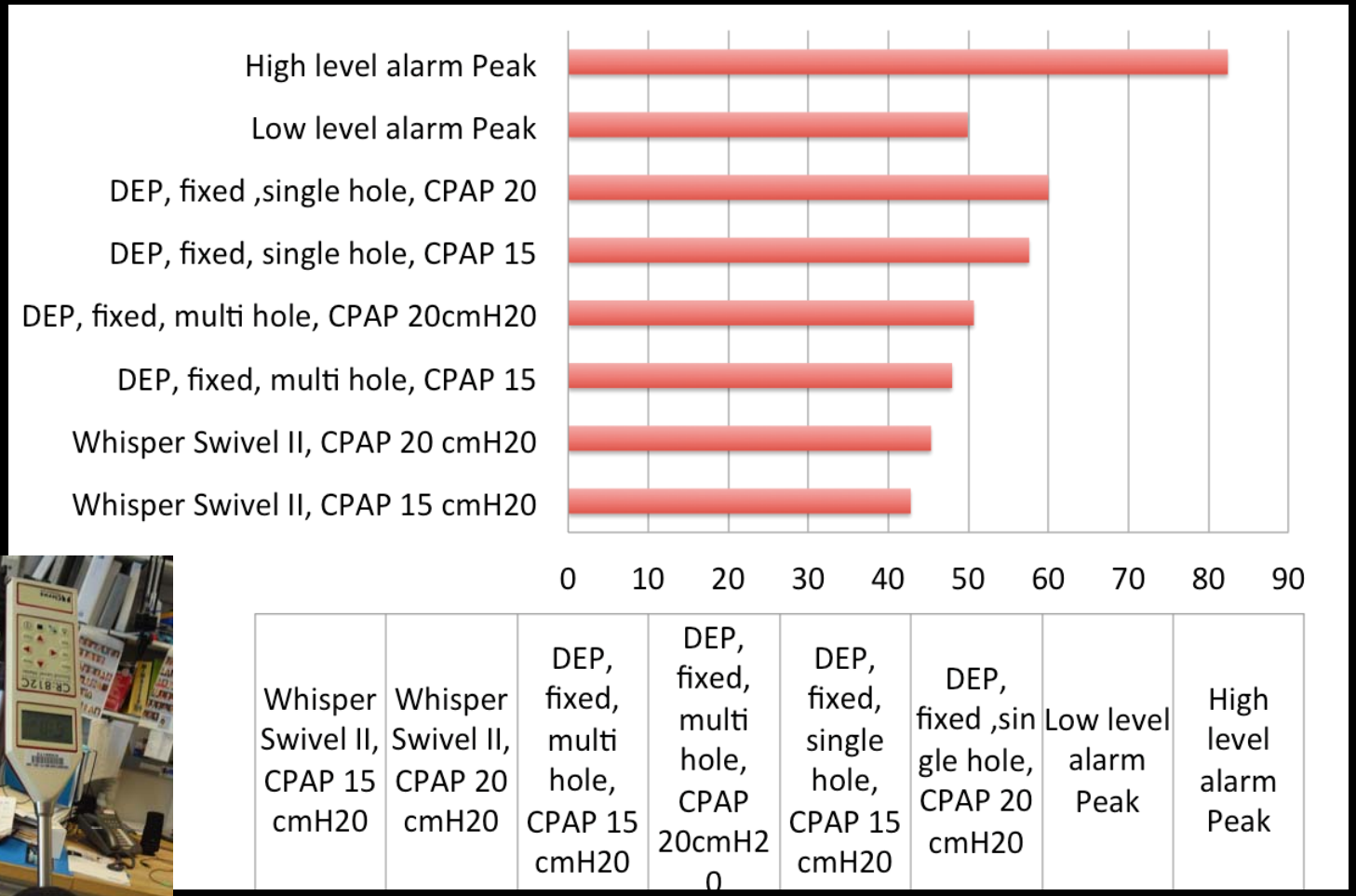
Noise Studies



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Technology Dependent Patients

- Passive vs. Active Circuit
- Triggering
- Volume accuracy
- Alarms

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Role of RT (Inpatient and Clinic)

- Check for Circuit Disconnect Alarm
- Evaluate low minute ventilation setting
- Look at home vent data to recognize alarm fatigue

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Summary

- The National Patient Safety Goal Focusing on Alarms Provides Great Opportunities for RT's
- We need more data driven decisions surrounding alarm management
- More Partnering with Industry is Important for Meeting Patient Needs

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Questions?

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