VITAL SIGN INTEGRATION ON MED/SURG UNITS

Challenges, Successes and Unintended Consequences

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CONFLICT OF INTEREST DISCLOSURE

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have no real or apparent conflicts of interest to disclose.

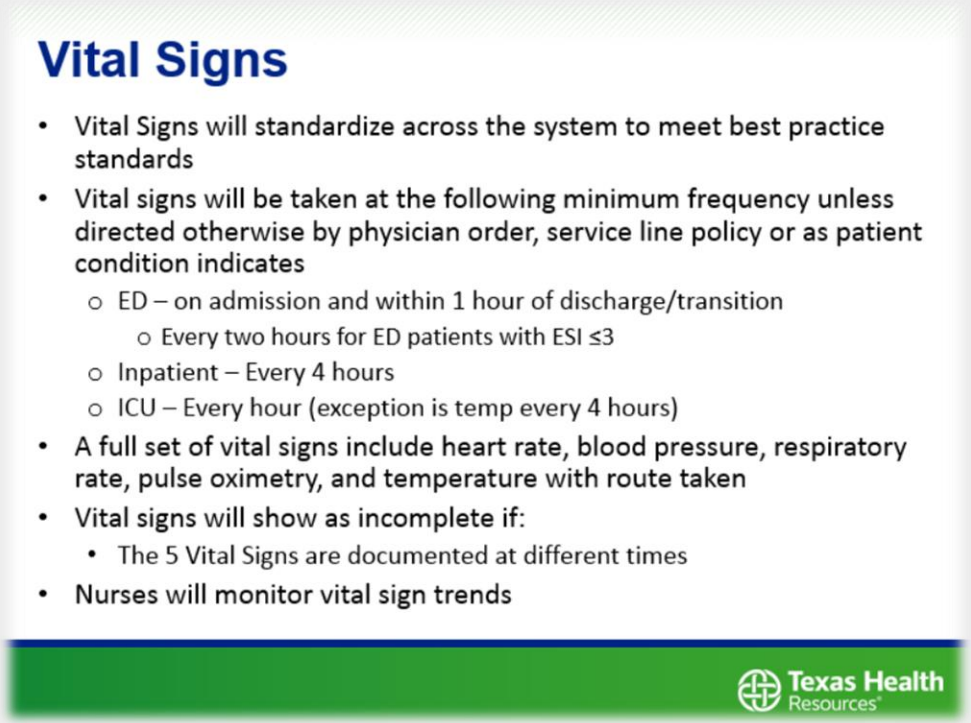
LEARNING OBJECTIVES

- Understand the vendor selection process and guiding operational decisions.
- Learn how THR managed the Vital Signs Integration project and implementation strategies
- Recognize the value added through time savings and data accuracy
- Realize unintended consequence

PROJECT NEED

To provide vital sign integration using mobile noninvasive devices to

- Support the Reliable Care Blue printing practice of obtaining vital signs every 4 hours for low-acuity adult inpatient areas, such as Med Surg and Telemetry.
- Improve nursing efficiency and accuracy (avoid transcription errors)
- Improve near real time documentation of vital signs, to support early detection of sepsis and other conditions leading to patient deterioration.



ALIGNMENT TO SYSTEM STRATEGY

1. Culture

Extend our culture across the care continuum and into the community

- Provides enhanced patient safety, supporting our Mission and vision.
- This continued integration demonstrates
  - our commitment to innovation to improve patient safety
  - advancing quality of care
  - staff engagement and satisfactions.

2. Value and Quality

Innovate and expand our Care delivery to reliably deliver compelling value (quality, cost, and service)

- Reduces cost through decreased documentation errors.
- Increases staff productivity through reduction of device wait times
- Increases compliance to timely and accurate documentation of vital signs and hourly rounding

3. Financial sustainability

Generate the financial capacity to fund our transformation

- Provides higher value and lower clinical documentation
- Provides a platform to expand growth potential with vital sign and other device integration
- Provides standardization of device hardware, software and licenses for the system.

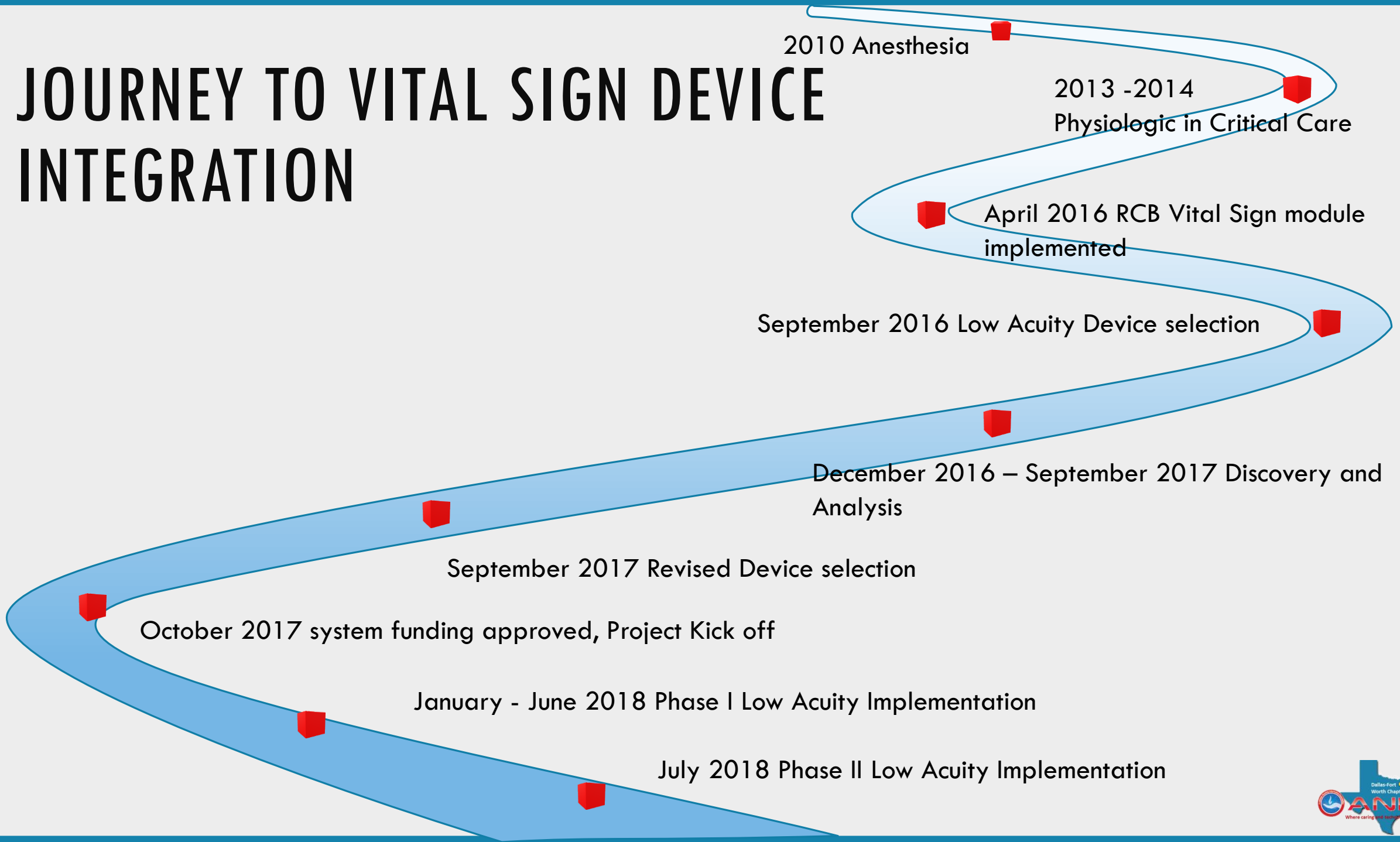
DEFINITIONS- VITAL SIGN INTEGRATION HIGH ACUITY

- Integration in intensive care units, emergency department, PACU and procedural areas where the nurse is responsible for obtaining, monitoring and documenting vital signs.
- Values include hemodynamic parameters which populate to the clinical flow sheet rows every one minute
- Authentication of clinical data occurs in the EMR flow sheet row at a time and interval based on organizational and clinical area policy
- Monitors are hardwired
- Device is attached to patient record via device selection within the EMR

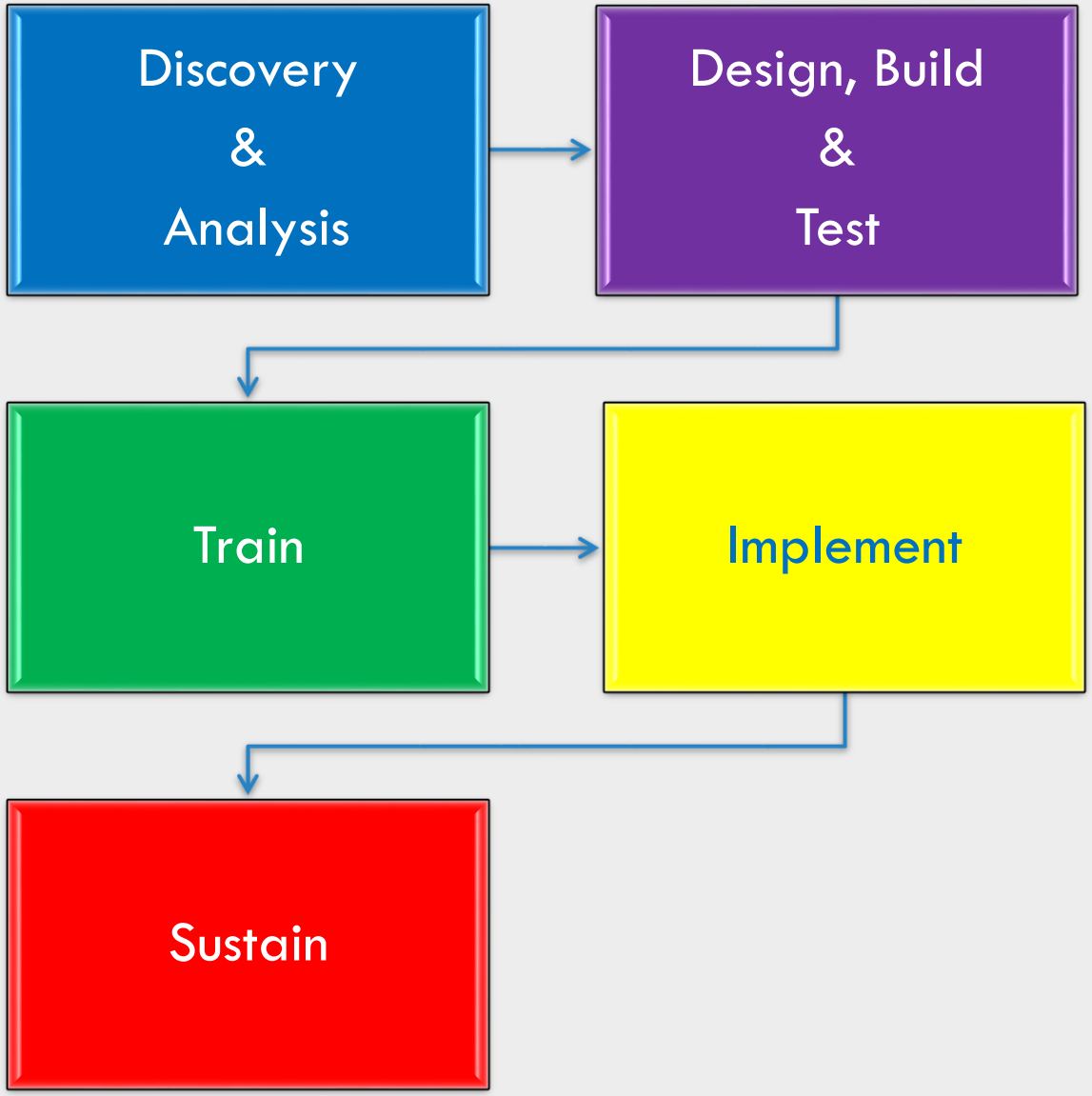
DEFINITIONS- VITAL SIGN INTEGRATION LOW ACUITY

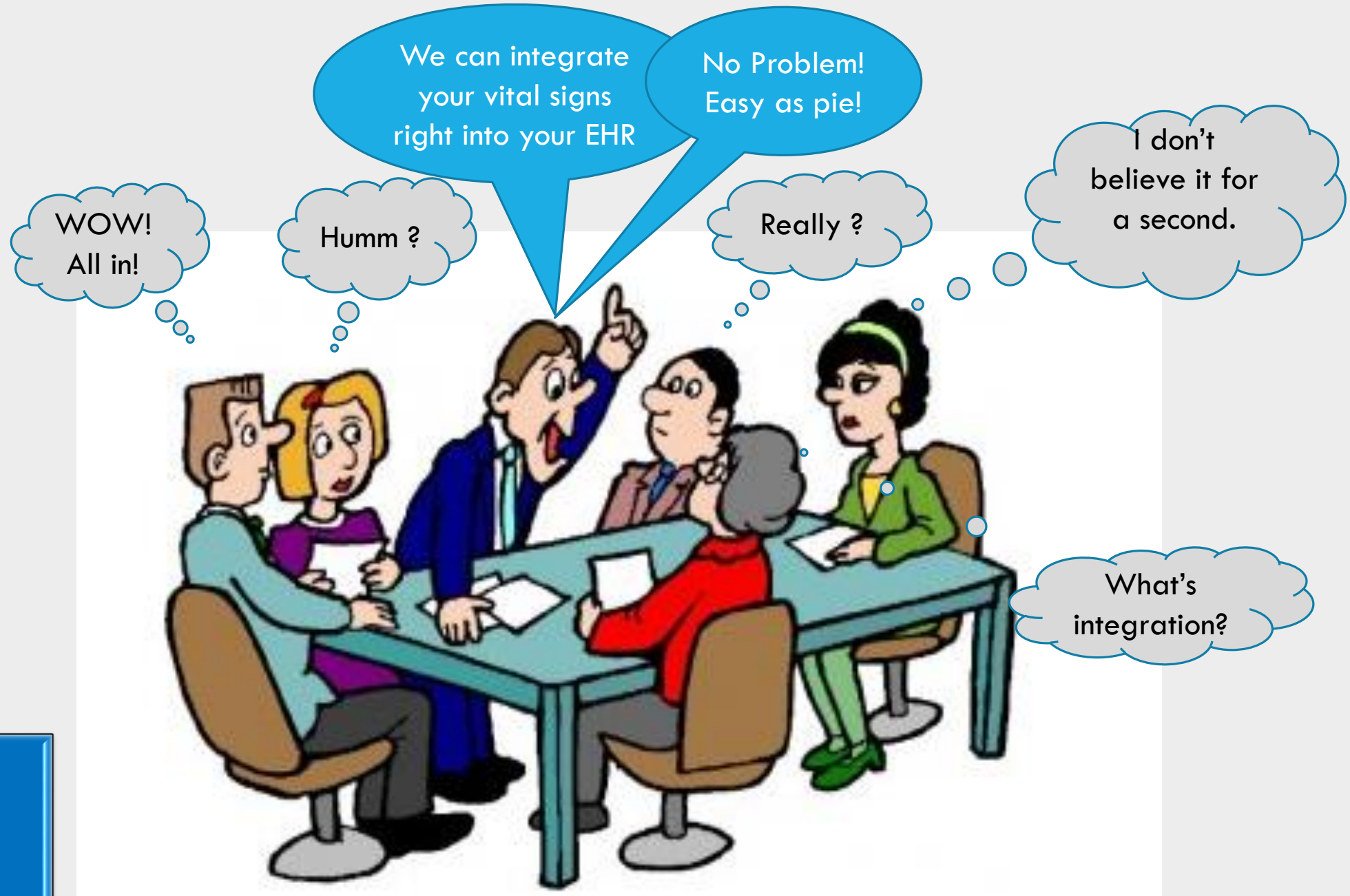
- Integration in non-critical care or procedural areas
- Collected vital sign values include B/P, heart rate, respiratory rate, temperature and SpO2
- Include vital sign modifiers
  - Location
  - Source
  - Device
- Includes other documentation options
  - I&O,
  - weight,
  - safety and purposeful rounding
- Devices connect via a wireless network
- Device is attached to patient record via ADT feed
- Values are authenticated at the time values are “SENT” to the EMR

JOURNEY TO VITAL SIGN DEVICE INTEGRATION



PROJECT PLAN/





Discovery & Analysis

SYSTEM DISCOVERY AND ANALYSIS CHALLENGES

Device Selection

- Option 2 vendors
- Based on existing Architecture
- Both had limiting factors
  - Price point
  - Interface, network and licensing requirements
  - Compatibility with existing vital sign machines

Infrastructure Requirements

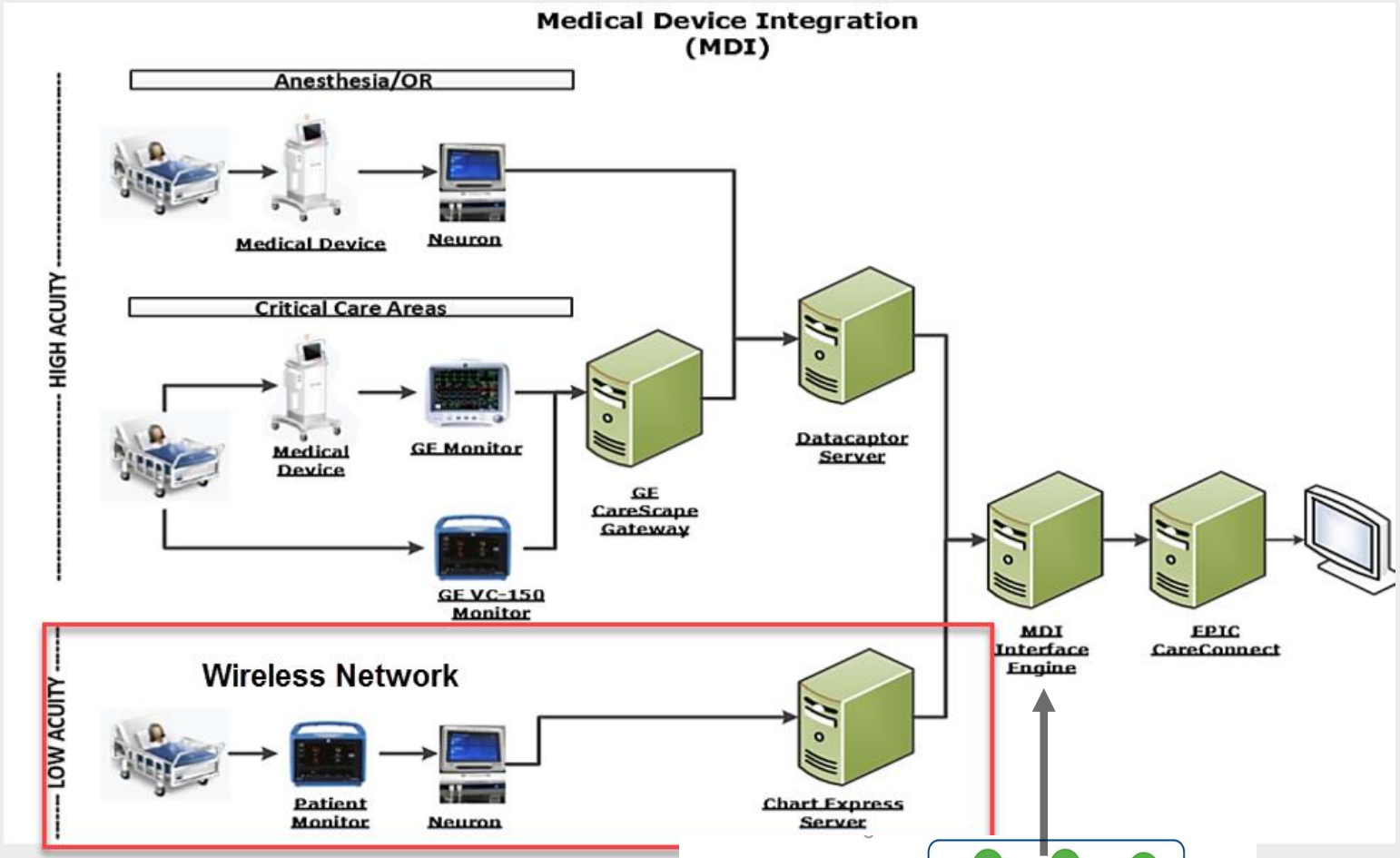
- ADT Interfaces
- Network
- Drivers if needed
- License and implementation costs
- User access security: active directory

Implementation

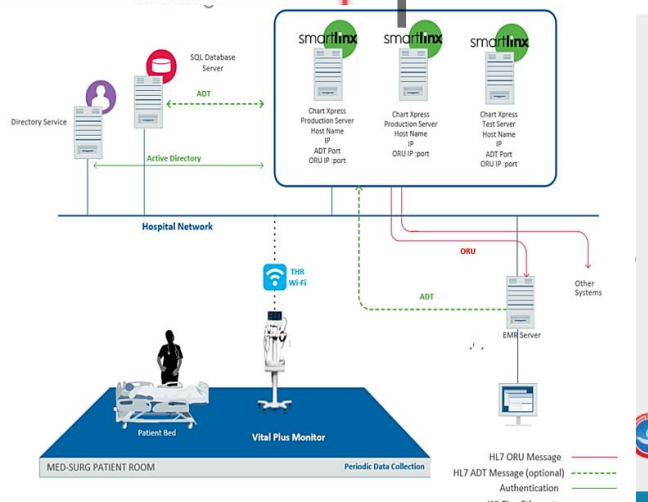
- Financial
  - Integration costs
  - Supported by system or individual entity
- Hardware
  - End of Life (EOL) status
  - Device Software Compatibility
  - Allocation of purchased devices: limited supply

INFRASTRUCTURE

Physiologic Monitoring
2010 - 2014

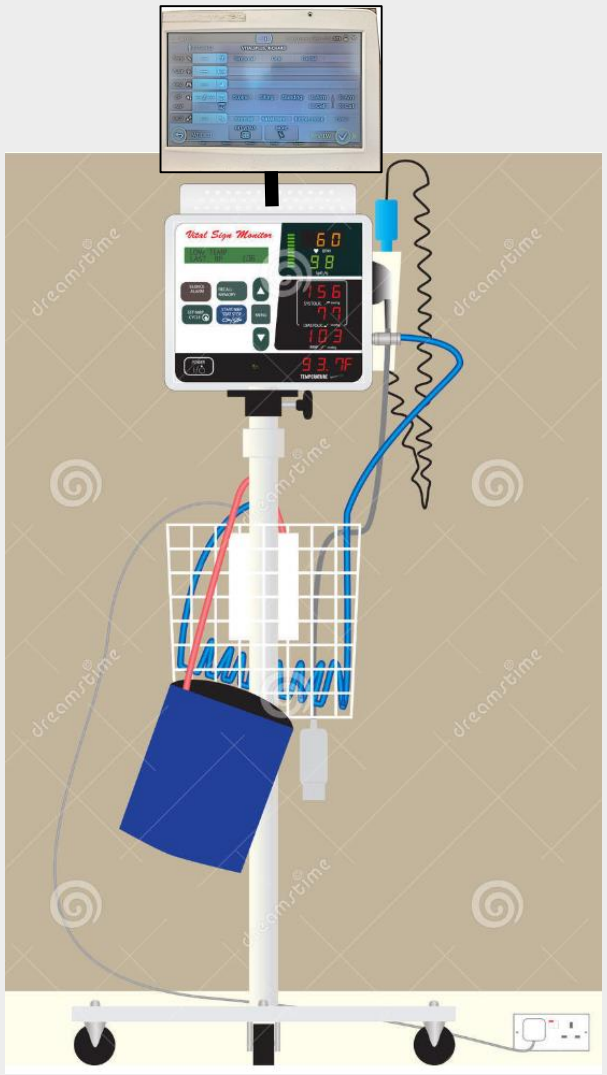


Low Acuity VS Integration
Phase I



Low Acuity Vital Sign Integration
Phase II

COMPATIBLE DEVICES



- Phase I Neuron Capsule compatible with 7 Brands of vital sign machines.

- THR Inventory of Low Acuity
- > 8 brands and models
- Devices = > 1,271

Impacts to decision

- End of life status
- Additional software costs and licenses too accommodate an add on configuration

SYSTEM DISCOVERY AND ANALYSIS SUCCESS

Device Selection

- Vendor choice supports strategic plan to accommodate existing device hardware and build on the device architecture.
- Price point
- Supports the end user experience
- Building block approach
- Established system standard for Vital Sign Machines*

Infrastructure Requirements

- No change to current architecture
- Uses existing network
- License and implementation costs reduced
- Established system standard for Vital Sign Machines *

Implementation

- Financial
  - Initial hardware, licensing and implementation costs covered by system budget
  - Future costs individual entity responsibility
- Provided a phased approach
  - Upgrading existing VS hardware with neuron
  - All in one implementation
  - Includes single sign on option

PROJECT TEAM

- Executive Sponsor
- Business Owner
- Project Managers
- Team

SCOPE

Phase I

- Wholly owned + 1 Joint Venture Partner (JVP)
- Implementation and device costs covered by ITS
- 166 devices allocated to 13 entities
- Acute Med/Surg Inpatient Units
- Single VS brand and model
- Managed by PM

Phase II

- All in one device, system standard
- Implementation costs covered by system
- Hardware and License costs by entity
- All clinical areas on wireless network except Critical Care/Procedural areas
- Coordinated by HTM and Nursing Informatics

DESIGN

Phase I

System standard: Neuron affixed to 1 brand and model VS machine

Design team comprised of RN, PCT, analysts from clinical documentation, QA, data exchange and vendor

General and relative to med/surg clinical areas

Utilized mobile documentation application as foundation

Includes B/P, HR, SpO2, RR and Temp with up to 5 modifiers

5 clinical documentation fields

Single instance of vital sign and other documentation messages sent

Phase II

System standard: All in one device

Used foundation created in Phase I

General and relative any clinical area except ICU and procedural areas

Incorporated optimization requests from Phase I, modified phase I design

Includes B/P, HR, SpO2, RR and Temp with up to 7 modifiers

7 clinical documentation fields

Supports interval vital sign

Individual or groups of vital signs and other documentation messages can be sent

BUILD/TEST

Build

- Devices
  - Biomed
- Documentation (HL7)
  - Data Exchange/Management
  - Clinical Documentation
- Servers: *5*
  - 2 production,
  - 1 test/train
  - Individual server each for joint venture (2)

Testing

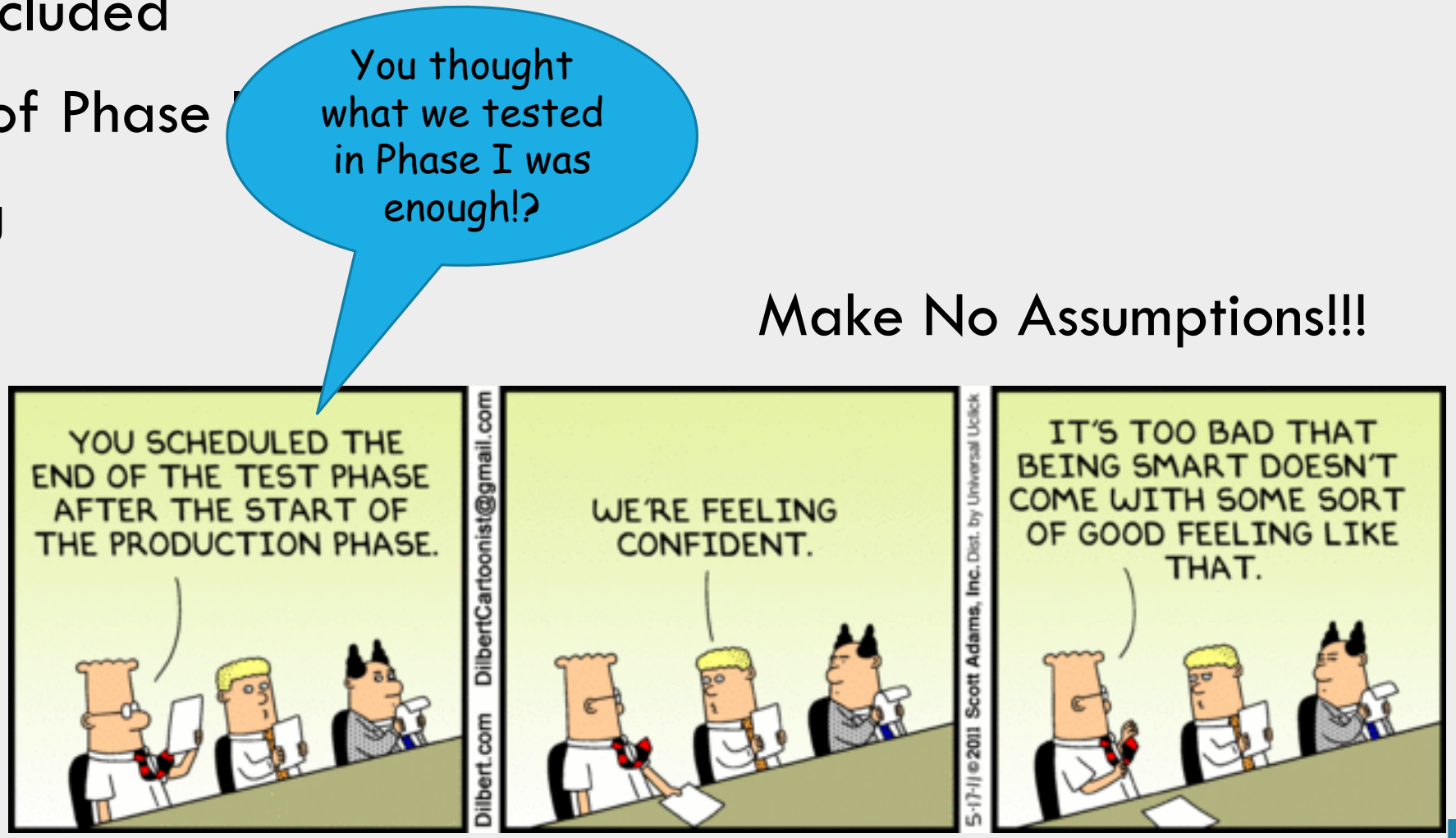
- Connectivity
- Active Directory
  - Wholly owned
  - Joint Venture

- Admission Discharge Transfer (ADT)
  - Invision
  - CPSI
  - CC1
- Medical Device integration: results to EMR
- User acceptance : validation of workflow

TESTING

Phase II testing Included

- All components of Phase
- Negative testing
- Interval testing

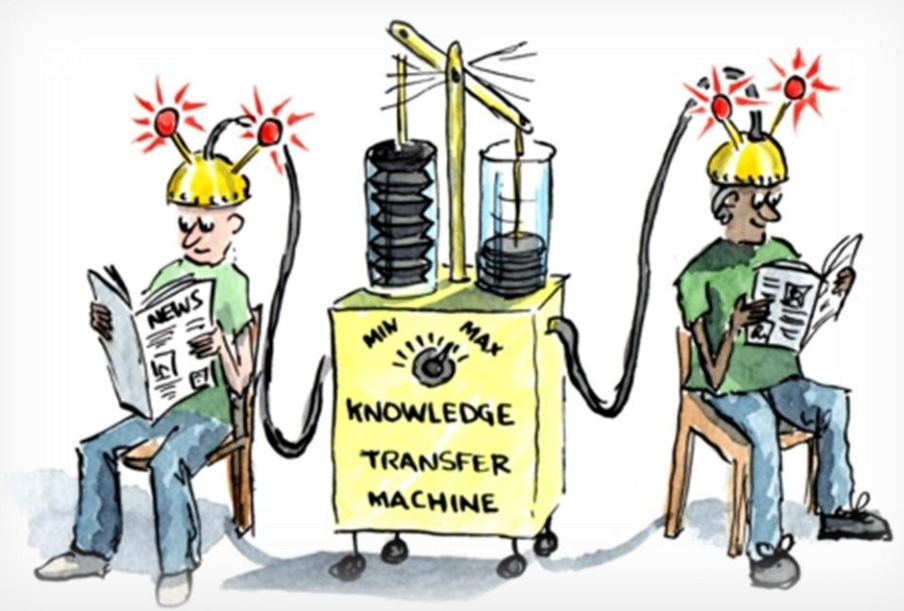


Make No Assumptions!!!

TRAIN

Vendor training

- System administration 1 day
- Train the trainer
  - Biomed: device assembly and maintenance 1.5 days
  - Nursing: 3 – 4 hours
- Super User Training
  - Biomed: half a day
  - Nursing: 3 – 4 hours
    - Basic Assembly
    - Functionality
    - Care and Maintenance
    - Trouble shooting
- End User Training
  - User access validation at the elbow
  - Basic functionality
  - At the elbow go live support by super users



IMPLEMENTATION: GO LIVE

Readiness Check list

- Change Management reviewed and approved
- Device assembly validation: Biomed
- Infrastructure validated: Network, driver configurations and servers
- Support
  - Onsite
  - Remote
  - Super Users
- Activate Production

SUSTAINMENT

- Change management Process

Requests

Service Desk Knowledge Articles
- User Access
- Ticket routing
- Downtime

Customer Service

Education

New employee Competence/Mastery validation Updates

Strategic Goals

- Preventive and Quality Maintenance
- Medical Component Management
- Cable management

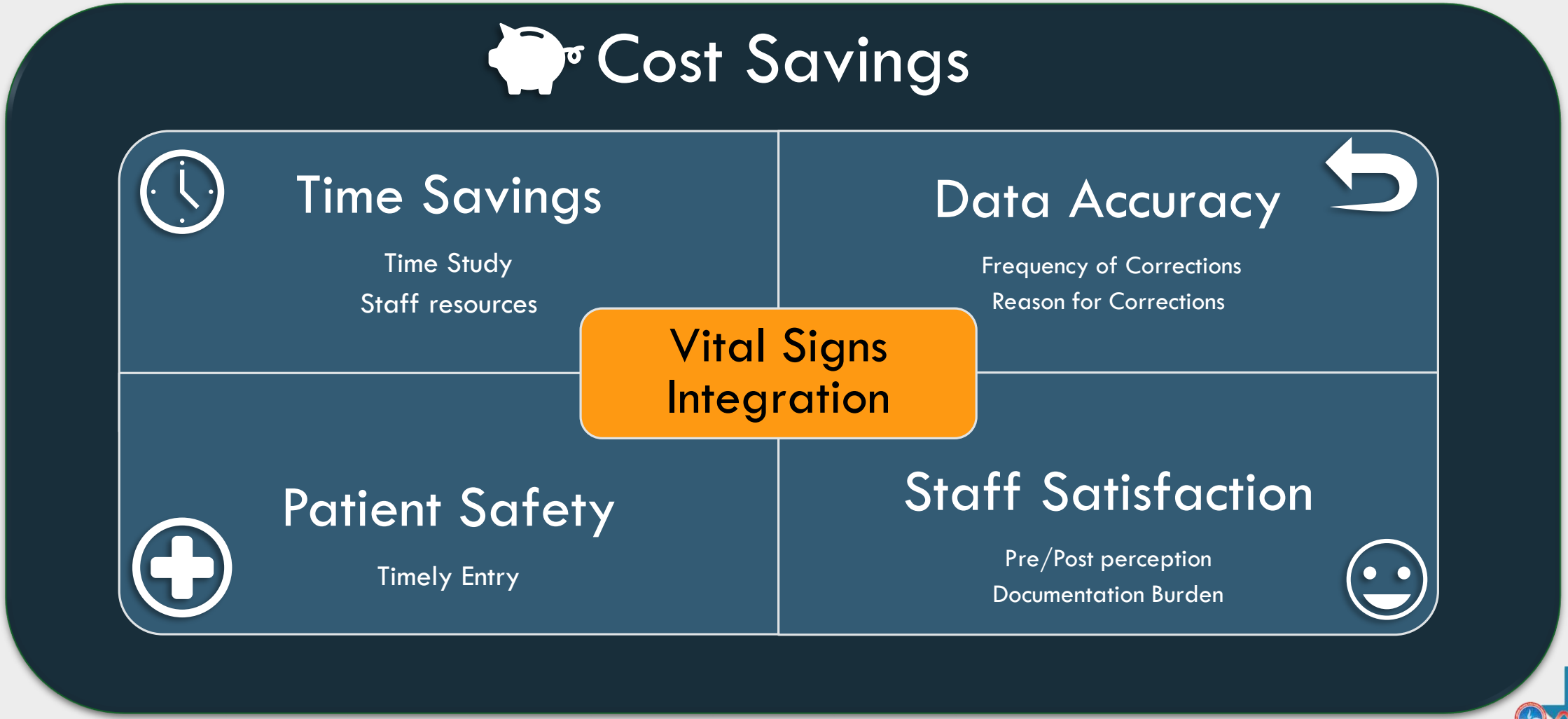
Device Mgt.

- Server Updates
- New or changing applications
- Downtime

Infrastructure

Sustain

OUTCOME EVALUATION STRATEGY



REQUIRED DOCUMENTATION CONSIDERATIONS

Primary Focus

Vital Signs (Every 4 Hours)

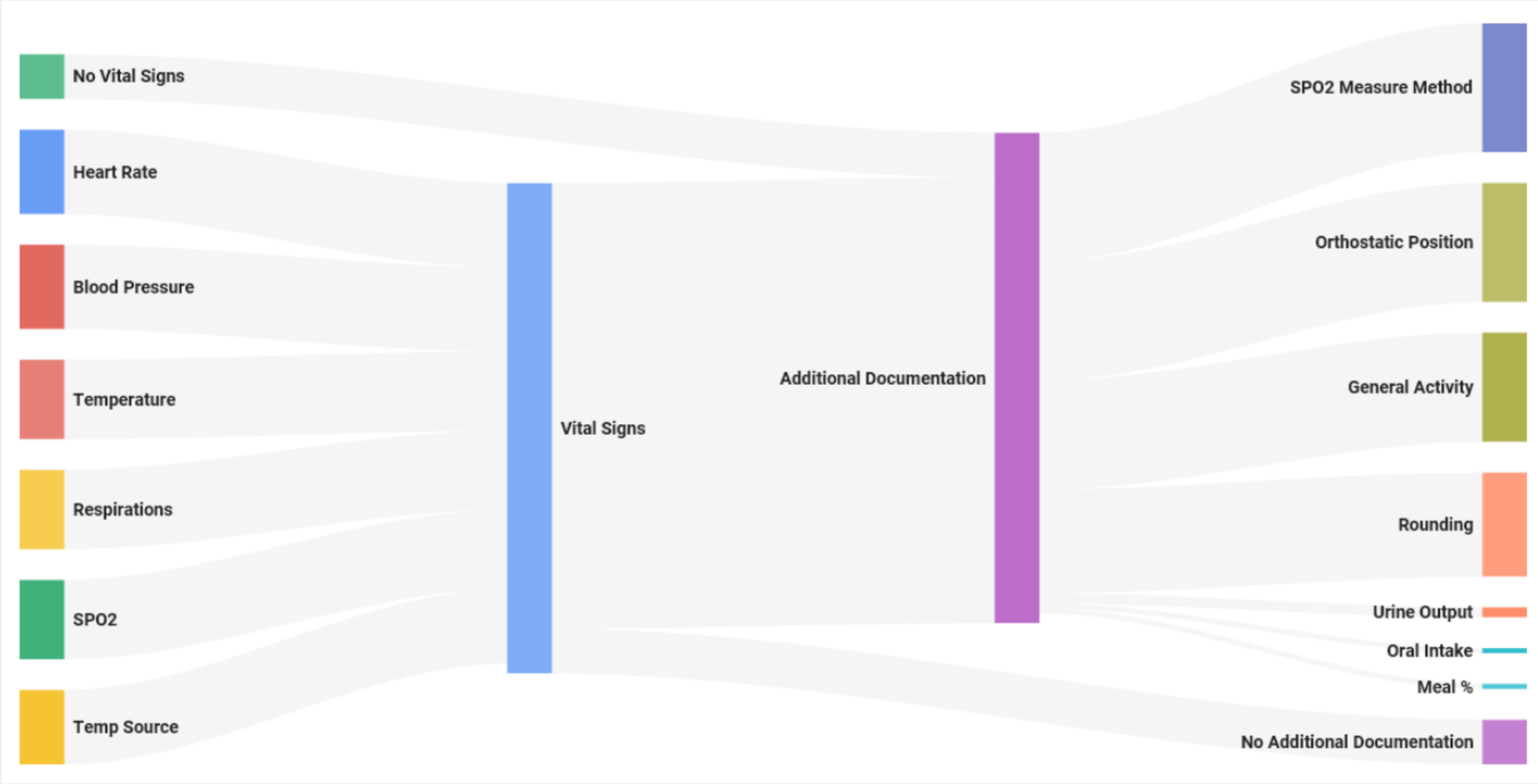
- Blood Pressure
- Heart Rate
- Respirations
- Temperature
- Temp Source
- SPO2

Secondary Focus

Additional Flowsheet Rows

- Rounding (every 1 hour)
- Upon Occurrence
  - General activity
  - Oral intake
  - Intake %
  - Urine output
  - Orthostatic position
  - SPO2 monitoring

DATA FLOW


No Vital Signs
Heart Rate
Blood Pressure
Temperature
Respirations
SPO2
Temp Source
Vital Signs
Additional Documentation
SPO2 Measure Method
Orthostatic Position
General Activity
Rounding
Urine Output
Oral Intake
Meal %
No Additional Documentation

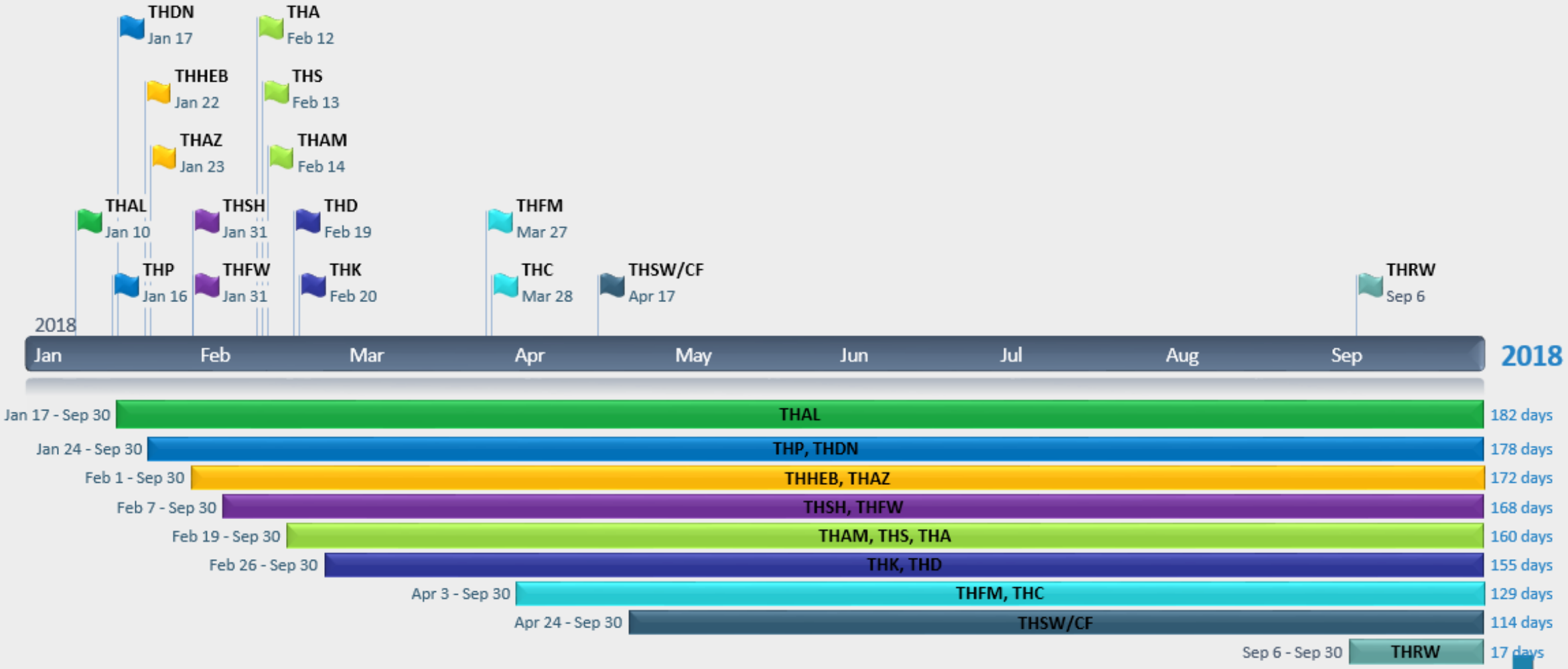
RETROSPECTIVE ANALYSIS: VITAL SIGNS

75 nursing units evaluated individually:

- Historical baseline – Manually documented vital signs (n= 9,535,894): July – December 2017
- After implementation – Manually documented and device integrated vital signs (n= 11,253,351)
  - Time varies based on go-live (see timeline)
  - Began data collection 7 days after implementation

- Inclusion:
  - Patients assigned to participating Med/Surg and Telemetry units
  - Documented during the time the patient was assigned to the unit
  - Documented by RNs, PCTs, Unit Clerks
- Exclusion:
  - Integrated through other means (GE monitors, surgery, ED)
  - Rows without a vital sign value recorded (comment only documentation)
  - Documented by other disciplines not assigned to a specific nursing unit (RT, PT, OT)

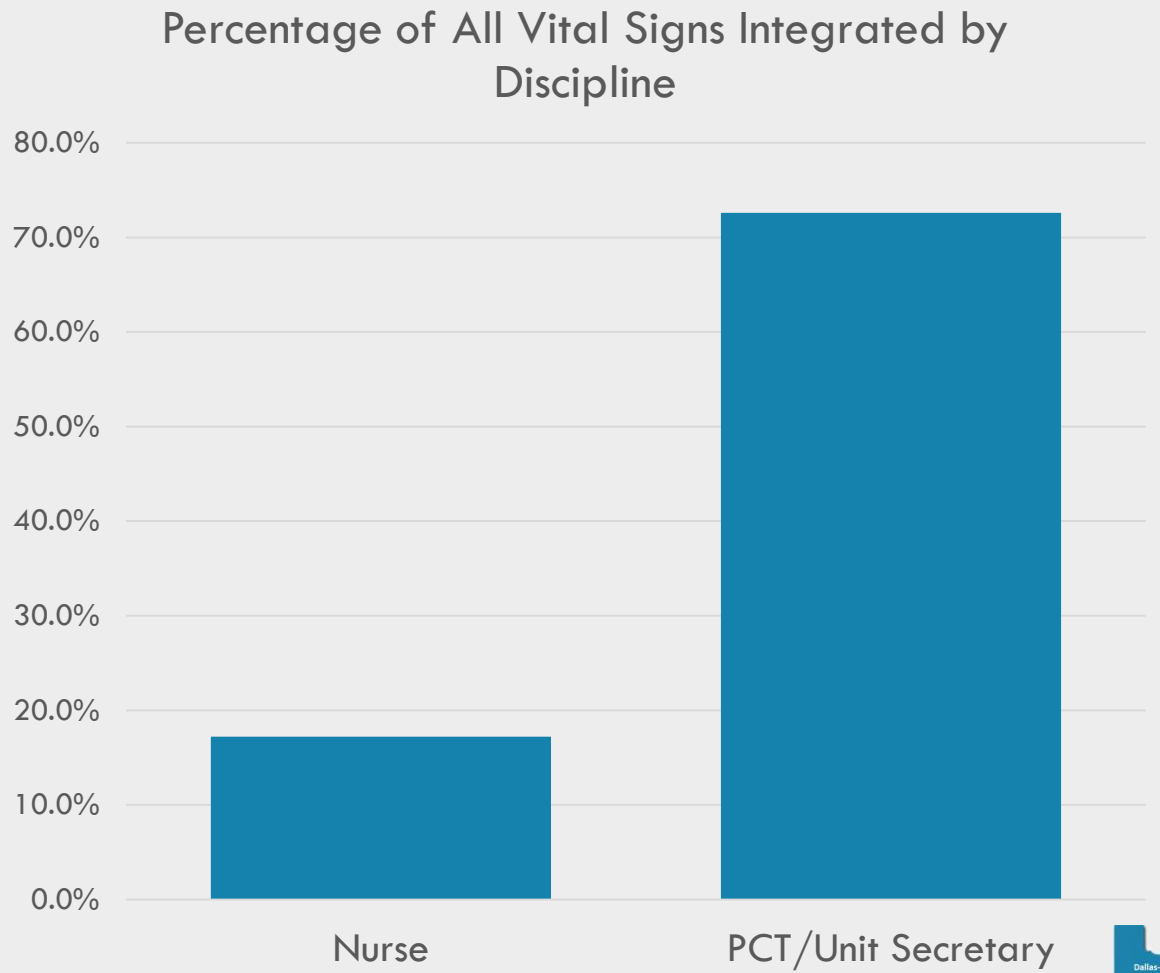
GO-LIVE TIMELINE AND DATA ACQUISITION DATES



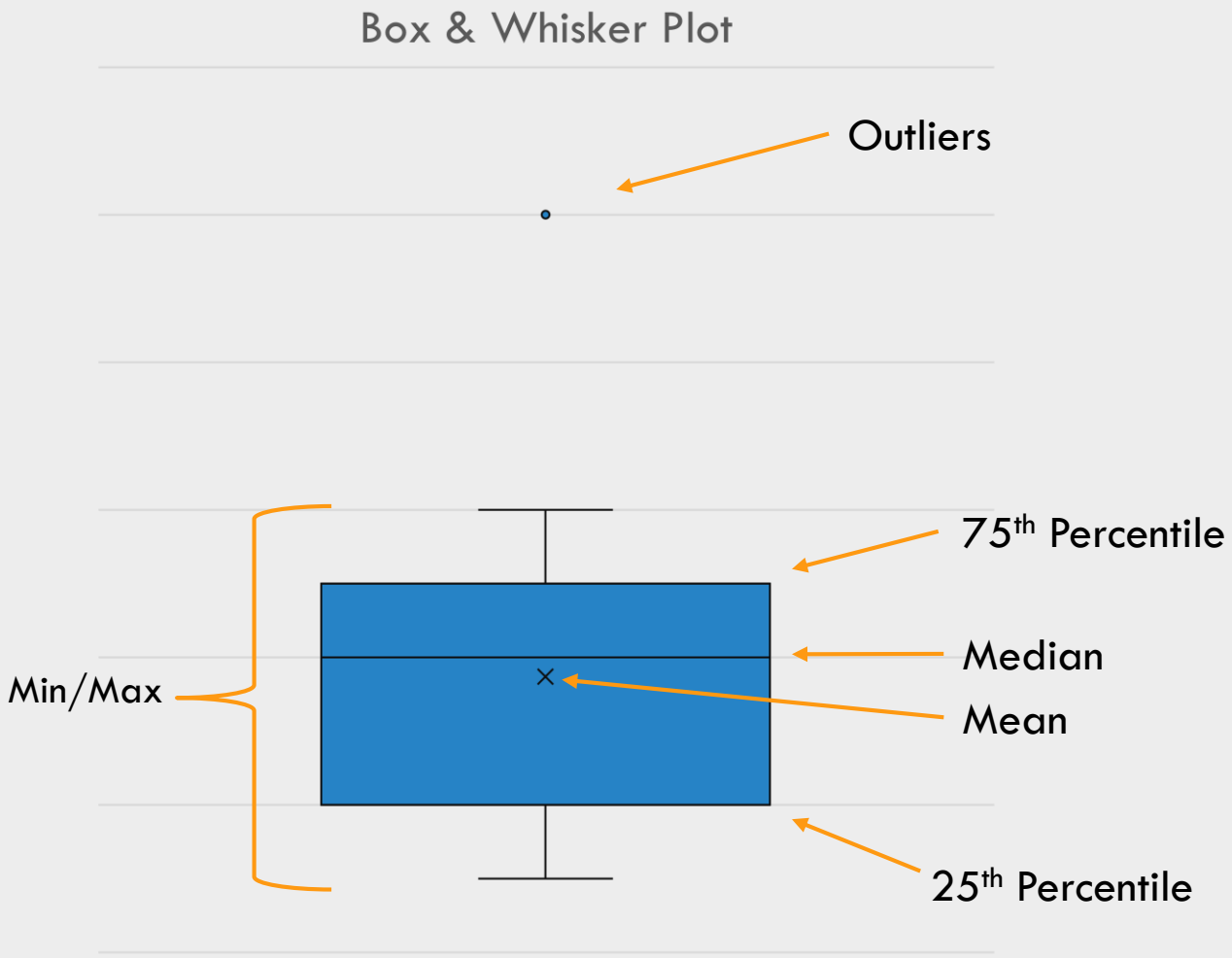
INTEGRATION OF VITAL SIGNS: OVERVIEW

Overall Integration

60.3%



BOX AND WHISKER OVERVIEW



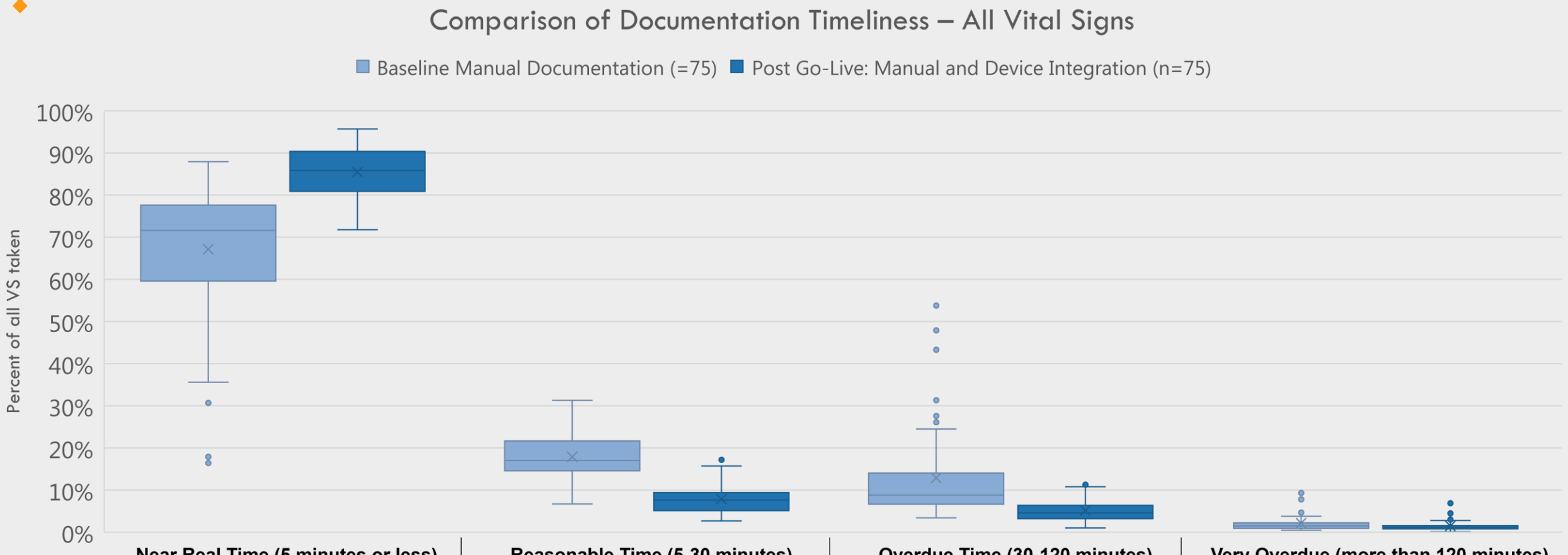
Shows a lot of information in a small space

Easy comparison between manual vs. integrated documentation

PATIENT SAFETY

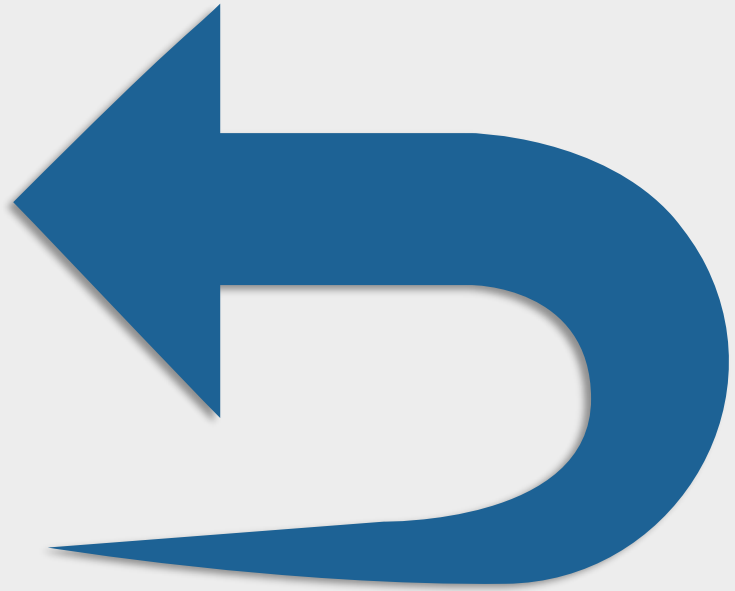
Timely Entry

DOCUMENTATION DELAYS



Near Real Time (5 minutes or less)	Reasonable Time (5-30 minutes)	Overdue Time (30-120 minutes)	Very Overdue (more than 120 minutes)
Pre (M = 67.125, SD = 16.254)	Pre (M =17.871 , SD =5.802)	Pre (M =12.869 , SD =10.672)	Pre (M =2.143 , SD =1.961)
Post (M = 85.459, SD = 5.752)	Post (M =7.840 , SD =3.321)	Post (M =5.177 , SD =2.589)	Post (M =1.509 , SD =1.136)
$t_{(92)}$ = 9.2083 p < 0.0001, $CI._{95}$ -22.288 to -14.379	$t_{(117)}$ =12.9933 p < 0.0001, $CI._{95}$ 8.502 to 11.560	$t_{(82)}$ =6.0661 p < 0.0001, $CI._{95}$ 5.169 to 10.215	$t_{(118)}$ =2.4204 p =0.0170, $CI._{95}$ 0.115 to 1.151

Welch's two-tailed independent t-test



DATA ACCURACY

Frequency of Data Correction

Reasons for Data Correction

CONSIDERATIONS FOR DATA CORRECTIONS

Average: 1 minute to correct data

Scenario 1
Recognition of Another's Error

1. Identify the issue
2. Contact the original documenter
3. Clarify VS value
4. Original documenter:
    1. logs in to EHR
    2. opens patient chart
    3. goes to correct flowsheet and time column
    4. enters corrected values

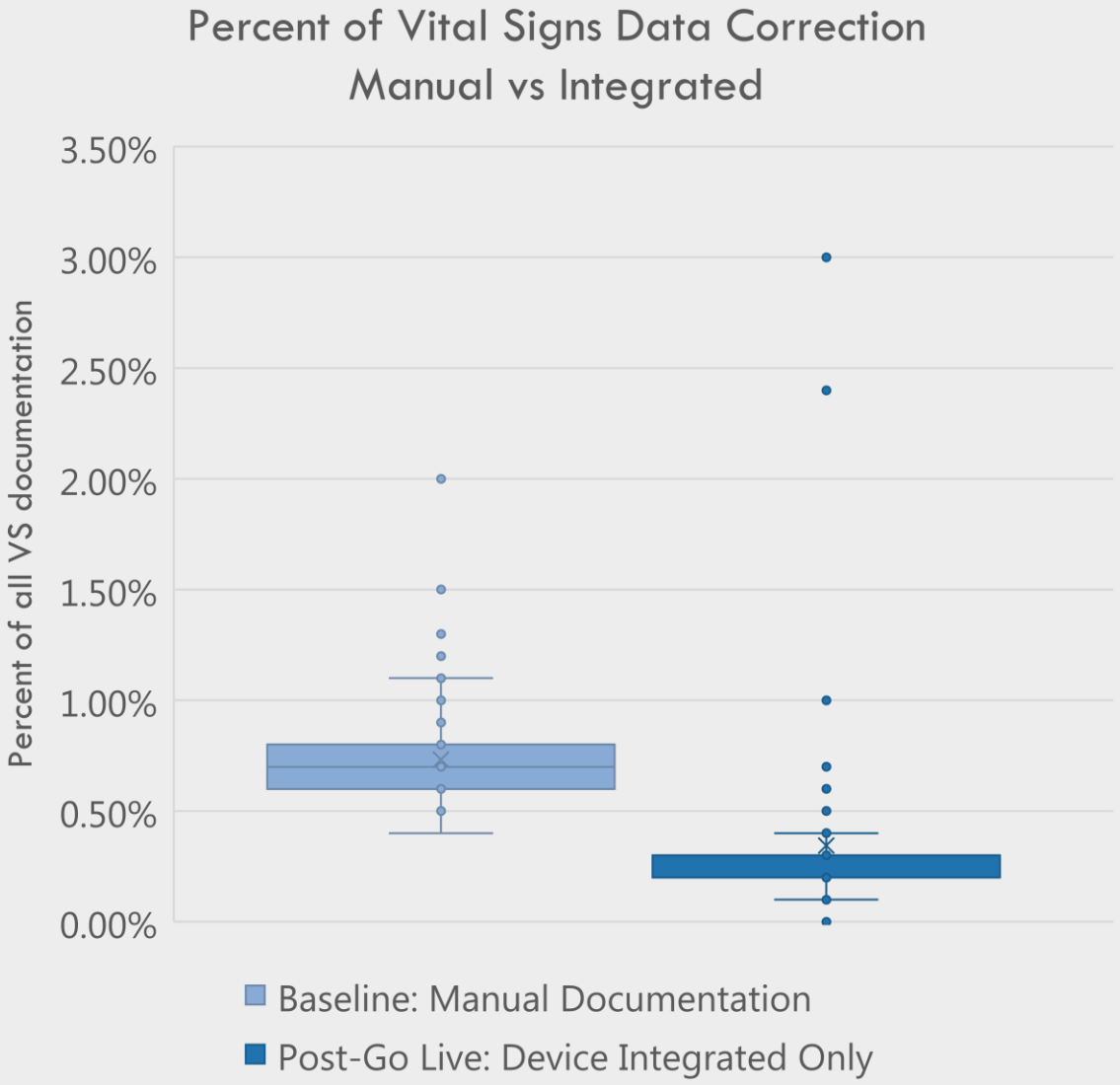
Assumptions: Original documenter is in close proximity at time of discovery and vital signs information is also nearby.

Scenario 2
Recognition of Self Error

1. Identify the issue
2. Clarify VS value
3. Enter corrected values

Assumptions: Individual is at a workstation, logged in to EHR system, and vital signs information is nearby.

DATA CORRECTION: MANUAL VS INTEGRATED



Statistically significant decrease in data correction

pre-implementation (n=75) (M=0.7320, SD =0.2343)

post-implementation (n=75) (M=0.3440, SD =0.4221)

$T_{(115)} = 6.9600$, $p < 0.0001$, $CI_{.95}$ 0.2776 to 0.4984

Note: Welch's independent two-tailed t-test

DATA CORRECTION: MANUAL VS INTEGRATED

Manual Documentation

7.3 corrections

per 1,000 entries

Device Integration

3.6 corrections

per 1,000 entries

50.7% decrease in data correction

EXAMINATION OF COMMENTS ASSOCIATED WITH DATA CORRECTION: WHY WAS THE CORRECTION MADE?

Category	Finding	Why is this important?
Wrong Patient	**Significant** Manual (n=75) (M=0.075283, SD =0.168792) Device Integration (n=75) (M=0.000000, SD =0.000000) $T_{(74)} = 3.8626$, p = 0.0002, CI.95 0.036447 to 0.114118	Integration and the use of barcode scanning helps significantly with documentation on the correct patient
Error in Entry	**Non-Significant** Manual (n=75) (M=0.095929, SD =0.173518) Device Integration (n=75) (M=0.106221, SD =0.250473) $T_{(131)} = 0.2925$, p = 0.7704, CI.95 -0.079895 to 0.059311	More study of the use of "Error" is needed
Recheck	**Non-Significant** Manual (n=75) (M=0.154647, SD =0.203744) Device Integration (n=75) (M=0.185593, SD =0.304861) $T_{(129)} = 0.7309$, p = 0.4662, $CI_{.95}$ -0.114718 to 0.052824	Integration does not significantly decrease the use of comments to clarify reasons for data correction
Notified	**Non-Significant** Manual (n=75) (M=0.305951, SD =0.254203) Device Integration (n=75) (M=0.327423, SD =0.394107) $T_{(126)} = 0.3965$, p = 0.6924, $CI_{.95}$ -0.128639 to 0.085695	Integration does not significantly decrease the use of comments to explain next steps if needed.

Note: Welch's independent two-tailed t-test

TIME SAVINGS

Time Study
Staff resources

INFORMAL TIME STUDY

Convenience Sample

2 Hospitals

5 Nursing Units

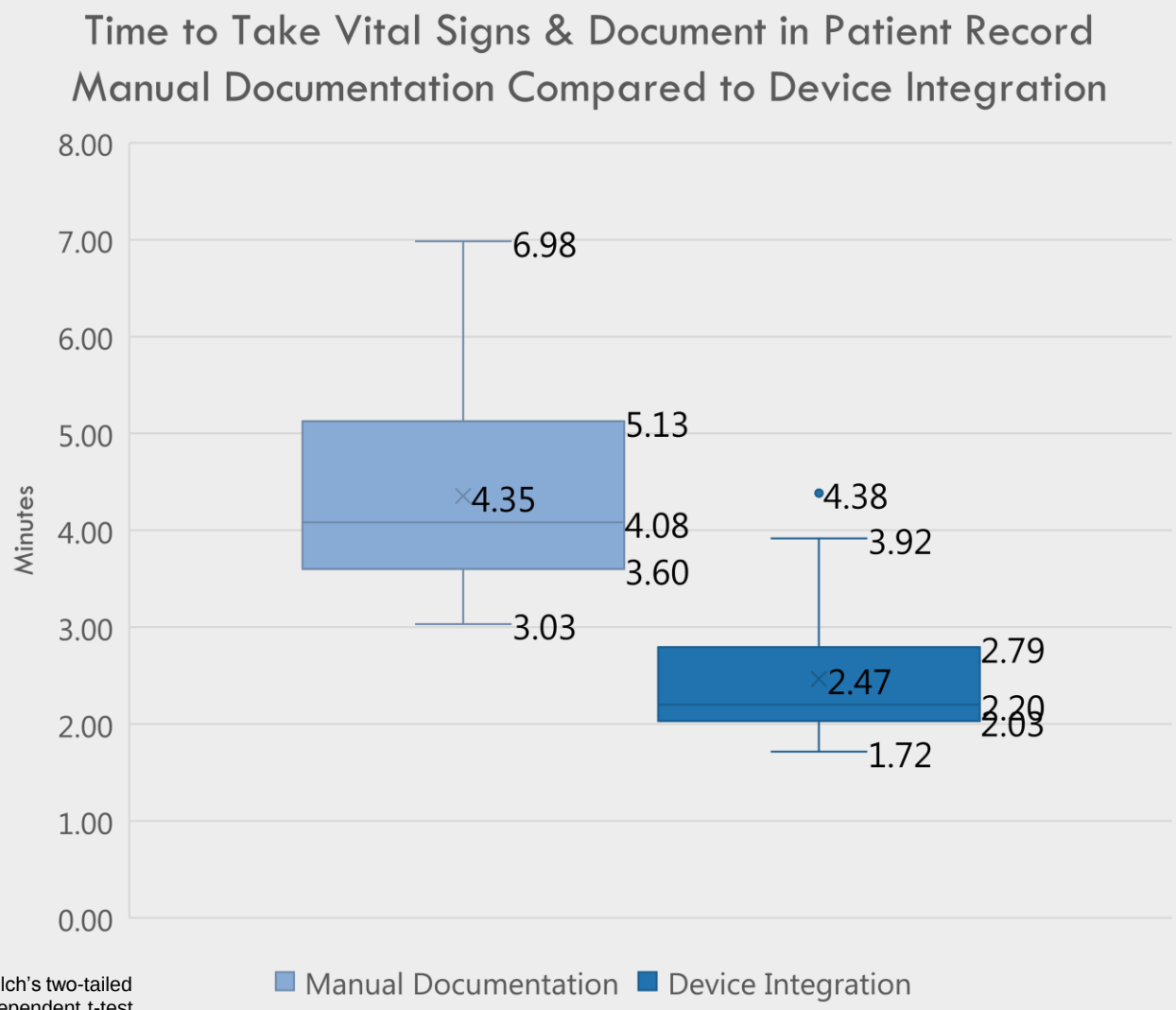
8 Users (6 PCTs, 2 Nurses)

63 total observations

Limitations

- Time study done at the end of project implementation
- Two of the eight users were observed doing both manual documentation and device integration

MANUAL VS DEVICE INTEGRATION COMPARISON



Welch's two-tailed independent t-test

Overall Results:

Observations (n=63)

Statistically significant difference in time to obtain vital signs and document

Manual Doc. (n=32) (M=4.3537, SD =1.1049)

Integration (n=31) (M=2.4671, SD =0.6701)

$T_{(51)} = 8.2236$, $p < 0.0001$, $CI_{.95}$ 1.4261 to 2.3472

Time savings of 1.89 minutes per episode obtaining routine vital signs

Individual Results:

User A: time savings of 2.0 minutes

User B: time savings of 1.87 minutes

STAFF SATISFACTION

Pre/Post perception

Documentation Burden

WHAT STAFF HAVE TO SAY…

COST SAVINGS

- Patient Safety
- Data Accuracy
- Time Savings
- Staff Satisfaction

COST & TIME SAVINGS: ROUTINE VITAL SIGNS

A 25 bed unit obtaining Vital Signs every 4 hours saves

1.89 minutes per “episode”

4.73 hours savings per day with Vital Signs Integration

1,725 hours of savings per year per nursing unit

COST & TIME SAVINGS: DATA ACCURACY

Average Med/Surg or Tele nursing unit takes 254,291 vital signs annually

50.7% decrease in data correction equates to **0.4** hours savings daily

146 hours saved annually per nursing unit

LESSONS LEARNED

- Don't make a device decision based on probability
- Device integration expanding rapidly
  - Options change faster than infrastructure capabilities
  - Costs change as vendor implementations increase
- Complete an inventory of assets and life span before analysis
- Modifications to build should not be based on "low use"
- Critical need for biomed on-site presence at go live

UNINTENDED CONSEQUENCES

- Identified competency and mastery of tasks
  - Competence
    - "The ability to observe and gather information, recognize deviations from expected patterns, prioritize data, make sense of data, maintain a professional, response demeanor, provide clear communication, execute effective interventions, *perform nursing skills correctly, evaluate nursing interventions, and self reflect for performance improvement within a culture of safety*."
  - Mastery
    - Attained through deliberate practice
      - "Effortful activities designed to optimize improvement
    - Lost due to inconsistent teaching, testing, retention and skill drift
    - Diminishes without routine validation

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QUESTIONS

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