

Siemens Nursing Thought Leadership  
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**Main Line Health**

Well ahead.<sup>SM</sup>

**Technology as a Tool to  
Support Complex Clinical  
Workflow Processes**

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# Disclosures

- It is the policy of Corexcel and IMNE to ensure fair balance, independence, objectivity, and scientific rigor in all programming.
- In compliance with the American Nurses Credentialing Center (ANCC) and the Accreditation Council for Pharmacy Education (ACPE), it is the policy of Corexcel and IMNE that faculty disclose all financial relationships with commercial interests over the past 12 months.

## Objectives

- To understand the value of workflow technology within the electronic health record
- 2. To articulate the differences between rules and alerts and an imbedded workflow technology
- 3. To discuss the importance of aligning strategic objectives and workflow initiatives
- 4. To discuss an infrastructure, based on collaboration across the clinical team, that can lead to success
- 5. To describe methods for monitoring clinical performance following the implementation of workflow technology



## Linking Technology Tools to Corporate Clinical Strategy

- Our Strategic Aim: To demonstrate improvement in healthcare performance indicators of quality, efficiency, safety, and cost reduction through empirical evidence derived from design and implementation of seven strategic clinical workflows within the Soarian (SmartChart) clinical application.
- Our Tactical Approach: Standardize seven strategic clinical workflows across settings, automating key clinical decision support to achieve positive patient outcomes while meeting quality and safety standards, and reducing time required for manual chart reviews and audits.



## Linking Resources to Support the Workflow Clinical Strategy

- Executive Sponsorship and Executive Alignment
  - Identification of high clinical/quality impact workflows
  - Releasing resources for design, review, and testing
- Multiple Discipline Participation
  - Staff from three hospitals contributed to the design and review of seven complex workflows, including physicians, nurses, quality coordinators, infection control practitioners, clinical informatics leadership, and IT staff.



## Workflow Engine with Rules Engine

- Process Automation / Business Process Management
- Multiple steps, over time, for multiple users
- State-aware: keeps track of point in time and waits (listens) for next event to happen
- Asynchronous
- Plug-in services (EAI)
- Graphical programming

## Rules Engine

- Rule-based Clinical Decision Support
- Single decision point for single user
- Not State-aware – runs at trigger event
- Synchronous



- Advanced Workflow Goals
  - Communication between workflows
  - Impact is greater than the sum of the individual workflows
  - Supports improved patient care
- Traditional Workflow
  - Discrete start and end
  - Discrete series of steps
  - Each step monitored for successful completion
  - Reacts to the data available at task completion or timeout
- Advanced Workflow
  - Collection of two or more workflows that interact and share pertinent information
  - Allows running processes to impact and react to other processes



# Rationale for Selection

- Workflow and Advanced Workflow Examples

- Timeline – 6 month process to implement 7 clinical decision support workflows. 12 month process for metrics and outcomes.

- Selection and Rationale

- Falls
- Pressure Ulcer
- Heart Failure
- Acute Myocardial Infarction
- Central Lines
- Rapid Response
- Stroke Workflows

Patient  
Outcomes

Meaningful  
Use  
Criteria

Core  
Measure  
Initiatives


Complexity

Best  
Practices

Cost  
Savings



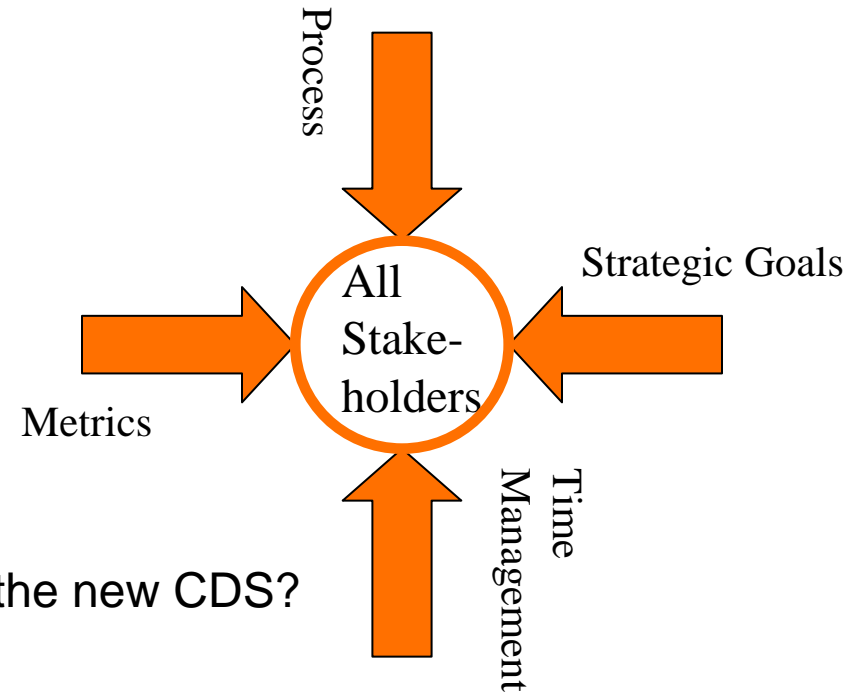
# Selected High-Impact Workflows

Workflow	Metrics and Outcomes	Rationale	Exec. Dashboard
Falls	Documentation Prevention	High-frequency, high-impact, and challenging	✓
Pressure Ulcers	Documentation Prevention	High-frequency, high-impact, and challenging	✓
AMI Core Measures	Efficiency of Documentation Care Guidelines	Top percentile already – but with high human effort. Attempt to increase efficiency.	✓
CHF Core Measures	Efficiency of Documentation Care Guidelines	Top percentile already – but with high human effort. Attempt to increase efficiency.	✓
Central Lines	Zero CLABSI Checklist + Follow up	Clinical priority – 0 events Automate checklist	✓
Rapid Response Team	Accuracy and Timeliness	Automated Decision Support tool as by-product of clinical documentation	
Stroke	Timing compliance to Care Guidelines – tPA, CT	Clinical Alignment to Stroke Center Designation	 <b>Main Line Health</b> Well ahead™

## Rapid Improvement Sessions

### Factors to Consider (5 W's)

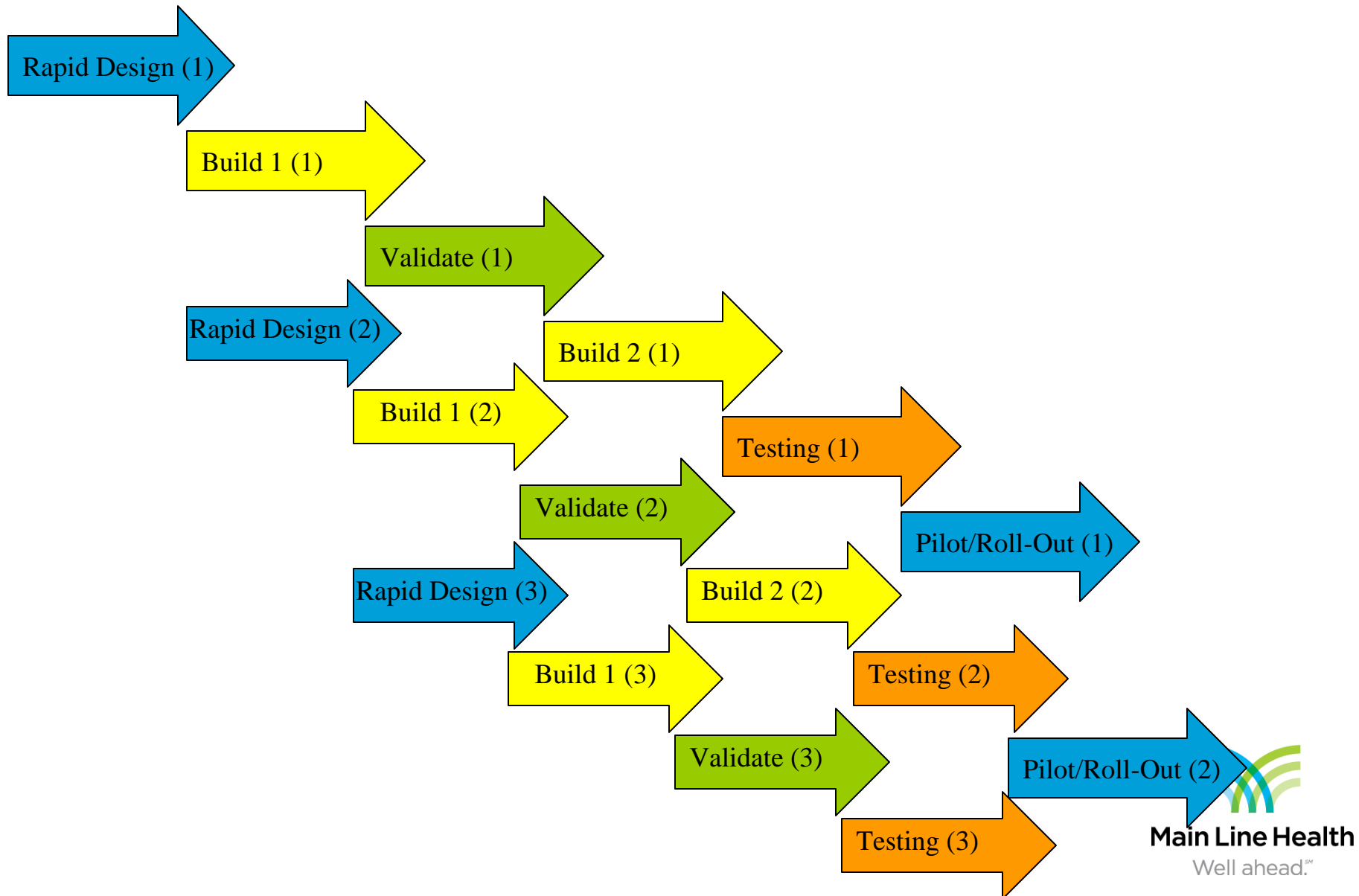
- What is the current process?
- Who are the stakeholders?
- What are you trying to achieve?
- What are the motivating factors behind the new CDS?
- What are the Metrics for this initiative?



### Benefits

- Motivating
- Best utilization of personnel
- Quick and efficient





## – Positives

- Use of GoTo Meetings and typing minutes as you go
- Demo of build (helps to understand workflow impacts)

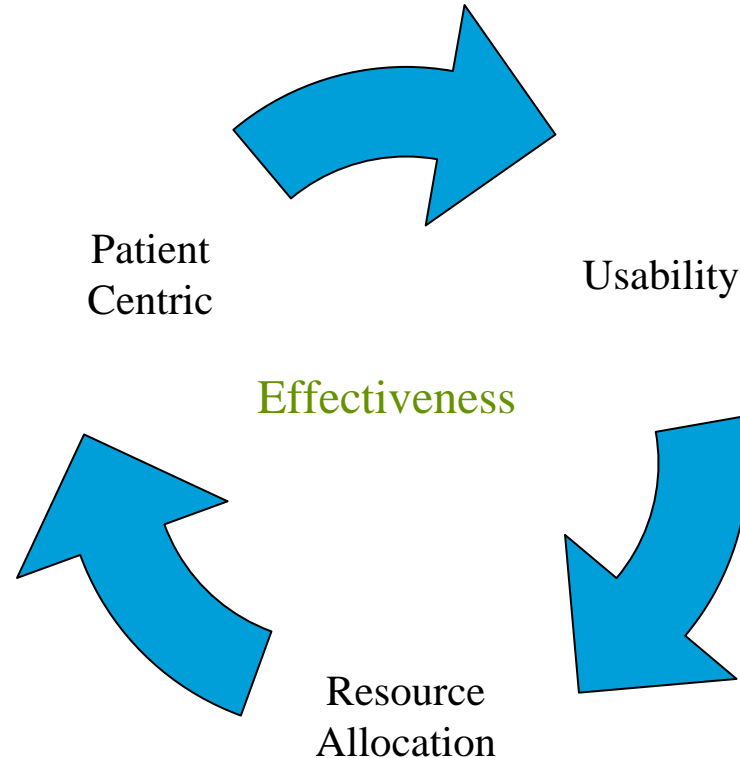
## – Cautions

- Balance of personnel
  - Team bigger than you think – Workflow involves the whole team. Example: Central Line Workflow
- Balanced Timeline - Don't overlap too much (leave some cushion)
- Balance complexities:
  - “Too many alerts lead to automatic overrides by clinicians. Too few may fail to prevent what could be preventable errors.” (Effken, J. 2010)



- **Metric types to consider-**

- Utilization - Are the order-sets and alerts being utilized?
- Clinical Outcomes
- Efficiency



- Falls
  - Order for Falls Precautions and discontinue when documentation indicates.
  - Metric = Falls Reports
- Pressure Ulcer
  - Alert to physician when pressure ulcer present on admission with a link to assessment to document.
  - Automatic Nutrition Consult when Braden Score indicates.
  - Automatic Wound Consult when Stage 2 or greater Pressure ulcer.
  - Metric = Data Collection (time-savings) for NDNQI data.
- Heart Failure
  - LVEF order in HF order set to document Ejection Fraction if known. Includes ACEI/ARB information.
  - Physician Alert to order ECHO if appropriate.
  - Physician Alert to select appropriate diagnosis to add to problem list (acute, chronic, diastolic or systolic).
  - Physician Alert when new ECHO result available – links to ECHO result and documentation for the new EF value.
  - Physician Alert if ACEI/ARB needed (i.e. EF <40). Ability to document contraindications.
  - Various Quality Alerts when above alerts not “acted on”
  - Discharge notifications for Case Management and Quality Personnel.
  - Discharge Instruction criteria
  - Metrics = Percentage patients with specific diagnosis codes (acute, chronic, etc)



# Complex Workflow Specifics

- Acute Myocardial Infarction
  - Alert to physicians when Troponin Elevated to indicate “yes” AMI patient or reason why not. If physician indicates “yes”, AMI is added to problem list.
  - Preselected order in AMI order set to document aspirin on presentation. Alert in 2 hours if not filled out (links to order)
  - Physician Alert if no LDL order within 2 hours of admission
  - Physician Alert if “Best Practice” orders not present (Aspirin, Plavix, BetaBlockers)
  - Physician Alert if no LDL result within first 12 hours of admission
  - Various follow-up/Quality Alerts as needed for above (escalation alerts)
  - Discharge Instruction information to be added at later date.
  - Metrics = Percentage of AMI Problems added on Problem List.
- Central Lines
  - “Line Insertion Checklist” for documenting that best practices were followed during line insertion.
  - Alerts for physicians when line due to be removed (and options to document reasons for keeping or reasons for discontinue)
  - Alerts for nursing when cap and/or dressing changes due.
  - Metrics = Total # central lines & duration, Central Line Infection Rate
- Rapid Response (Modeled after “MEWS” scoring)
  - Scoring of patient based on vital signs, neuro assessment and latest lab results.
  - Results will be analyzed to correlate scores with retrospective data on Rapid Response team calls and/or Codes.
  - Once data analyzed, alerts will be sent if scoring indicates.
  - Metrics = Number of Rapid Response per 1000 patient days.



- Three component workflows
  - Stroke tPA
    - Notifies the physician when the CT scan and key lab results are complete
    - Notifies the physician if aspirin is ordered
    - Communication events to DVT Prophylaxis and Stroke Core Measures workflows
      - TPA Information (given or not given)
  - Stroke Core Measures
    - Monitors Core Measures compliance and notifies physicians if orders are indicated.
    - Reacts to communication from Stroke tPA workflow
      - Tracks patients considered for tPA treatment
        - » Appropriate Alerts 24 hours post treatment.
  - DVT Prophylaxis
    - Checks for DVT Prophylaxis risk assessment and order (if appropriate) 4 hours after admission
    - Notifies physician if patient at risk for DVT does not have prophylaxis orders
    - Monitors discontinued DVT prophylaxis orders for re-order within 8 hours
    - Reacts to events from Stroke tPA workflow



# Central Line Insertion Checklist

Line Inserti...

Procedure Note

Attending Ad...

**Line Insertion Checklist**

Unit/Room

Reason For Line

**NOTE: Central Line placement not indicated for Blood Draws Only.**

**Location Preferences (in order of most preferred to least preferred location):**

1. Midline -Most preferred [\(MLH Location Selection Guidelines\)](#)

2. Tunneled PICC

3. PICC

4. Subclavian

5. IJ

6. Femoral -Least preferred [\(CDC Guidelines for the Prevention of Intravascular Catheter-Related Infections\)](#)

**Check List**

Primary nurse notified

Consent obtained

Time out done

Ultrasound used

	Inserting Clinician	Assisting Clinician	Observing Clinician
<b>Inserting Team</b>	<input type="text" value=""/>	<input type="text" value=""/>	<input type="text" value=""/>
Hand Hygiene	<input checked="" type="checkbox"/> Alcohol-based hand rub <input checked="" type="checkbox"/> Soap and Water	<input type="checkbox"/> Alcohol-based hand rub <input type="checkbox"/> Soap and Water	<input checked="" type="checkbox"/> Alcohol-based hand rub <input checked="" type="checkbox"/> Soap and Water
Barriers	<input checked="" type="checkbox"/> Mask <input checked="" type="checkbox"/> Cap <input type="checkbox"/> Sterile gown	<input type="checkbox"/> Mask <input type="checkbox"/> Cap <input type="checkbox"/> Sterile gown	<input checked="" type="checkbox"/> Mask <input checked="" type="checkbox"/> Cap

Guidance to most preferred line location

Guidelines

Checklist!!

### Central Line Insertion Checklist - continued

**Verified insertion team followed hand hygiene and barriers**

Ok to continue procedure 11:37 (Start auto timestamped)

**Skin Prep**

2% CHG/70% alcohol (preferred prep) OR  Povidone Iodine

30 second scrub  30 second scrub

2 minute scrub (Femoral)  2 minute scrub (Femoral)

1 minute dry time  2 minute dry time

Reason for using Povidone Iodine

**Site Selection**

Site (Lines 1 - 3)	Line 1	Line 2	Line 3
Site/Line Type	Internal Jugular Left (V)	Basilic Right (PICC)	
Insertion Date/Time	04/14/20 13:00	04/16/20 11:30	// :

Site (Lines 4 - 6)	Line 4	Line 5	Line 6
Site/Line Type			
Insertion Date/Time	// :	// :	// :

**End of Procedure**

Line Secured and Dressing Applied

Chest Xray Ordered

Procedure Finished 11:56 (Finish auto timestamped)



# Central Line – Procedure Note

**Procedure Note**

Lot Number MBAD610

Device Type Churchill Medical PICC Kit tripl

Line Inserted

No of Lumens 3

No of Attempts 1

All ports flushed sterile saline

All ports flushed with Heparin (Applicable to implanted chest wall port and dialysis catheters ONLY.)

Dressing applied

Preferred Order to Secure a Line

Line secured with  Chlorhexidine Gluconate (CHG) Transparent Dressing

Catheter Securement Device

Suture

Insertion Comments

Electronically Signed By [Redacted] on 04/16/2011 11:57

**By completing this form you are invoking your Electronic Signature**

**PICC or Mid Line Additional Information**

Confirmation X-ray

Catheter size 6F

Catheter length 43cm

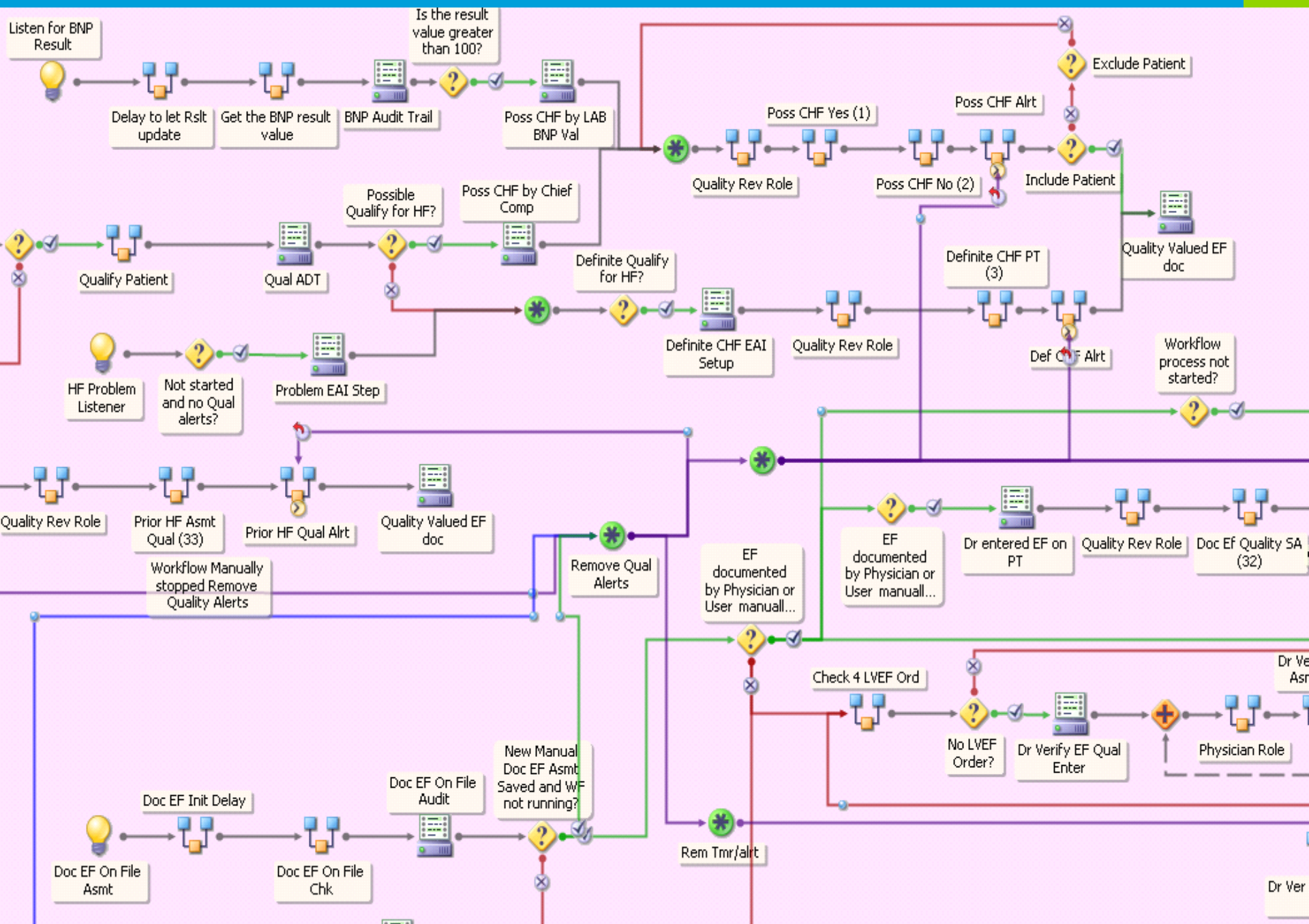
External catheter length 0

Arm circumference 29cm

Amount of lidocaine used 5cc



# Example of Heart Failure Workflow




# “Early Warning Systems: Scorecards That Save Lives”... Institute for Healthcare Improvement

## MEWS – Modified Early Warning System

- The MEWS measures...
  - Respiratory rate
  - Heart rate
  - Systolic blood pressure
  - Conscious level
  - Temperature
  - Hourly urine output (for previous 2 hours)
- Main Line Health modification “MEWS Plus” measures...
  - Carbon dioxide
  - Glucose
  - Pulse oximetry
  - Hemoglobin
  - White blood cell count
  - Creatinine
  - Potassium
  - End tidal CO<sub>2</sub>



## MEWS scores in Clinical Summary

TEST, ANN		DOB: 01/01/1989(21y) ♀ TLH - 2RC	
Allergies: (1  )		Diagnosis: (0)	
PT#4000107154		MR# 404884	
Medicine - TLH			
Patient Record Clinical Summary Charting Plan of Care Orders Visit			
Summary /Handoff		Vitals and I/O	
Problems		Lab	
Meds and Orders		Clin Docs	
Radiology		Transcri	
Vitals		Intake and Output	
I&O (Detailed)		Input/Outputs Graph	
Vitals Graph		Ht/WT	
Problems			
3 Days ▶			
		10/27/2010 15:39	
		10/27/2010 15:35	
Vital Signs			
Temperature		105	
Pulse		99	
Blood Pressure		150/88 H	
Respiratory Rate		185 H	
Pulse Oximetry		25	
O2 Setting		1 LPM	
O2 Device		Humidified O2	
Glucose, POC, manual mg/dL (Accu ...		55 L	
MEWS (Rapid Response)			
MEWS Score		4	
MEWS Score Plus		5	
MEWS Change in Patient		Acute change in heart rate < 40 or > 130 bpm, Acute change in conscious state	
MEWS Suggested Action		Consider calling a Rapid Response	

## MEWS and Main Line Modified “MEWS Plus” Scoring

### Rapid Response (MEWS) Testing Only - No Action Required

#### WORKFLOW ONLY FORM

MEWS Score

MEWS Score Plus

The calculation of Modified Early Warning System Scores (MEWS) is part of a project to identify trends in patient status. Starting 12/20/2010, data will be collected in order to analyze and correlate the calculated scores to MIT and Code occurrences.

[Click here for more information about the MEWS](#)

### MLH MEWS\* (Modified Early Warning System)

\*"MEWS" and "MEWS plus" score is calculated every time a vital sign assessment is saved.

Score defaults to zero, if there is no value.

Score	3	2	1	0	1	2	3
Respirations		< 8		9-14	15-20	21-29	> 30
Pulse		< 40	40-50	51-100	101-110	111-129	> 129
Systolic BP	< 70	71-80	81-100	101-199		> 200	
Temperature (C)		< 35.0	35.1- 36	36.1 - 38	38.1 - 38.5	> 38.6	
Level of Consciousness	Unresponsive	Responds to Pain	Responds to Verbal	WNL	Agitated		

### MLH MEWS Plus \*\* (Additional Labs and Assessments)

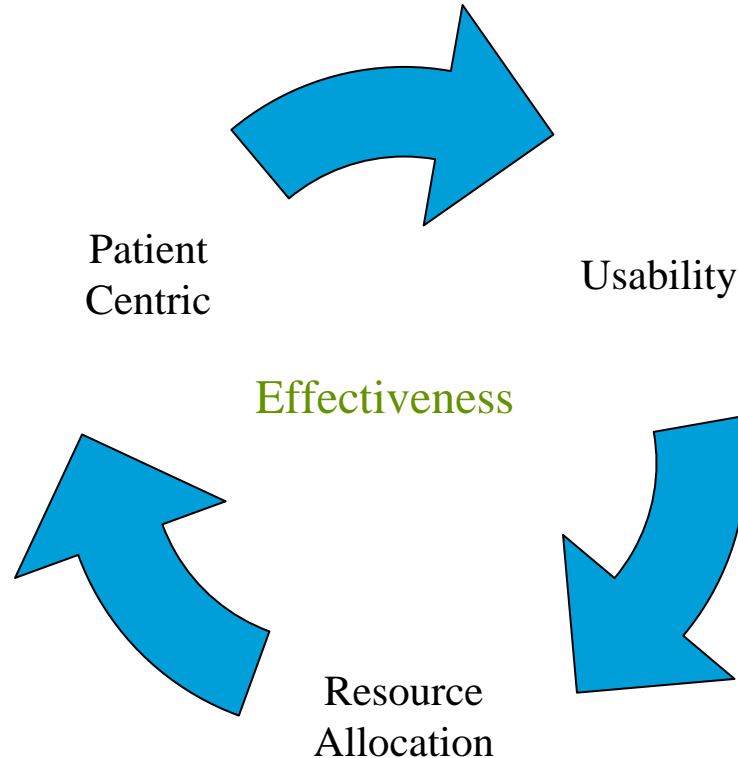
\*\*The lab results are taken from the latest result for the patient's visit.

Carbon Dioxide	< 14	14 - 17	18 -21	22 - 32	> 33		
Glucose	< 40	40 - 59	60 -69	70 - 99	100 - 349	> 350	
Pulse Oximetry	< 85	85 -89	90 -94	95 - 100			
Hemoglobin	< 7	7 - 8.9	9 - 11.9	> 12			
WBC Count	< 1	1 - 1.9	2 - 4.4	4.5 - 10.8	10.9 - 13	13.1 - 20	> 20
Creatinine				0.8 - 1.3	1.4 - 1.8	1.9 -2.5	> 2.6
Potassium	< 2.4	2.5 -2.9	3 -3.5	3.6 - 5.1	5.2 - 5.5	5.6 - 5.9	> 6
End-Tidal CO2 (ETCO2)				35 - 45	46 - 50	> 50	



- **Metric types to consider-**

- Utilization - Are the order-sets and alerts being utilized?
- Clinical Outcomes
- Efficiency



## Metrics and Outcomes

Complex Workflow	Findings to Date	Action
Falls	Nursing Documentation - Charting incomplete – gap between event recording system and EMR	Effectiveness and Compliance – Performance Improvement
Pressure Ulcers – automated workflow reporting	Reduction of ~70 hours/month nursing time for point prevalence studies	Efficiency – Projected annualized savings ~0.5 FTE
Heart Failure – Management of Core Measure Heart Failure	Role-specific alert reports Quality – 8 Case Management – 1 Nurse Practitioner – 6 Physicians - 6	Utilization of Alerts. Feedback to clinicians, evaluation care process, Compare compliance improvement to reimbursement

## Metrics and Outcomes

Complex Workflow	Findings to Date	Action
Central Lines	<p>Baseline: Daily manual collection of data – central lines/unit.</p> <p>Current: 2 months of data, 1 hospital. 225 lines - full documentation of insertion and clinical assessments - 8 % non-compliant</p>	<p>Feedback to clinicians; daily reports available to Infection Preventionists and Infection Control.</p>
Rapid Response	<p>Application is running “in the dark”</p>	<p>Analysis being conducted on the relationship between the MEWS and MEWS+ to actual rapid response events and codes.</p>

## Metrics and Outcomes

Advanced Workflow	Findings to Date	Action
Stroke : <ul style="list-style-type: none"> <li>•Patients considered for tPA</li> <li>•Patients receiving tPA</li> <li>•Average time (in minutes) CT Scan order to CT scan completion</li> <li>•Average time (in minutes) ED registration to tPA Administration</li> </ul>	Alert Utilization for DVT – Demonstrates low alert usage (18%) when DVT Prophylaxis is missing.	Reconvene with design group to investigate underlying reasons for low alert usage.



## Advanced Workflows Require Alignment of Technology, Technique, Teamwork

- Clinical Decision Support and Workflow Technology are complex, need careful design and need to be meaningful.
- Select processes that are common, manual and labor intensive, and high impact, patient-safety intensive.
- Rapid, iterative, design sessions are essential for changing complex processes.
- Successful design involves a balance of participants, time management and solutions.
- Metrics are essential for evaluating, improving and evaluating again.



**Thank you. Please feel free to contact us.**

## **Contact Information**

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