TRANSLATING GUIDELINES INTO PRACTICE: IMPROVING CONTINUOUS GLUCOSE MONITORING DEVICE VALIDATION FOR PATIENTS USING INSULIN PUMPS DURING HOSPITALIZATION

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UVA | SCHOOL of NURSING

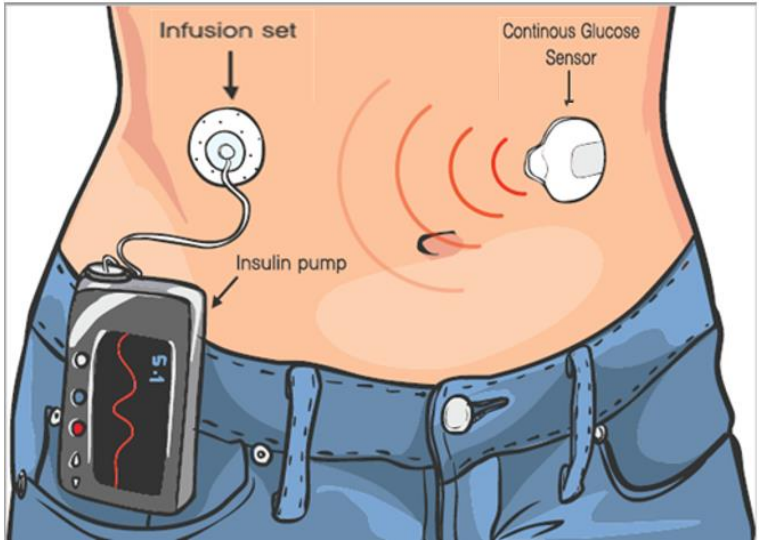
BACKGROUND

- Type 1 Diabetes increasing in prevalence in both adults and children
    - 3% annual increase since 2000 (t1dindex.org)
    - 1 out of every 30 families impacted (t1dindex.org)
- Covid increases risk for newly diagnosed diabetes (T1D and T2D) (Barrett et al.,2022; Metwally et al., 2021)

SIGNIFICANCE

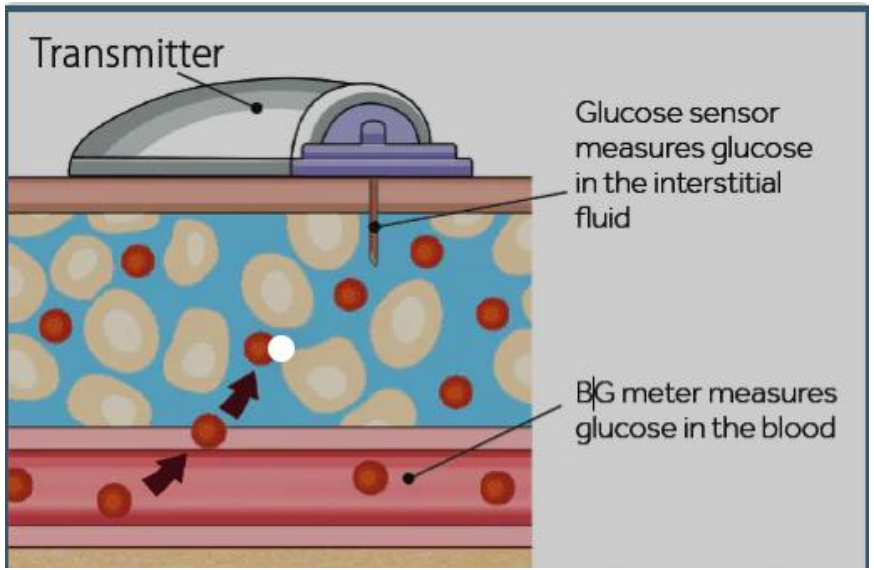
- Approximately 60% of T1D patients choose wearable diabetes technology to manage glucose (Foster et al., 2019)
- National organizations recommend continuation of diabetes technology during hospitalization (Elsayed et al., 2023; Galindo et al., 2020; Korytkowski et al., 2022)
- CGM and AID not FDA approved for inpatient management

DIABETES TECHNOLOGY



- Wearable diabetes technology
  - Insulin pumps
  - Continuous Glucose Monitors (CGMs)
  - Automated Insulin Delivery (AID) mode
- Improves glycemic measures (time in range) and outcomes (reduced A1c) (Elsayed et al., 2023; Galindo et al., 2020; Korytkowski et al., 2022)

DIABETES TECHNOLOGY - CGM



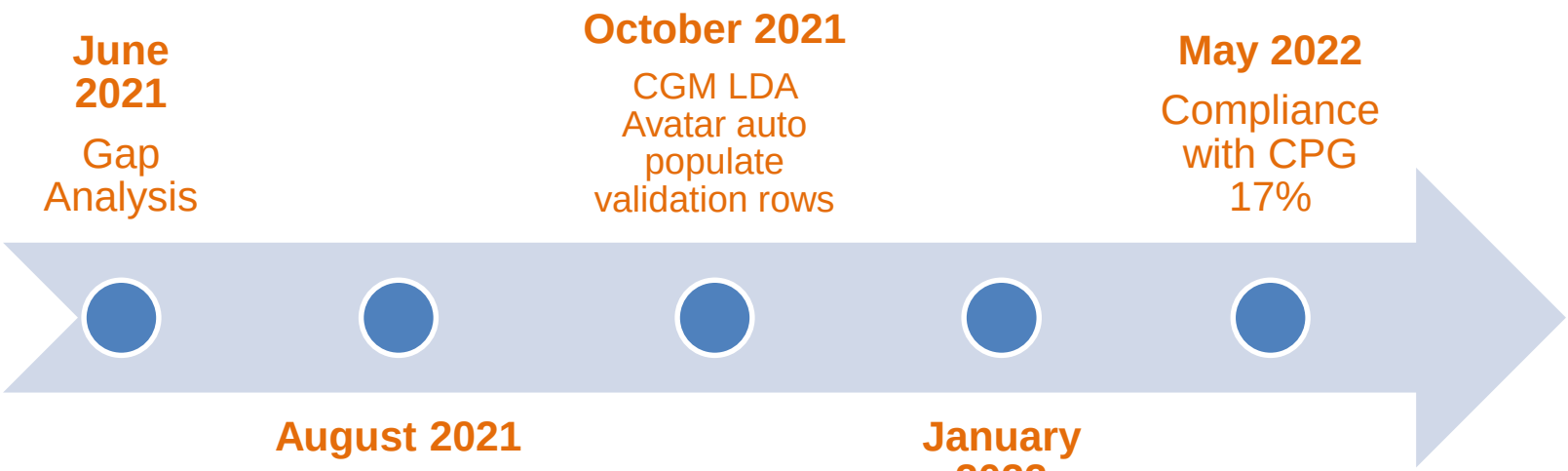
- Interstitial glucose vs capillary glucose
- Unknown effects on device accuracy
  - Dehydration
  - Fluid overload
  - Acidosis
  - Vasoactive infusions
  - External radiation
- Know effects on device accuracy
  - Hydroxyurea
  - Acetaminophen
  - Vitamin C

OPPORTUNITY FOR IMPROVEMENT

June 2021 TJC issued Quick Safety 59: Safe use of insulin pumps and CGM devices during hospitalization

- Personal glucose testing devices (CGMs) should be validated for accuracy against hospital's glucose meter

TIMELINE OF IMPROVEMENT



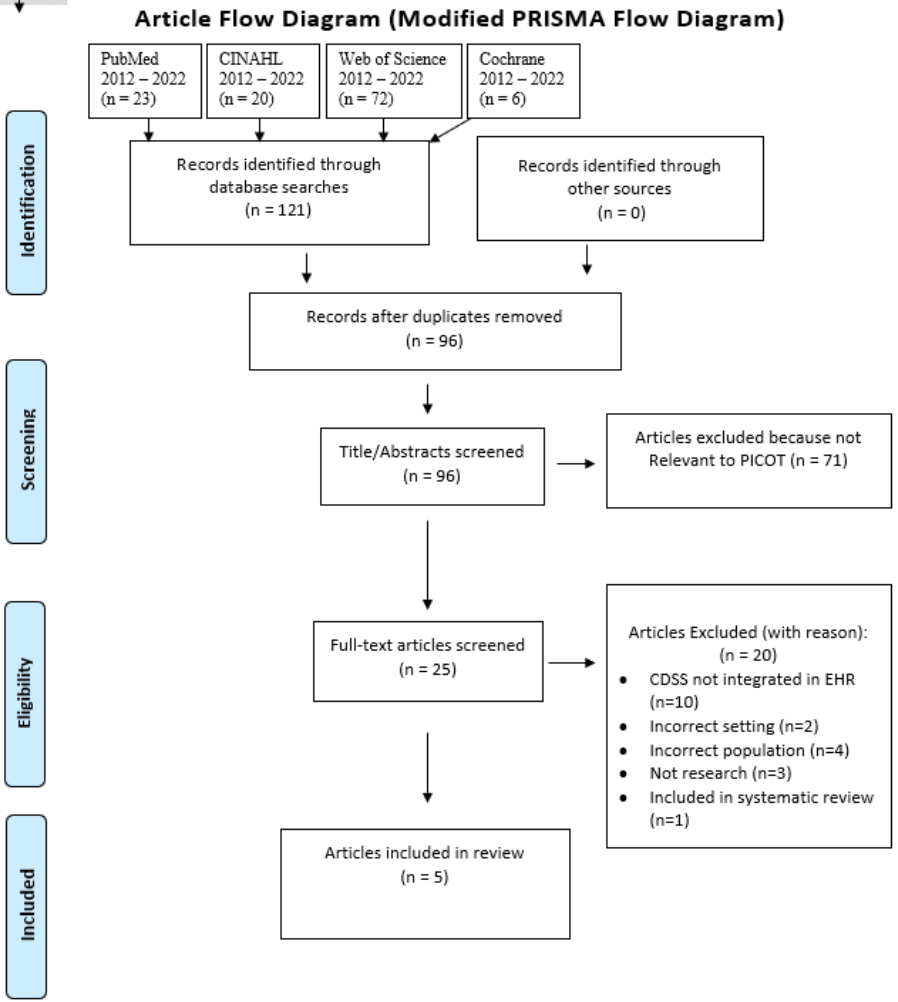
CLINICAL DECISION SUPPORT

- Clinical decision support (CDS) provides clinicians with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health care (ONC, 2018)
    - Computerized alerts or reminders
    - Condition specific order sets
    - Clinical guidelines
    - Focused data reports
    - Documentation templates
- CDS benefits include increased quality of care, avoidance of adverse events, and improved efficiency and clinician satisfaction

PICOT

The purpose of the evidenced based review of the literature was to answer the following nursing practice question:

Among nurses working in inpatient settings (P), does clinical decision support embedded within the EHR (I), improve adherence to clinical practice guidelines (O) during hospitalization (T)?



REVIEW OF LITERATURE

1. Clinical Decision Support Systems
2. Nurs*
3. Guideline Adherence

- 3 Integrative reviews
- 1 RCT
- 1 Quasi experimental

REVIEW OF LITERATURE

Themes

1. CDS embedded within the EHR that provides actionable information improves nursing process outcomes
2. CDS commonly implemented along with educational intervention thereby limiting knowledge on the impact of CDS alone

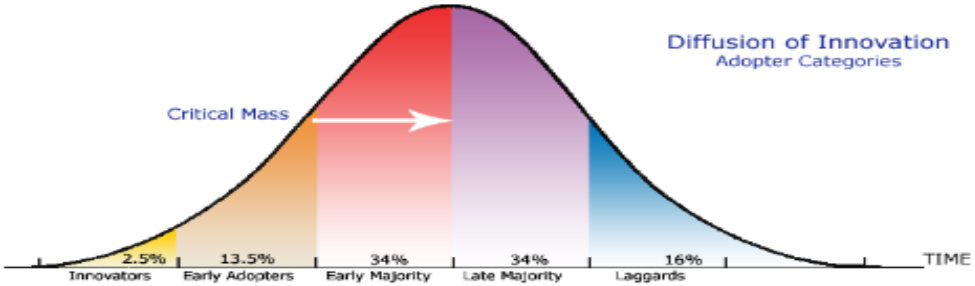
Sufficient but not strong evidence to support the use of CDS that is embedded within the EHR to improve nursing adherence to CPGs

THEORETICAL FRAMEWORK

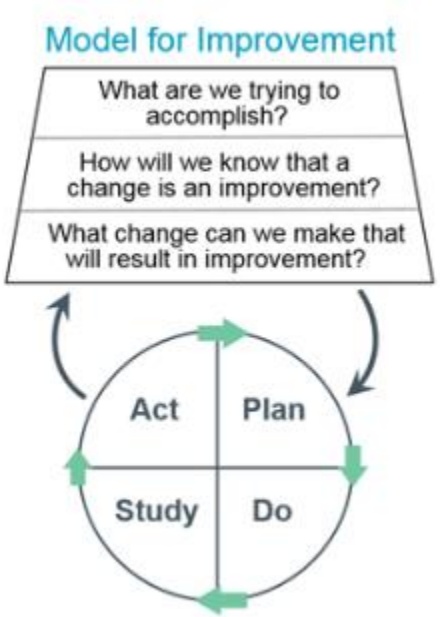
Diffusion of Innovation Theory states that there are specific characteristics that determine adoption of new technology:

1. Observability – degree to which results of innovation are visible to adopters
2. Relative advantage – degree to which innovation is perceived to be superior to current practice
3. Compatibility – degree to which the innovation is perceived to be consistent with socio-cultural values, pervious ideas, and/or perceived needs
4. Trialability – degree to which innovation can be experience on a limited basis
5. Complexity – degree to which an innovation is difficult to use or understand

Distribution of adopters



IMPLEMENTATION FRAMEWORK



Project Aim:

Increase the percentage of patients admitted to the hospital wearing an insulin pump and a CGM who have their CGM validated per the institutional clinical practice guideline

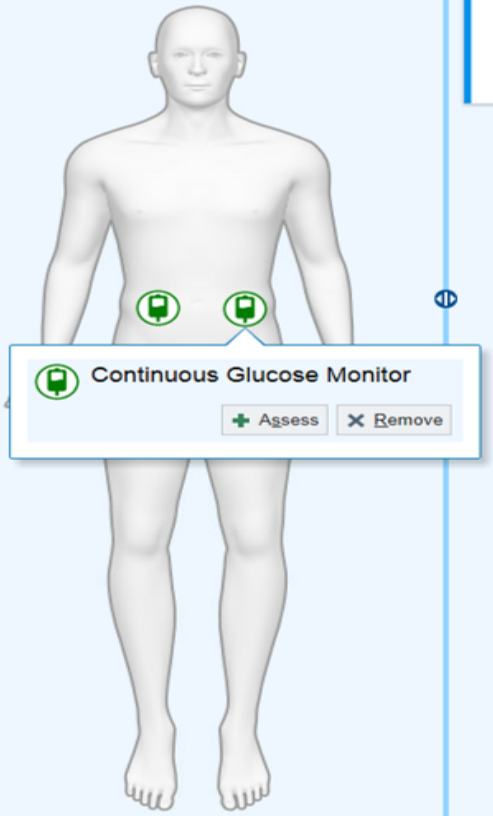
DESIGN

1. **PLAN** - Develop a test of change
    - Form a team: Collaboration with nurse informaticist
    - Set the Aim: Improve RN documentation
    - Establish measures: CGM validation per CPG
    - Test of Change: Nursing task for Epic “brain”

Avatar

Add LDA (Alt+L) + Add

(1) Insulin Subc... (2) Continuous...



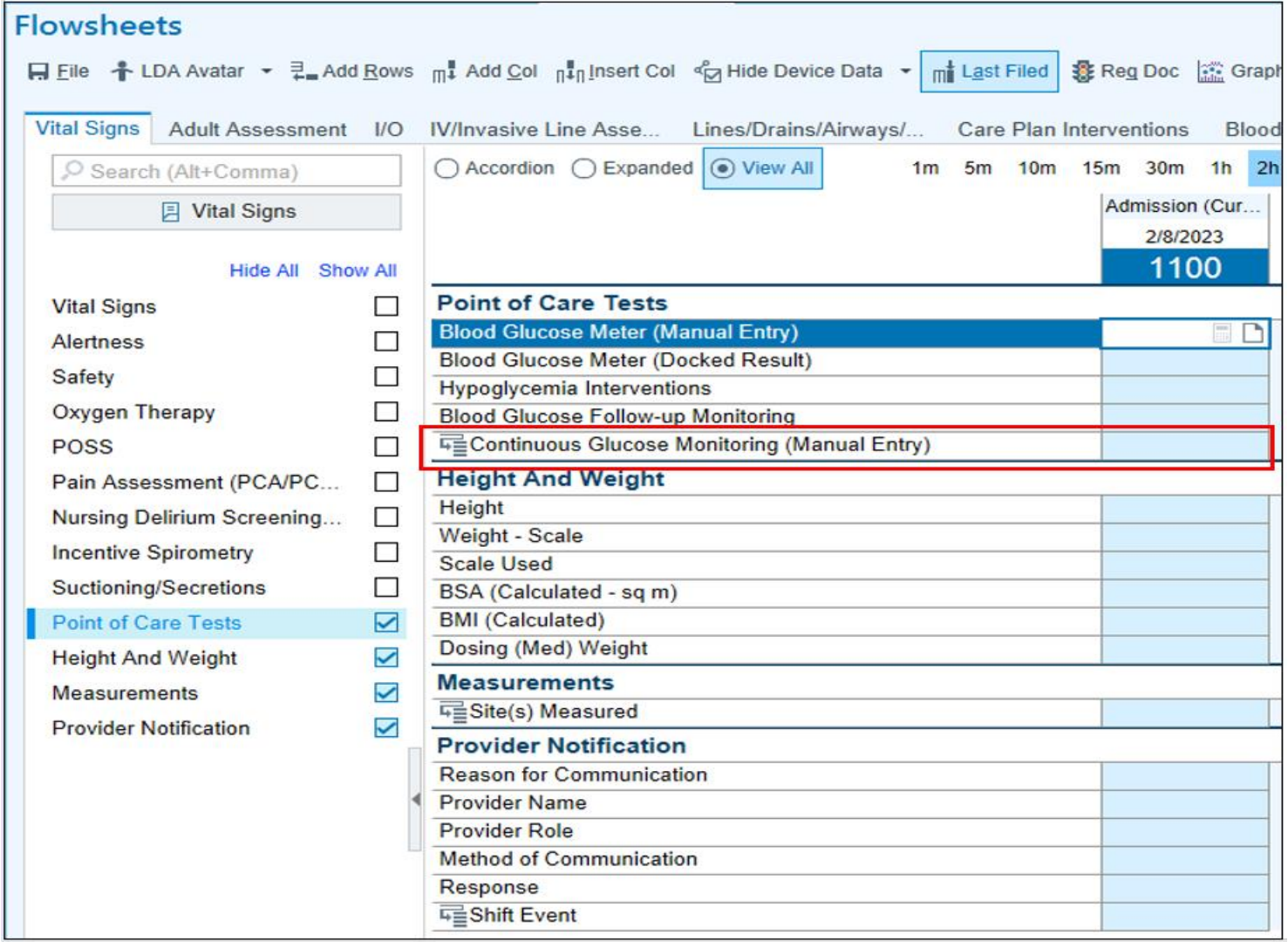
View back

Active LDAs and Wound Care

Active | Removed

Insulin Subcutaneous Infusion Set — 0 days
Placement Date/Time: 03/23/23 1648 Location Orientation: Lower;Right Site: Abdomen Inserted by: In place on arrival to facility Obvious device defects (cracks, broken or missing dials, etc) causing pump to be inoperable : No

Continuous Glucose Monitor — 0 days
Placement Date/Time: 03/23/23 1648 Location Orientation: Left;Lower Site: Abdomen Inserted by: In place on arrival to facility


Flowsheets
File
LDA Avatar
Add Rows
Add Col
Insert Col
Hide Device Data
Last Filed
Reg Doc
Graph
Vital Signs
Adult Assessment
I/O
IV/Invasive Line Asse...
Lines/Drains/Airways/...
Care Plan Interventions
Blood
Search (Alt+Comma)
Vital Signs
Hide All
Show All
Vital Signs
Alertness
Safety
Oxygen Therapy
POSS
Pain Assessment (PCA/PC...
Nursing Delirium Screening...
Incentive Spirometry
Suctioning/Secretions
Point of Care Tests
Height And Weight
Measurements
Provider Notification
Accordion
Expanded
View All
1m
5m
10m
15m
30m
1h
2h
Admission (Cur...
2/8/2023
1100
Point of Care Tests
Blood Glucose Meter (Manual Entry)
Blood Glucose Meter (Docked Result)
Hypoglycemia Interventions
Blood Glucose Follow-up Monitoring
Continuous Glucose Monitoring (Manual Entry)
Height And Weight
Height
Weight - Scale
Scale Used
BSA (Calculated - sq m)
BMI (Calculated)
Dosing (Med) Weight
Measurements
Site(s) Measured
Provider Notification
Reason for Communication
Provider Name
Provider Role
Method of Communication
Response
Shift Event

Flowsheets

File | LDA Avatar | Add Rows | Add Col | Insert Col | Hide Device Data | Last Filed | Reg Doc | Graph | Go to Date | Responsible | Refr

Vital Signs Complex | Adult Assessment | I/O | IV/Invasive Line Asse... | Lines/Drains/Airways/... | Care Plan Interventions | Restraints | Blood Administration

Search (Alt+C...

Vital Signs C...

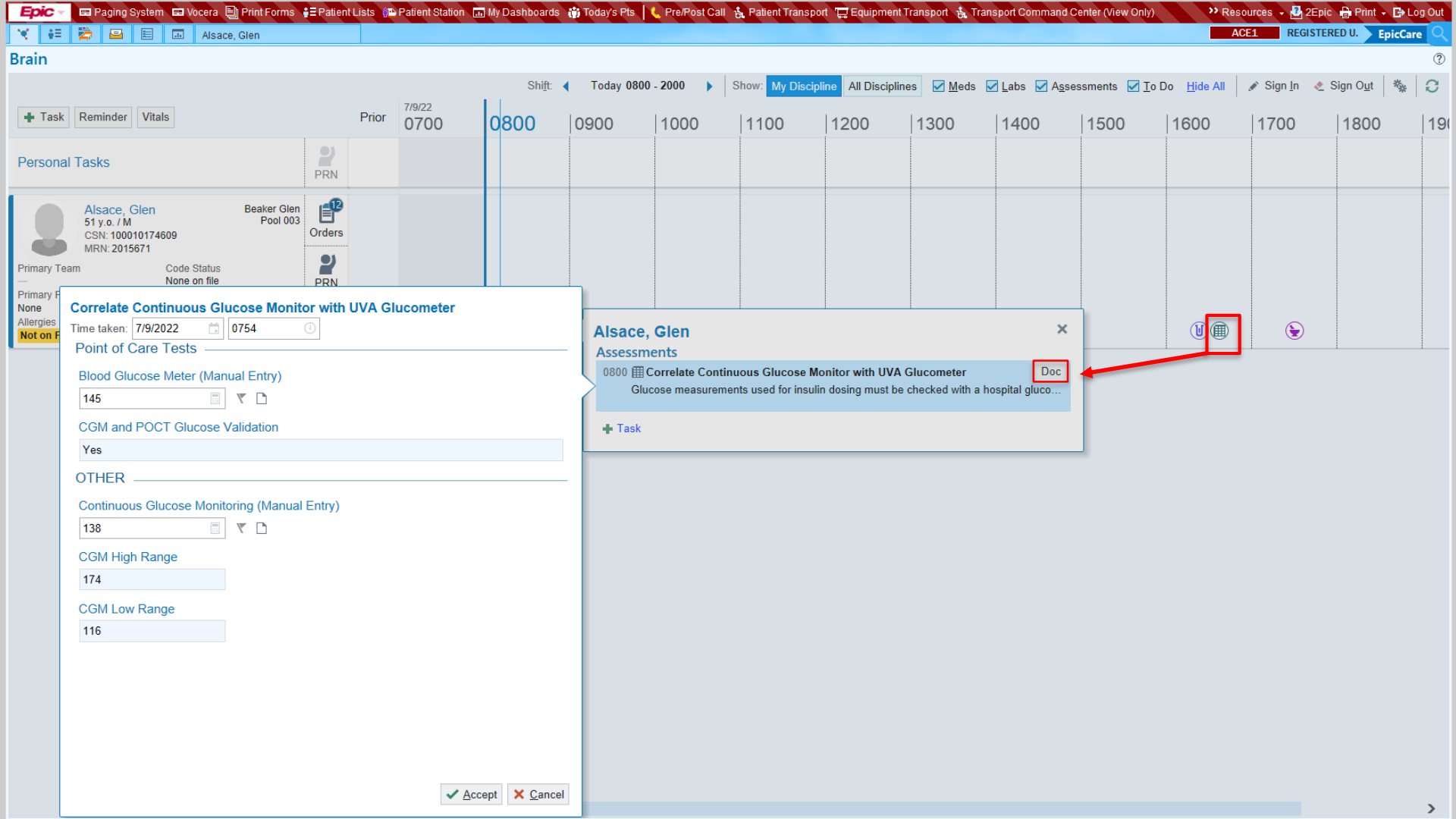
Hide All Show All

- Vitals
- Safety
- Oxygen Ther...
- CoMET Score...
- POSS
- Pain Assess...
- RASS/Deliriu...
- Nursing Deliri...
- Respiratory In...
- Point of Care...
- Height And W...
- Measurements
- Provider Notifi...

Accordion | Expanded | View All

1m 5m 10m 15m 30m 1h 2h 4h 8h 24h Interval Start: 0700 | Reset Now

	Admission (Current) from 3/21/2023 in 8 West		
	3/21/2023	3/22/2023	3/23/2023
	1400	1258	1600
Nursing Delirium Screening Scale-NuDESC (Adult Acute Care)			
Disorientation			
Inappropriate Behavior			
Inappropriate Communication			
Illusions and Hallucinations			
Psychomotor Retardation			
NuDESC Score			
NuDESC Assessment			
Respiratory Interventions			
Respiratory Interventions			
Point of Care Tests			
Blood Glucose Meter (Manual Entry)	! 225	! 250	! 225
Blood Glucose Meter (Docked Result)			
Hypoglycemia Interventions			
Blood Glucose Follow-up Monitoring			
Continuous Glucose Monitoring (Manual Entry)			220
CGM High Range			270
CGM Low Range			180
CGM and POCT Glucose Validation			Yes
Source of Validation Sample			


Epic
Paging System
Vocera
Print Forms
Patient Lists
Patient Station
My Dashboards
Today's Pts
Pre/Post Call
Patient Transport
Equipment Transport
Transport Command Center (View Only)
Resources
2Epic
Print
Log Out
Alsace, Glen
ACE1
REGISTERED U.
EpicCare
Brain
Shift:
Today 0800 - 2000
Show:
My Discipline
All Disciplines
Meds
Labs
Assessments
To Do
Hide All
Sign In
Sign Out
Task
Reminder
Vitals
Prior
7/9/22
0700
0800
0900
1000
1100
1200
1300
1400
1500
1600
1700
1800
Personal Tasks
PRN
Alsace, Glen
51 y.o. / M
CSN: 100010174609
MRN: 2015671
Beaker Glen
Pool 003
Orders
Primary Team
Code Status
None on file
Allergies
Not on F
None
Correlate Continuous Glucose Monitor with UVA Glucometer
Time taken:
7/9/2022
0754
Point of Care Tests
Blood Glucose Meter (Manual Entry)
145
CGM and POCT Glucose Validation
Yes
OTHER
Continuous Glucose Monitoring (Manual Entry)
138
CGM High Range
174
CGM Low Range
116
Accept
Cancel
Alsace, Glen
Assessments
0800
Correlate Continuous Glucose Monitor with UVA Glucometer
Doc
Glucose measurements used for insulin dosing must be checked with a hospital gluco...
Task

DESIGN

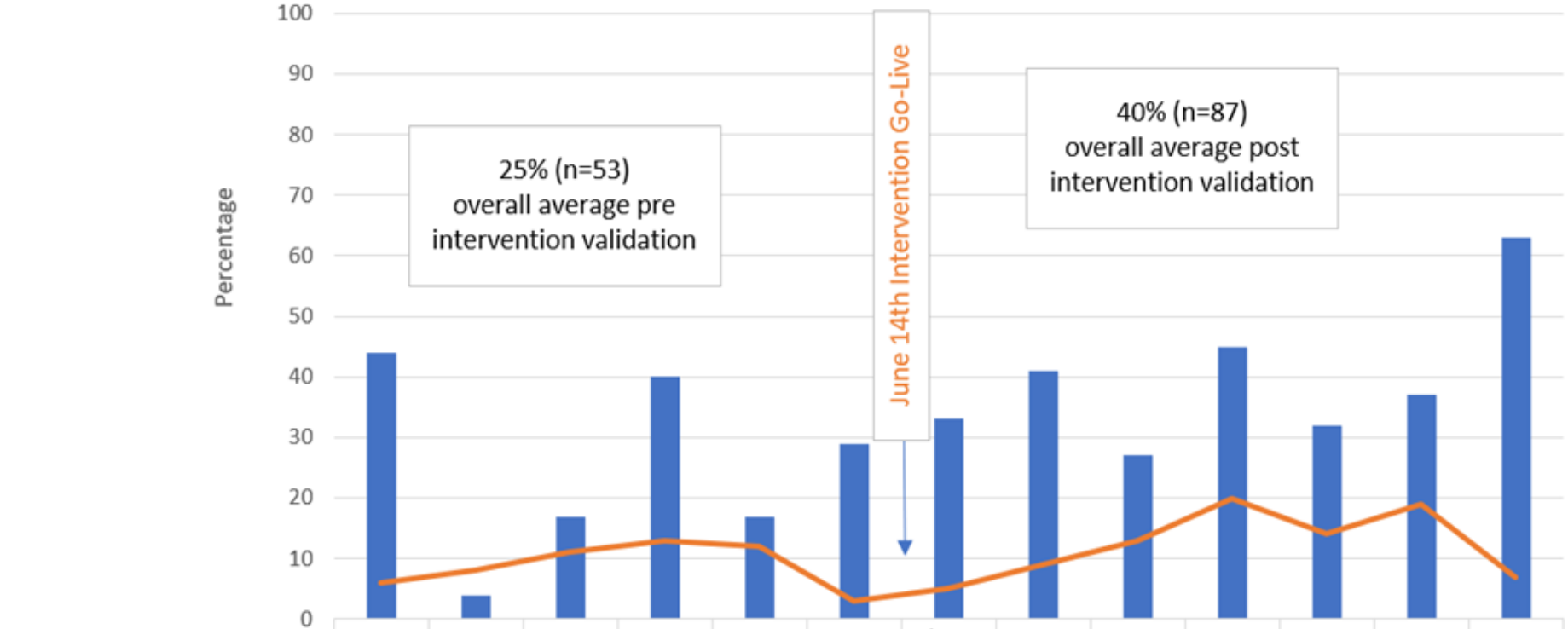
2. DO – Implement test of change

- Nursing task went live on June 14th 2022

3. STUDY – Observe and learn

- Data 6 mo. before & after implementation

Percentage of CGM validation that occured per the Clinical Practice Guideline criteria



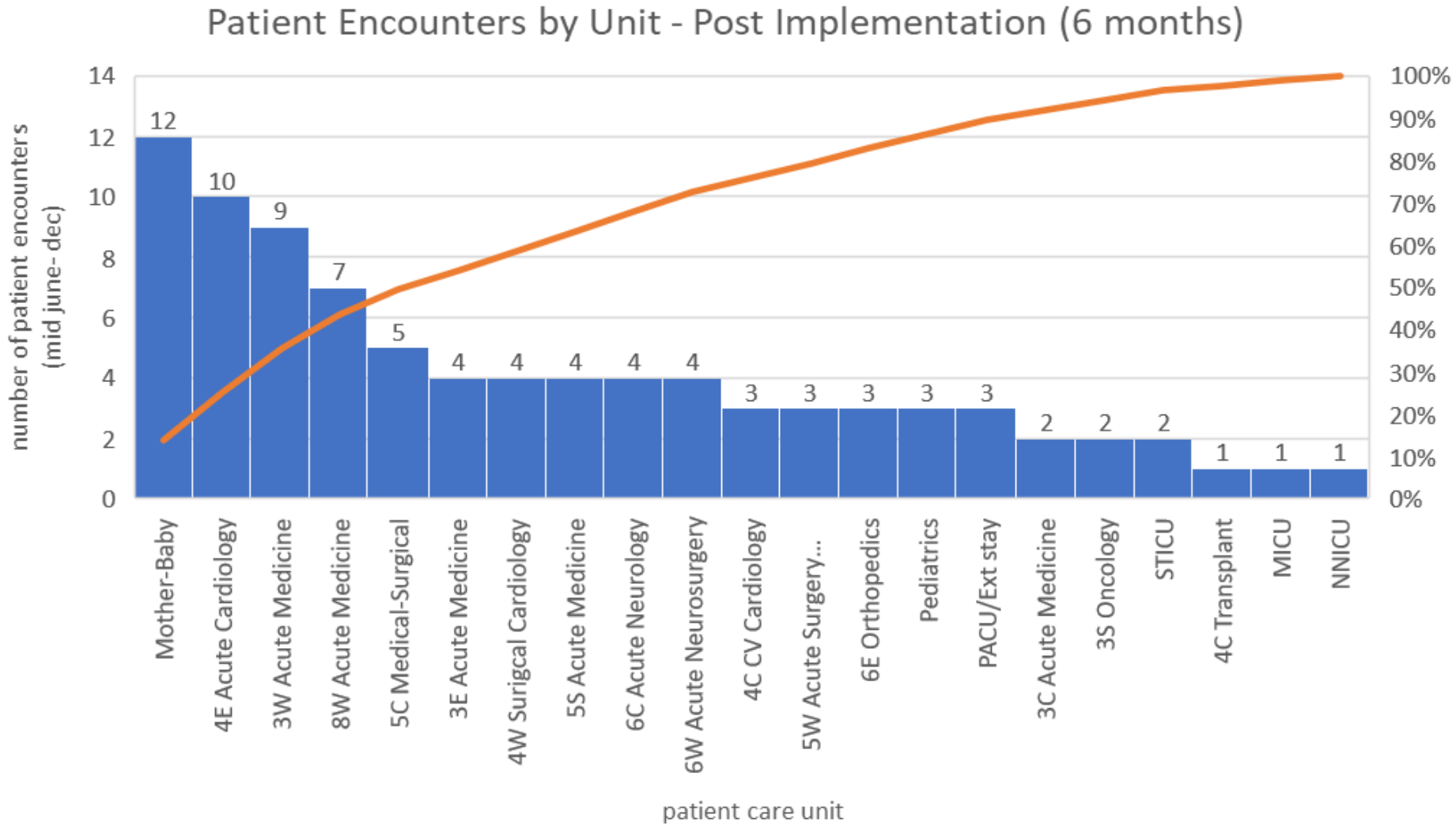
	Jan-22	Feb-22	Mar-22	Apr-22	May-22	June Pre	June Post	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Percentage CGM validation	44	4	17	40	17	29	33	41	27	45	32	37	63
Patient Encounters	6	8	11	13	12	3	5	9	13	20	14	19	7

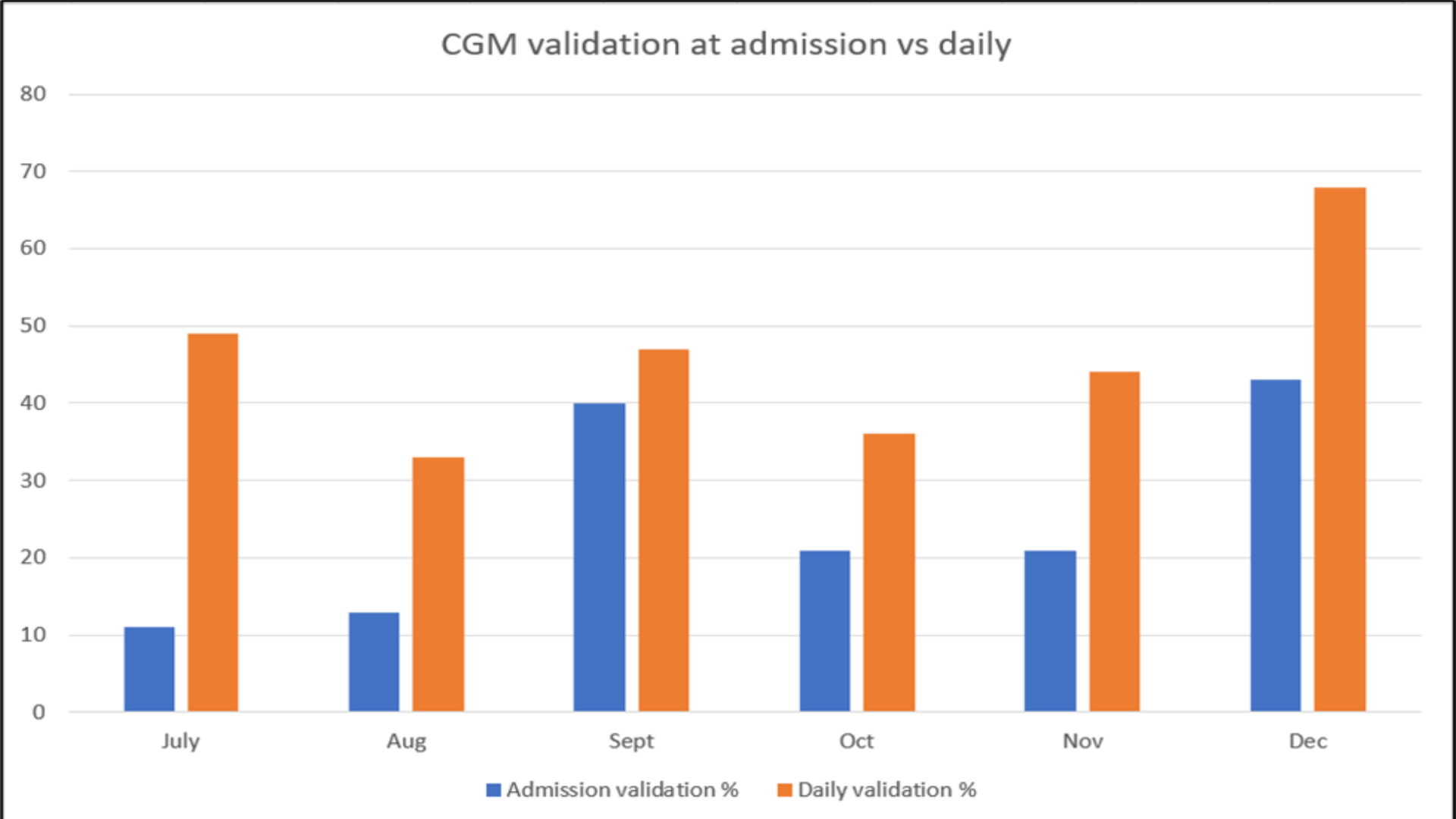
Month

DESIGN

4. ACT – Determine modifications

- Repeat cycles as needed based on results
- Plan to sustain change


Patient Encounters by Unit - Post Implementation (6 months)
number of patient encounters (mid june- dec)
patient care unit
0
2
4
6
8
10
12
14
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
12
10
9
7
5
4
4
4
4
4
3
3
3
3
3
2
2
2
1
1
1
Mother-Baby
4E Acute Cardiology
3W Acute Medicine
8W Acute Medicine
5C Medical-Surgical
3E Acute Medicine
4W Surigcal Cardiology
5S Acute Medicine
6C Acute Neurology
6W Acute Neurosurgery
4C CV Cardiology
5W Acute Surgery...
6E Orthopedics
Pediatrics
PACU/Ext stay
3C Acute Medicine
3S Oncology
STICU
4C Transplant
MICU
NNICU

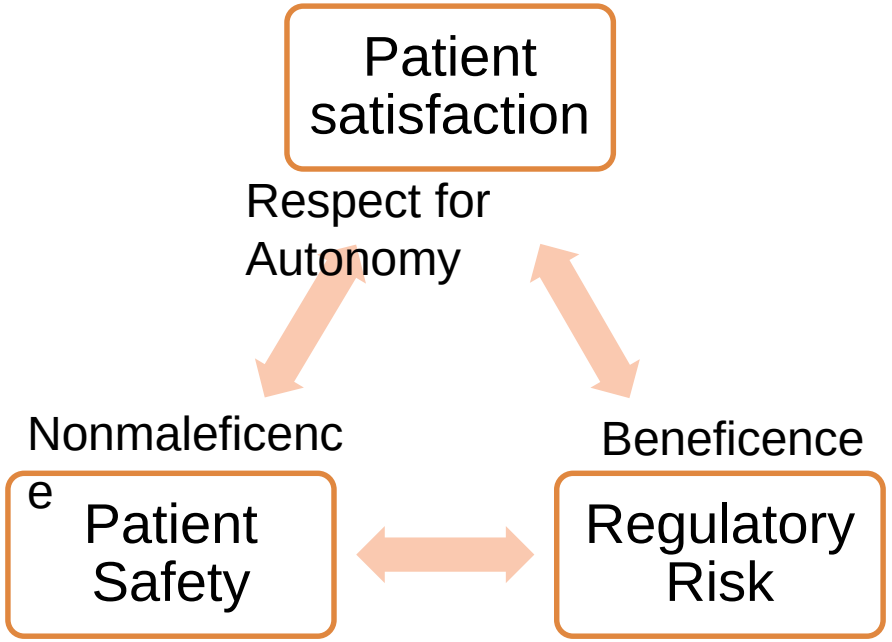

CGM validation at admission vs daily
80
70
60
50
40
30
20
10
0
July
Aug
Sept
Oct
Nov
Dec
Admission validation %
Daily validation %

FINANCIAL ANALYSIS

Financial impact of intervention to organization

- EHR build
- Data collection and interpretation
- Sustainability

ETHICAL ISSUES



DIVERSITY EQUITY INCLUSION

Table 1. Participant Characteristics

	Overall	NH Black	Hispanic	NH White
	N = 300	N = 97	N = 103	N = 100
Diabetes technology use[a]				
Insulin pump	129 (43%)	17 (18%)	40 (39%)***	72 (72%)*,**
CGM	135 (45%)	27 (28%)	38 (37%)	70 (71%)*,**

(Agarwal et al., 2021)

CONCLUSION - CDS

- CDS targeted at nursing processes can improve compliance with CPGs
- Contextual elements within EHR impact effectiveness of CDS

CONCLUSION – DIABETES TECHNOLOGY

- Validation of CGM supports patient self management and safe use of diabetes technology during hospitalization

ACKNOWLEDGEMENTS

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Questions?

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