



Advantages of Programming and Implementing an Internally Developed NICU/Newborn Nursery cPOE

Beth Israel Deaconess Medical Center
Boston, Massachusetts

AIM

To develop a Computerized Provider Order Entry (cPOE) program that mimics the order sets and forms that were currently being used in the NICU and Newborn Nurseries.

SETTING

48 bed Level III NICU, Academic Medical Center
Approximately 5,000 deliveries per year

METHODS

IMPLEMENTATION

The team began meeting in June, 2008.

The neonatal formulary weight based dosages were programmed into cPOE using the existing renal dosing for adults.

Clinicians worked directly with our medical center programmers to develop a user friendly cPOE with good work flow.

The cPOE went live in our NICU and Newborn nurseries on November 29, 2011.

ASSESSMENT

To assess one measure of impact of the cPOE implementation, we reviewed orders for parenteral nutrition entry for 3-month periods prior to and after cPOE launch. Parenteral nutrition is the most complicated platform within cPOE. Orders were reviewed for number requiring revision after pharmacy review.

To assess staff satisfaction, a survey was sent to NICU clinicians in September 2013.

TEAM

- Chair: Susan Young CNS
- Clinical Systems: Laura Ritter-Cox, Mary Biagiotti
- Dietitian: Claire Shoaie
- MDs: Munish Gupta, Stephanie Hale, Camilia Martin, DeWayne Pursley, Vincent Smith
- NPs/PA: Aimee Madden, Mary Ann Ouellette, Mary Quinn, Laura Tannenbaum
- RNs: Radka Arnold, Janine Caruso, Jane Smallcomb, Deirdre Wooley
- Pathology: Gina McCormack
- Pharmacists: May Adra, Holly Creveling, Greg Dumas, Christine Huynh, Rena Lithotomos
- Pharmacy Information Systems: Steve Maynard
- Pharmacy Interns: Jessica Baron, Lauren Escobar
- Programmers: Kevin Afonso, Jeanne Hurley, Nan Zullo
- Respiratory Therapist: Nina Koyama

CORRESPONDING AUTHOR:

Greg Dumas, RPh
gdumas@bidmc.harvard.edu

RESULTS: cPOE DEVELOPMENT

NICU Daily Orders Entry Screen

Fluid Goal: 100 mL/kg/day
M Day of Life: 1 PMA: 28 w 1 d Adm: 09/29/13 SR-968-02
Gest Age at Birth: 28 w 0 d

Birth Weight: 1110 grams (2.45 lbs)
Daily Weight - 09/30/13: 1110 grams (2.45 lbs)
Daily Weight - 09/29/13: 1110 grams (2.45 lbs)
Daily Weight - 09/28/13: Not Recorded

Total Fluid Goal: 100 mL/kg/day (Effective: 09/30/13 @ 1146)
Overall Fluid Status (mL/kg/day)

Current Orders

Change	DC	Current Total Fluid Goal: 100 mL/kg/day	Recorded by: JUNA/MARY	Effective as of: 09/30/13 @ 1146
Change	DC	CHANGE Custom PN at 75.7 mL/kg/day	Start: 09/30/13 @ 1800	TO Custom PN at 75.7 mL/kg/day
Change	DC	CHANGE Diet: NPO	Start: 09/29 @ 1230	TO Diet: PG
Change	DC	Heparin (Preservative Free) 0.5 UNIT per 1 mL in 5% Dextrose	Continuous at 20 mL/kg/day via DLUVIC (Dual Lumen Umbilical Venous Catheter)	Start: 09/30 @ 1800 End: 10/01 @ 1700
Change	DC	Heparin (Preservative Free) 0.5 UNIT per 1 mL in 5% Dextrose	Continuous at 30 mL/kg/day via DLUVIC (Dual Lumen Umbilical Venous Catheter)	Start: 09/30 @ 0202
Change	DC	Heparin (Preservative Free) 0.5 UNIT per 1 mL in 5% Dextrose	Continuous at 30 mL/kg/day via DLUVIC (Dual Lumen Umbilical Venous Catheter)	Start: 09/30 @ 0052

The internally developed cPOE programming allowed customization to include:

- a scrolling view of all active orders
- the ability for clinicians to make changes and enter new orders while scrolling through active orders
- a total fluid goal bar created by all parenteral and enteral orders
- display of birth weight and weight from last 3 days

Original Paper PN Order Form

Beth Israel Deaconess Medical Center
NEONATAL PARENTERAL NUTRITION (PN) ORDER FORM

1. Starter PN: Complete Sections A and H. Order STAT.
2. All other PN orders: complete sections A through G.
A 24 hour supply of neonatal parenteral nutrition must be ordered daily. Refer to pharmacy by 1300.

A. Calculation Weight: _____ kg

B. LABORATORY DATA
Please document most recent lab data. Date: ____/____/____
Na⁺ _____ Cl⁻ _____ Ca²⁺ _____ BUN _____ SCr _____
K⁺ _____ CO₂ _____ Mg²⁺ _____ P_i _____ TIG _____
WBC _____ Hgb _____ Gluc (1) _____ Gluc (2) _____

C. PN INFUSION RATE
1) Total Fluid Goal Rate: _____ mL/kg/day
2) Total Fluid Goal (weight adjusted): _____ mL/kg/day
3) Total Fluids (C1+C2): _____ mL/kg/day
4) Total Fluids - Rate (C1+C2) x 24: _____ mL/kg/day
5) Total PN Rate: _____ mL/kg/day
6) Total PN for 24 hours (C3 x 24) (Pharmacy will add event): _____ mL/kg/day
7) Total PN weight adjusted (C4) x 100: _____ g/100mL

D. PROTEIN
1) Intake desired: Choose 1, 1.5, 2, 2.5, 3, 3.5 _____ g/kg/day
2) Intake desired (D1) x PN: _____ g/day
3) Total PN for 24 hours (D2) _____ mL/kg/day
4) Protein concentration (D3) = (D3) x 100 _____ g/100mL

E. PN SOLUTION
1) PN Route: _____
2) Order details (check one):
a) Preterm PN (C1/C2) _____
b) Term PN (C3) _____
3) Order details (check one):
a) Intake desired _____
b) Intake desired and % Ca²⁺ _____
c) Intake desired and % Ca²⁺ and % P_i _____
d) Intake desired and % Ca²⁺ and % P_i and % Mg²⁺ _____

F. PN CALORIE CALCULATIONS
1) Total carbohydrate (CHO) (kcal/kg/day): _____
2) Total protein (kcal/kg/day): _____
3) Total fat (kcal/kg/day): _____
4) Total calories per body weight = (F1) + (F2) + (F3) _____ kcal/kg/day
5) Glucose infusion rate (GIR) for previous day _____ mg/kg/min
6) Glucose infusion rate (GIR) for today _____ mg/kg/min

G. CENTRAL NUTRITION
1) Calories _____ kcal/kg/day
2) Protein _____ g protein/kg/day
3) Fat _____ g/kg/day

H. STARTER PN
1) Control Line: Dextrose 10 g/100 mL + Protein 6 g/100 mL with calcium gluconate 2 mL/100 mL + heparin 50 units/100 mL @ 50 mL/kg/day
2) Peripheral Line: Dextrose 10g/100 mL + Protein 3 g/100 mL @ 50 mL/kg/day

I. SIGNATURES
Order Date: ____/____/____ Order Time: (24 hour): _____
Signature: _____
Print Name: _____
Order Fax Time (24 hour): _____
Print Name: _____
Signature: _____

cPOE PN Order Form

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NEONATAL PARENTERAL NUTRITION (PN) ORDER FORM

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Please document most recent lab data. Date: ____/____/____
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2) Order details (check one):
a) Preterm PN (C1/C2) _____
b) Term PN (C3) _____
3) Order details (check one):
a) Intake desired _____
b) Intake desired and % Ca²⁺ _____
c) Intake desired and % Ca²⁺ and % P_i _____
d) Intake desired and % Ca²⁺ and % P_i and % Mg²⁺ _____

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2) Total protein (kcal/kg/day): _____
3) Total fat (kcal/kg/day): _____
4) Total calories per body weight = (F1) + (F2) + (F3) _____ kcal/kg/day
5) Glucose infusion rate (GIR) for previous day _____ mg/kg/min
6) Glucose infusion rate (GIR) for today _____ mg/kg/min

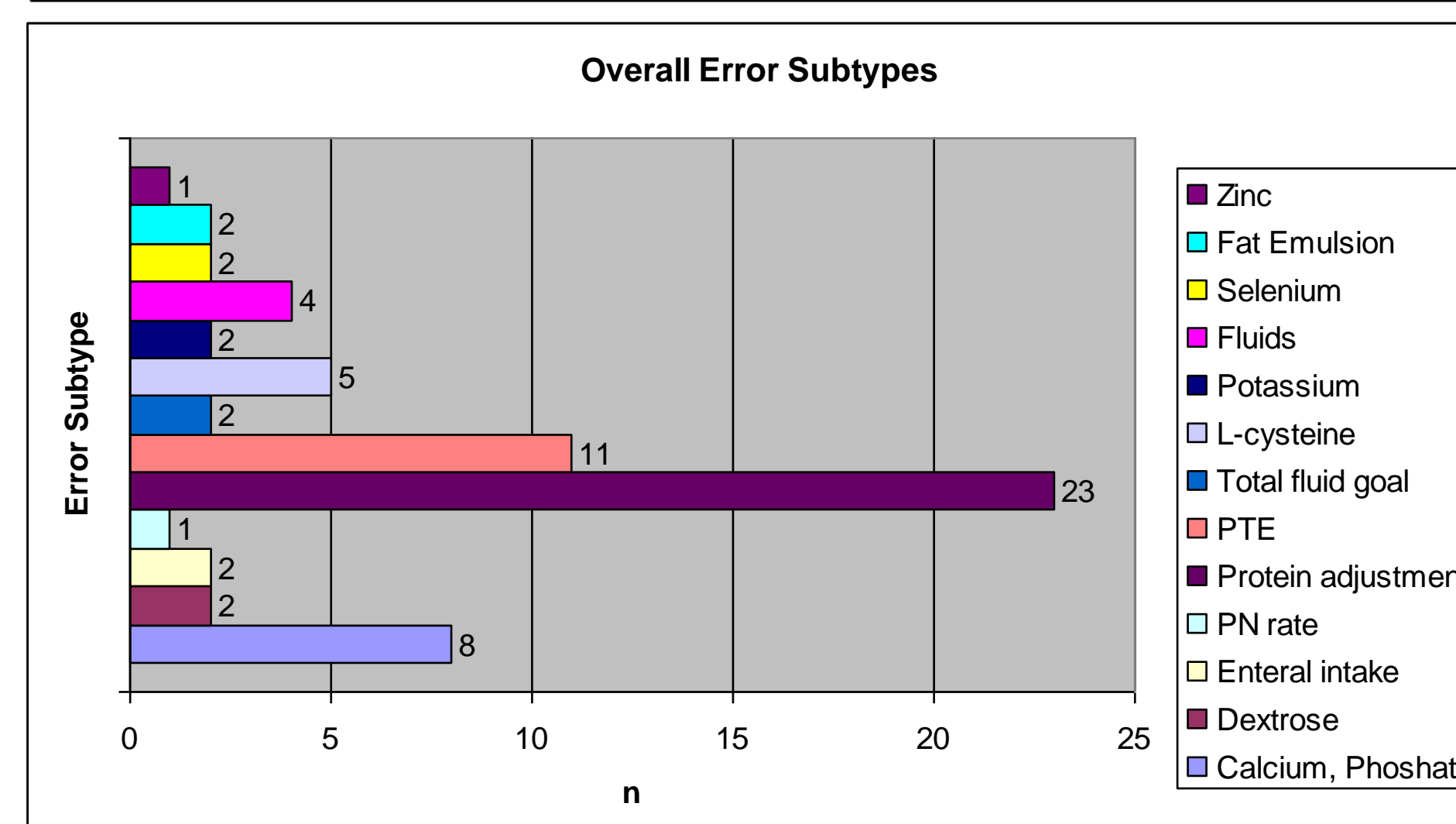
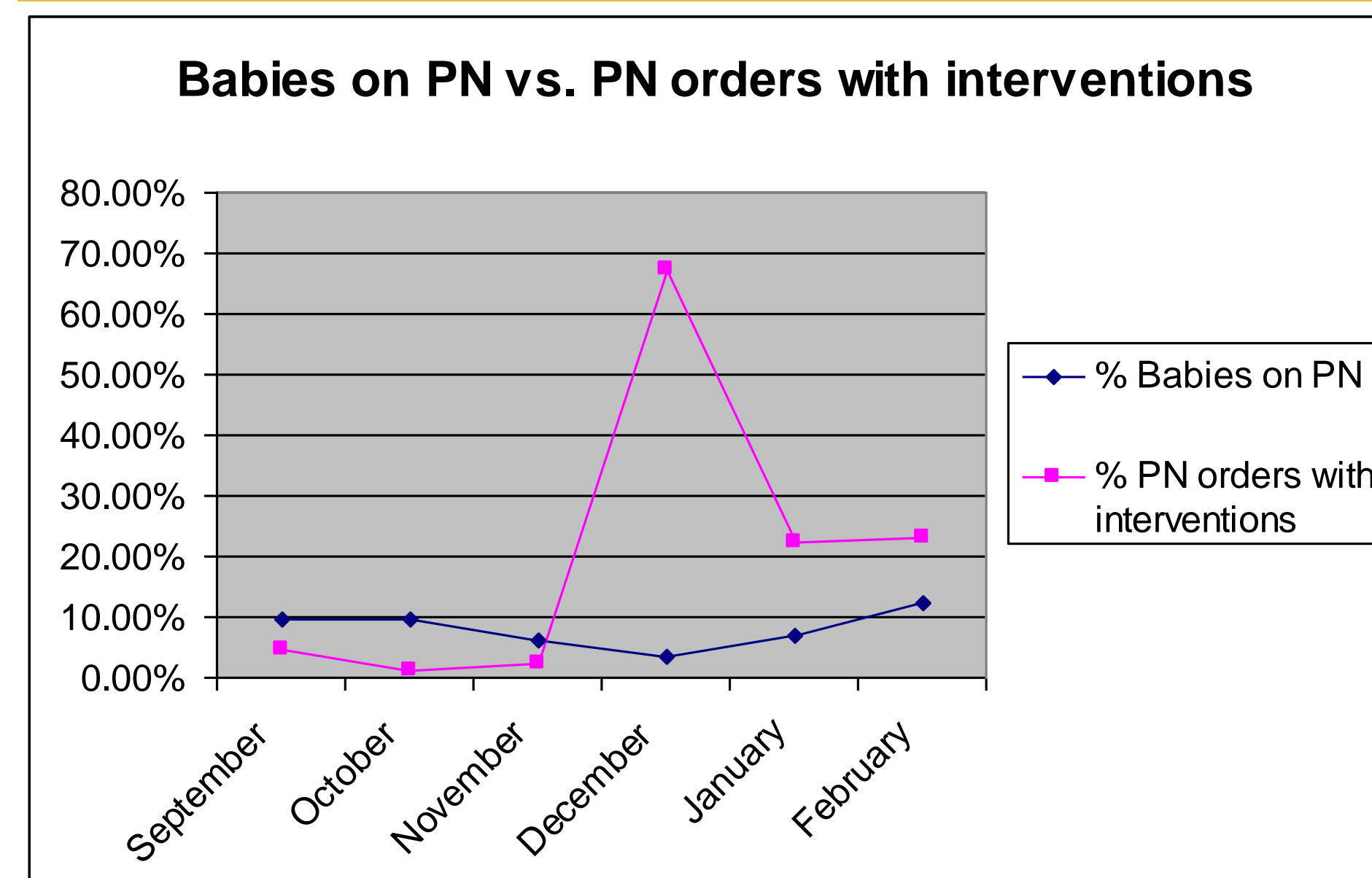
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1) Calories _____ kcal/kg/day
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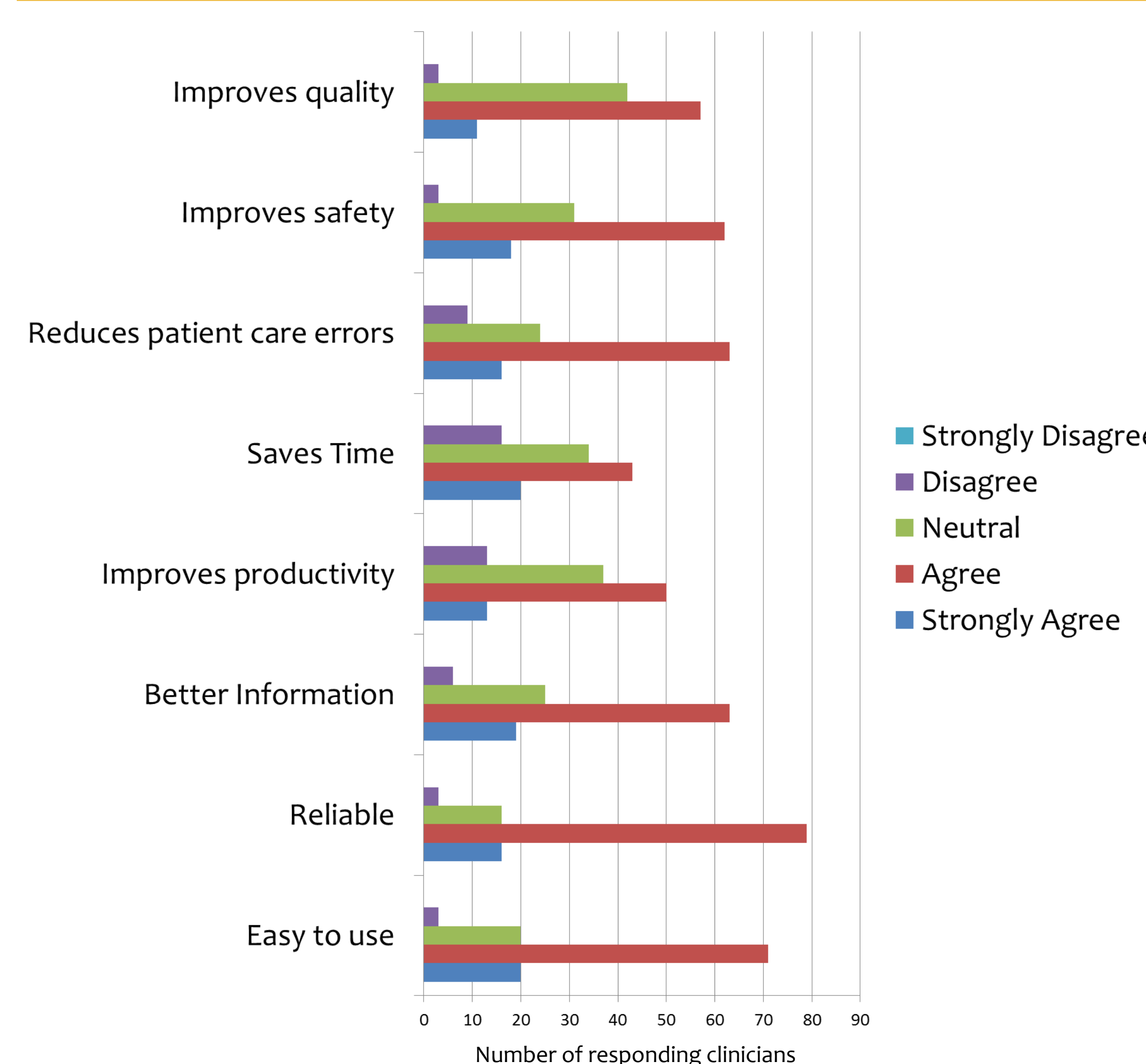
I. SIGNATURES
Order Date: ____/____/____ Order Time: (24 hour): _____
Signature: _____
Print Name: _____
Order Fax Time (24 hour): _____
Print Name: _____
Signature: _____

RESULTS: cPOE ASSESSMENT

Order Revisions Pre- and Post- cPOE



Survey of NICU Staff cPOE Users



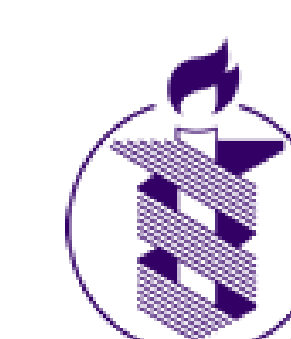
110 clinicians responded to the survey and 81% felt satisfied with cPOE.

LESSONS LEARNED

- Internally developed cPOE programs allow clinicians to work closely with programmers to reflect established clinical processes.
- Following implementation of cPOE, more pharmacy interventions were seen with PN orders than with paper order entry.
- Developing a PN order for cPOE that could do calculations and osmolarity checking proved to be a challenge. The paper form was more time consuming, but communicated changes more clearly than the cPOE PN order.
- Additives held for clinical issues were crossed out on the paper form making the change visible. With cPOE, the additive is deleted from the printed form which resulted in ordering and compounding errors.
- It is important to retest all aspects of cPOE when it is launched to insure that the functionality in Test is transferred to Live.

NEXT STEPS

- Add a feature to the cPOE PN order entry so that additives that are held are highlighted rather than deleted.
- Keep paper orders updated with cPOE format in case there is a computer downtime.
- Continue to update cPOE to maintain patient safety and reflect clinical practice changes.
- Continue to evaluate cPOE to insure that it accommodates order entry for infrequent clinical occurrences.



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