Feeding Protocols: Evaluating Utilization and Outcomes using Digital Electronic Health Record (EHR) Tools

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BACKGROUND

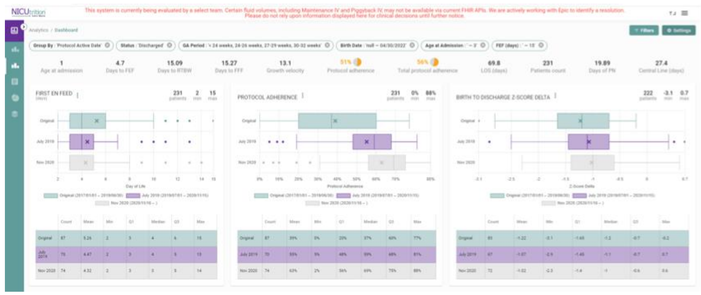
- Evidence-based feeding protocols improve nutrition and neonatal outcomes in preterm infants
- Digital tools that harness data collected in the Electronic Health Record (EHR) is urgently needed

PURPOSE AND HYPOTHESIS

- Improving compliance with established feeding advancement protocols will improve neonatal outcomes by decreasing time to full enteral feeds and reducing parenteral nutrition days

MATERIALS AND METHODS

- A .NET application to extract data directly from the EHR using secure Fast Healthcare Interoperability Resources Application Programming Interfaces (FHIR APIs) was developed
- An intuitive, user-friendly display was developed applying a proprietary Nutrition IQ framework to three complex feeding protocols over a 5 year period
- Inclusion criteria identified 227 unique individuals
  - <38 weeks estimated gestational age
  - Admitted before 3 days I
  - 3 cohorts
    - Cohort 1- infants born <30-week gestation (96)
    - Cohort 2 - EGA 30 0/7 to 32 6/7 (121)
    - Cohort 3 - birthweight <1500g (135)
- Exclusion
  - Infants whose feeds initiated at 15 days or more were excluded from data analysis to account for surgical diagnoses (19)



PROTOCOLS

- Protocol 1 – advance by 10-30ml/kg (weight-based); fortification with bovine human milk fortifier(bHMF) at 80 and 100ml/kg; ELBW have 3-5 day trophic (20ml/kg)
- Protocol 2 –advance 15-40ml/kg; shortened trophic interval to 3 days or less; fortification with bHMF to 24kcal/oz at 90ml/kg
- Protocol 3 – BWT <1250 grams fortified with human milk HMF to 26kcal/oz (24kcal/oz at 80ml/kg/d, 26kcal/oz at 105ml/kg/d); volume increments same as protocol 2, infants >1250g fed under protocol 2

RESULTS

- Baseline characteristics of cohorts did not statistically differ
- Compliance with feeding protocols increased steadily across the feeding protocols reaching statistical significance in all groups (Tables 1 and 2)
- Comparing protocol 1 to 3 showed a statistically and clinically significant decrease in days until the first fortification in all cohorts (Tables 1, 2)
- Days on parenteral nutrition (PN) trended towards a decrease in cohorts 1&2 (Table 1) but was unchanged in cohort 3
- Time to full enteral feeding volume decreased in all cohorts from protocol 1 to 3, reaching statistical significance in cohort 1 (Table 1) and approaching significance in cohort 3 (Table 2)
- NEC was identified as a balancing measure to alterations in feeding protocols. Data for NEC from 2017-2020 for cohort 3 (2.7-5.7%) did not differ between protocols 1, 2 or 3. NEC rates during the EHMD protocol were lower than previous years recorded (1.7%) but the period and number of patients with NEC are too few to establish a correlation with the EHMD protocol.

CONCLUSIONS

- Measuring the effectiveness of enteral feeding protocols is costly and time prohibitive
- Implementing software that harnesses EHR data allows for real-time monitoring of protocol adherence and patient outcomes, enabling clinical teams to continuously educate staff and make adjustments to improve patient outcomes

Table 1	Cohort 1: <30 weekers			
Age at Admission to 3 days Excludes infants that start feeds >15 days	Protocol 3	Protocol 2	Protocol 1	P Value Protocol 1 vs 3
# Infants	23	24	49	
Birthweight, grams	1089	1050	1105	
Mean GA @ Birth	27 4/7	27 3/7	27 3/7	
First Enteral Feed (# days)	4.6	4.9	5.8	0.1013
First Fortification (# days)	13.3	16.0	20.3	**0.0069**
First Full Feed (# days)	18.2	18.4	21.9	0.1673
Protocol Compliance	70%	62%	41%	**2.786E-07**
PN Days	21.5	24.2	23.2	0.6117
Length of Stay	90.6	90.7	78.6	0.1810
Birth to D/C Weight Z-score Delta	-1.2	-1.2	-1.3	0.3907
Birth to D/C HC Z-score Delta	-0.1	-1.1	-0.7	0.1075

Table 2	Cohort 2: 30 0/7 week - 32 6/7 week			
Age at Admission to 3 days Excludes infants that start feeds >15 days	Protocol 3	Protocol 2	Protocol 1	P Value Protocol 1 vs 3
# Infants	35	42	44	
Birthweight, grams	1726	1619	1591	
Mean GA @ Birth	31 5/7	31 3/7	31 1/7	
First Enteral Feed (# days)	4.1	3.7	4.4	0.5424
First Fortification (# days)	9.6	10.0	13.5	**0.0203**
First Full Feed (# days)	8.7	10.0	13.7	**0.0071**
Protocol Compliance	58%	56%	39%	**1.935E-04**
PN Days	12.4	9.8	14.9	0.5401
Length of Stay	51.1	48.2	48.8	0.7639
Birth to D/C Weight Z-score Delta	-1.0	-0.9	-1.1	0.3180
Birth to D/C HC Z-score Delta	-0.2	-0.5	-0.6	**0.0577**

Table 3	Cohort 3: VLBW <1500 g			
Age at Admission to 3 days Excludes infants that start feeds >15 days	Protocol 3	Protocol 2	Protocol 1	P Value Protocol 1 vs 3
# Infants	33	39	63	
Birthweight, grams	1146	1136	1125	
Mean GA @ Birth	28 4/7	28 6/7	28 2/7	
First Enteral Feed (# days)	4.6	4.6	5.5	0.1617
First Fortification (# days)	12.3	15.5	18.9	**0.0027**
First Full Feed (# days)	16.1	17.3	20.2	0.0727
Protocol Compliance	60%	58%	41%	**4.193E-05**
PN Days	21.4	20.2	21.0	0.9172
Length of Stay	82.2	75.3	71.6	0.1709
Birth to D/C Weight Z-score Delta	-1.1	-1.0	-1.2	0.3196
Birth to D/C HC Z-score Delta	-0.1	-0.7	-0.6	**0.0757**

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Protocol 1 – feed volume advanced by 10-30ml/kg based on birth weight categories; 2 step fortification with bovine human milk fortifier(bHMF) at 80 and 100ml/kg/d; 3-5 day trophic (20ml/kg/d) feedings for ELBW infants.
Protocol 2 – feed volume advancement 15-40ml/kg/d; shortened trophic interval to 3 days or less; single step fortification with bHMF to 24kcal/oz at 90ml/kg
Protocol 3, infants born under 1250 grams were fortified with human milk based HMF with advancement to goal 26kcal/oz (fortify to 24kcal/oz at 80ml/kg/d, 26kcal/oz at 105ml/kg/d); volume increments same as protocol 2, infants >1250g fed under protocol 2

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