ashp MIDYEAR 2017
Clinical Meeting & Exhibition

A Call to Action: Optimizing the Electronic Health Record in Parenteral Nutrition

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Disclosure

Michael Kraft

Baxter Healthcare: Advisory Board

All other planners, presenters, and reviewers of this session report no financial relationships relevant to this activity.

Learning Objectives

- Discuss the multi-organizational call to action paper regarding the electronic health record (EHR) in the parenteral nutrition process.
- Describe the challenges of building and configuring the EHR to optimize use in the parenteral nutrition process.
- Explain how to implement safe parenteral nutrition ordering using the EHR.

Presentation Outline:

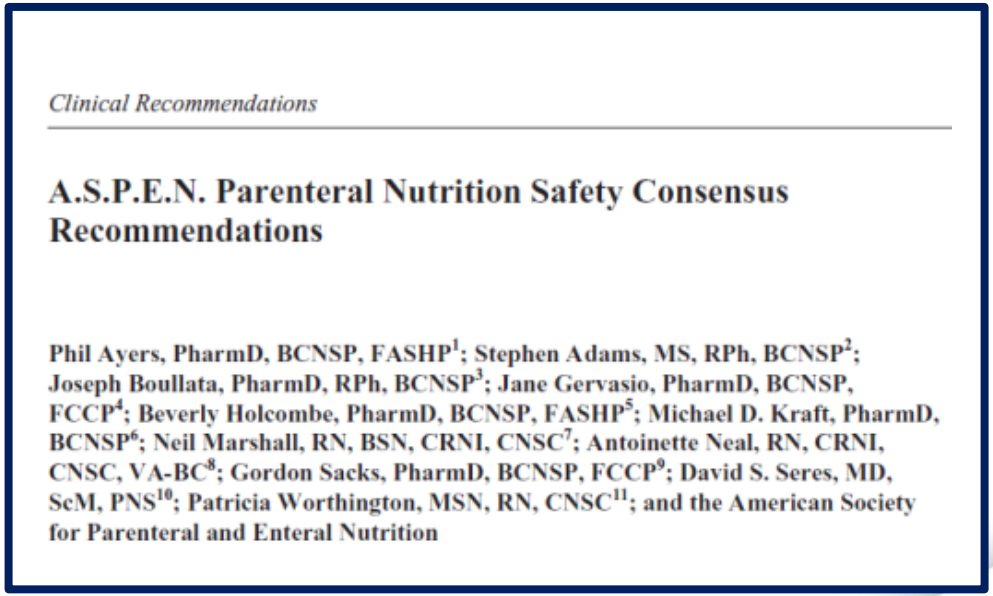
- Safe parenteral nutrition (PN) prescribing recommendations, errors and risk associated with PN prescribing
- PN workflow in EHR
- Optimizing PN Orders and PN Clinical Decision Support (CDS) in EHR
- Challenges faced when implementing/converting to new EHR vendor
- Informatics solutions to key PN workflow issues & continued challenges
- Key takeaways and future recommendations

Parenteral Nutrition Safety Efforts

- ASHP- A.S.P.E.N. PN Safety Website http://pnsafeuse.org/
- A.S.P.E.N. PN Safety Guidelines
- A.S.P.E.N. PN Safety Committee
  - ✓ PN Safety Recommendations
  - ✓ PN Competencies
- A.S.P.E.N. Clinical Nutrition Informatics Committee
  - ✓ A.S.P.E.N.-Epic PN Workgroup

  Prioritized list of PN enhancements
  - ✓ A.S.P.E.N.-ASHP-AND Workgroup

  Joint White Paper: Optimizing the EHR and PN Process



Clinical Recommendations

A.S.P.E.N. Parenteral Nutrition Safety Consensus Recommendations

Phil Ayers, PharmD, BCNSP, FASHP[1]; Stephen Adams, MS, RPh, BCNSP[2]; Joseph Boullata, PharmD, RPh, BCNSP[3]; Jane Gervasio, PharmD, BCNSP, FCCP[4]; Beverly Holcombe, PharmD, BCNSP, FASHP[5]; Michael D. Kraft, PharmD, BCNSP[6]; Neil Marshall, RN, BSN, CRNI, CNSC[7]; Antoinette Neal, RN, CRNI, CNSC, VA-BC[8]; Gordon Sacks, PharmD, BCNSP, FCCP[9]; David S. Seres, MD, ScM, PNS[10]; Patricia Worthington, MSN, RN, CNSC[11]; and the American Society for Parenteral and Enteral Nutrition

Boullata JI, et. al. *JPEN J Parenter Enteral Nutr* 2014; Ayers P, et. al. *JPEN J Parenter Enteral Nutr* 2014; Guenter P, et. al. *Nutr Clin Pract* 2015; Boullata JI, et. al. *Nutr Clin Pract 2016*

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PN Prescribing Errors

- Observational study of inpatient PN use → 1.6% error rate
  - 40% of errors during transcription (39%) & prescribing (1%)
- PN ingredients for a 16-year-old boy ordered in amounts/kg/day → PN prepared in amounts/day
  - CPOE PN order template did not match ACD
  - Lack of CDS and warnings in CPOE PN order and ACD
  - Multiple points of manual transcription, lack of redundancies
- ISMP Medication Error Reporting Program- PN-related errors = 44 reports between 2006-2016
  - Compounding/dispensing = 17
  - Administration = 14

Sacks GS, et al. *Pharmacother* 2009; *ISMP Medication Safety Alert*, vol. 17(13), June 28, 2012; Guenter P, et. al. *Nutr Clin Pract* 2017, DOI: 10.1177/0884533617715868 (online)

Safe PN Prescribing – Key Recommendations

- Healthcare organizations shall use a standardized process for PN management
  - PN Policies and Procedures
  - Comprehensive PN education and competency assessment, at least annually
  - Policy addressing credentials, training and competency of individuals involved in PN ordering
  - Applicable to all patients/ages/disease states
- PN-specific Policies and Procedures
- Optimization of CPOE (EHR) and clinical decision support (CDS)
- PN-use process shall include clinicians with expertise in the area of nutrition support, preferably from multiple disciplines

Ayers P, et al. *JPEN J Parenter Enteral Nutr* 2014

ISMP Recommendations

Improving PN Safety

- Match prescribing and pharmacy templates
- Build, test, and heed automated warnings
- Heighten suspicions of errors
- Carry out effective redundancies
- Provide clear labeling
  - Label should always match the PN order template in the PN order form/CPOE system and the ACD
- Educate and validate competency
- Eliminate transcription of PN orders

ISMP Medication Safety Alert, vol. 17(13), June 28, 2012; Ayers P, et al. *JPEN J Parenter Enteral Nutr* 2014

Safe PN Prescribing – Key Recommendations

- PN shall be prescribed using a standardized order format and review process
  - Standardized electronic PN orders
  - Verbal/telephone/handwritten orders should be avoided
  - All components ordered in amounts per day (or per kg per day), avoid amount/liter, % concentration or volume
- Clinical decision support should be available and utilized to avoid exceeding recommended/safe clinical limits and limits of compatibility
  - When CPOE is not available → use a standardized order template as an editable electronic document (avoid hand-written orders)
  - Required components for the PN order and suggested sequence
  - PN label should match the sequence on the PN order

Ayers P, et al. *JPEN J Parenter Enteral Nutr* 2014

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Reducing PN Prescribing Errors

Do the Recommendations Improve Safety?

- A children's hospital adopted standardized PN process
  - Reduced PN errors from 9 (in 2004) to 2 (in 2011) per 1000 PN orders
  - Pharmacist interventions needed: 26 per 100 orders (2004) down to 6 per 100 orders (2006 and again 2009)
- Impact of computerized PN order worksheet (outside of CPOE)
  - Reduced overall PN prescribing errors 14.5% → 6.8% (p=0.016)
  - Peripheral PN order errors 29.3% → 9.6% (p=0.002)
  - 12 errors in 177 PN orders all due to data entry or transcription errors (avoidable)

AHRQ Health Care Innovations Exchange. https://innovations.ahrq.gov/profiles/standardized-ordering-and-administration-total-parenteral-nutrition-reduces-errors, Accessed Sept 24, 2017; Brown CL, et. al. *Am J Perinatol* 2007

Reducing PN Prescribing Errors

Do the Recommendations Improve Safety?

- Children's hospital implemented electronic PN ordering & compounding
  - Interdisciplinary committee evaluated PN process, identified potential error-prone practices, prioritized, developed and implemented solutions
  - Included implementation of CPOE & ACD; CDS with limits; eliminated transcription; compliance with A.SP.E.N. Guidelines & Recommendations
  - Reviewed errors reported between 2007-2013
    - Total 230 errors / 84,503 PN prescriptions
    - **Frequency of errors = 0.27%** (vs. ~ 1.6% from a previous study)
    - **Transcription errors = 0**
    - Most errors (95%) occurred during administration

MacKay M, et. al. *Nutr Clin Pract* 2016

Are We Making Progress?

Table 10. Comparison of the 2 A.S.P.E.N. PN Surveys (2003 and 2011) and the 2014 A.S.P.E.N. Member and Nonmember EHR Surveys Combined Regarding Responses to Questions on Processes Used to Order and Prepare PN.[a]

Characteristic	2003 PN Survey	2011 PN Survey	2014 EHR Survey
Method of ordering PN	n = 536	n = 876	n = 689
Handwritten	382 (71)	589 (67)	253 (37)
Nonstandard	NA	45	22
Standard	NA	544	231
Electronic	154 (29)[b]	287 (33)[b]	436 (63)[b]
Nonstandard	NA	121	95
Standard	NA	166	341
Used to limit order entry errors[c]	NA	n = 114	n = 491
Limit space in free text fields	NA	43 (38)	149 (30)
Use checkboxes instead of free text	NA	57 (50)[d]	296 (60)
Auto-populate as many fields as possible	NA	38 (33)	204 (42)
Maintain entire order on a single screen	NA	57 (50)	205 (42)
Dosing guidelines and decision support tools are built into the system	NA	62 (54)	246 (50)
Order cannot be submitted until all required fields are complete	NA	60 (53)	263 (54)
Pharmacy computer software system separate from organization's EHR	NA	n = 722	n = 630
Yes	NA	353 (49)	339 (54)
Method of data entry into pharmacy system	NA	n = 337	n = 600
Automatic electronic interface with EHR	NA	51 (15)[d]	188 (32)
Barcode entry from a printed label/requisition	NA	11 (3)	26 (4)
Do you use ACD for PN compounding?[e]	n = 159	n = 608	n = 465
Yes	140 (88[f])[b]	410 (67)[b]	330 (71)[b]
How are PN orders entered into ACD?	n = 123	n = 396	n = 416
Manual entry (technician)	NA	112 (28)[d]	68 (16)
Manual entry (pharmacist)	103 (84)	211 (53)	233 (56)
Automatic electronic interface with EHR	20 (16)[b]	73 (19)[b]	115 (28)[b]

- Overall ~ 94% of respondents using an EHR (vs. 86% in 2012, $p<0.05$)
- Overall ~ 52% favorable response to PN ordering
  - Pharmacists: 55/120 (46%)

Vanek VW, et. al. *Nutr Clin Pract* 2016

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Many Challenges…

- Substantial time & effort, input/expertise from all disciplines
  - Including pharmacists, physicians, dietitians, nurses, NPs/PAs
  - **Informatics team/experts**
- May depend on EHR vendor, EHR version, “package” purchased
- No standard amongst EHR platforms (yet…)
- Integration of EHR and separate pharmacy system and/or ACD
  - May include customized/compounded PN vs. standard commercial PN
  - May utilize external company to outsource PN compounding
- Education, adoption by end-users
- Refining and optimizing system and process
- Transitions of care / home care

Limitations to Technology and CDS

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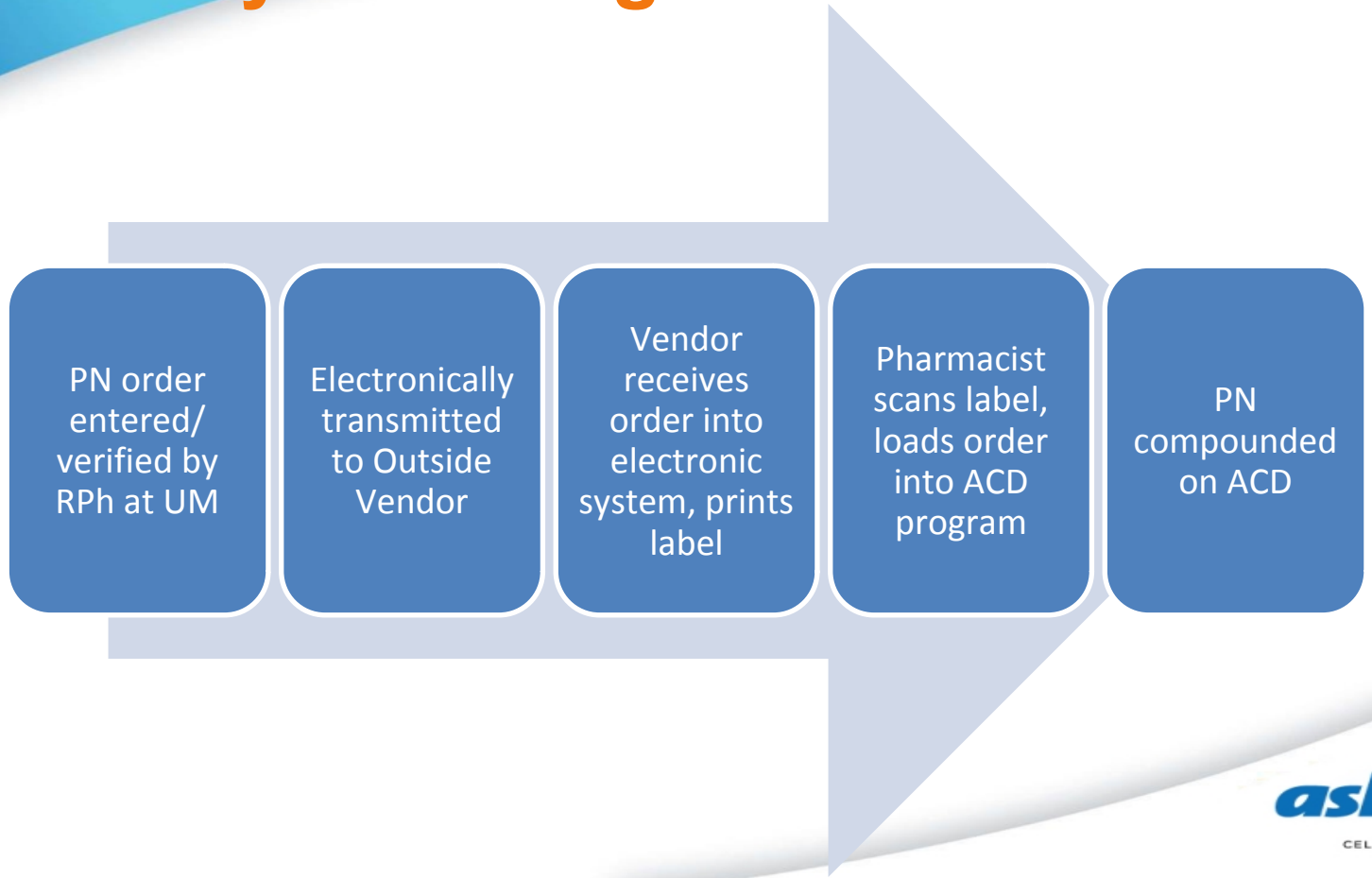
University of Michigan PN Order Process



Learning Assessment Question #1

Which of the following is the MOST accurate statement regarding PN safety ?

A. A.S.P.E.N. and ISMP recommend using non-standard PN orders on paper to maximize flexibility and customizability of PN orders

B. There have been almost no coordinated efforts or advances in PN safety over the past ~ 5 years

C. Based on a recently published survey, most hospitals have optimized PN ordering in their EHR systems, including complete electronic transmission of PN orders and optimized use of CDS

D. Recent data suggest that optimizing PN orders and CDS in EHR systems can improve PN safety and reduce PN-associated errors

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PARENTERAL NUTRITION WORKFLOW IN THE ELECTRONIC HEALTH RECORD

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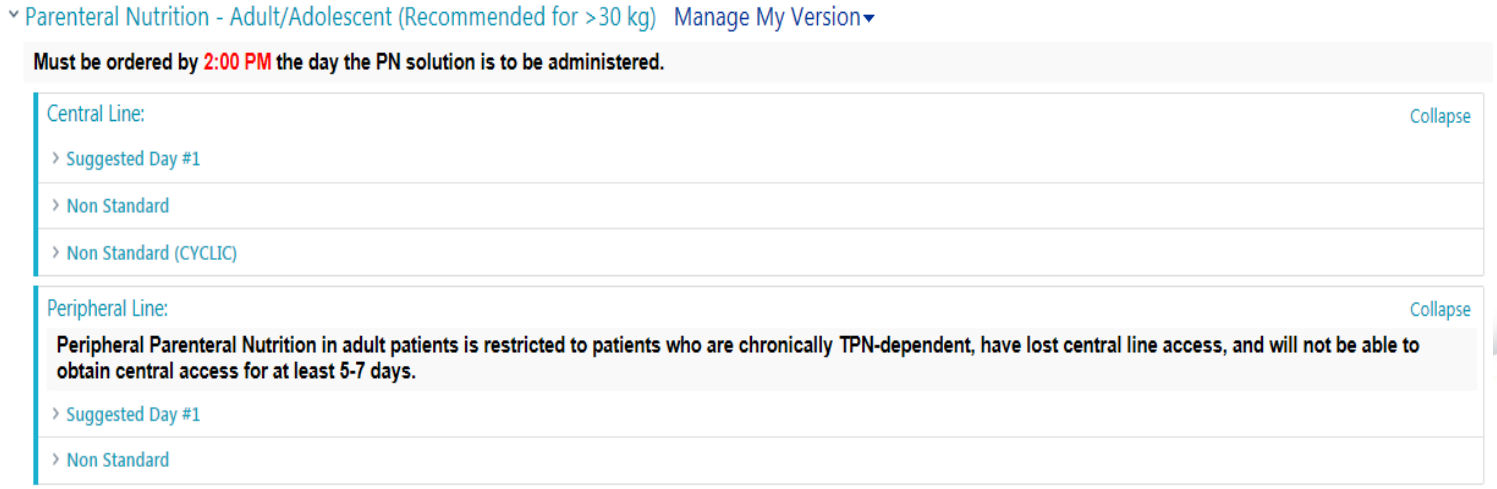
PN Workflow in EHR

- Organization and availability of orders
  - Consideration of patient population (adult/adolescent, pediatric, neonate)
  - Site (central and peripheral)
  - Day #1 defaults
  - Use of order set to help organize above



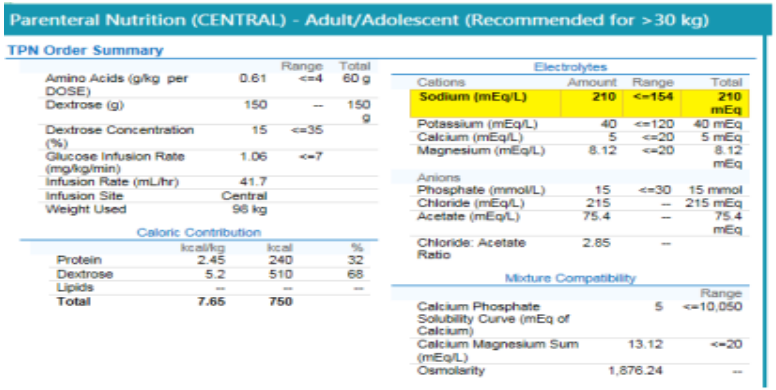
PN Workflow in EHR

- Ordering layout and components designed to support thought process and steps when designing patient's parenteral nutrition regimen and safe practices for parenteral nutrition
  1) Standardized & organized format, essential components, appropriate & safe units of measure, etc.
  2) Display of relevant patient information (e.g, laboratory, height/weight)
  3) Entry of volume, rate, duration/cycle and site (central vs peripheral)
  4) Entry of macronutrients (amino acids, dextrose, lipids)
  5) Entry of electrolytes
  6) Entry of other micronutrients (vitamins and trace elements)
  7) Entry of other supporting mediations (H2 blocker, insulin, levocarnitine, other vitamins, etc.)

A.S.P.E.N. Parenteral Nutrition Safety Consensus Recommendations. Ayers P., et al. *JPEN*. 2014:38:296-333

PN Workflow in EHR

- Display of other supporting information to facilitate and guide ordering process (i.e., clinical decision support "CDS")
  - Real-time display of calculation information (e.g., mg/kg/min of dextrose, protein and non-protein calorie information)
  - Cation and anion amounts in mEq/L with display of limit information if out of range
  - Soft- and hard-stops on various PN components



PN Workflow in EHR

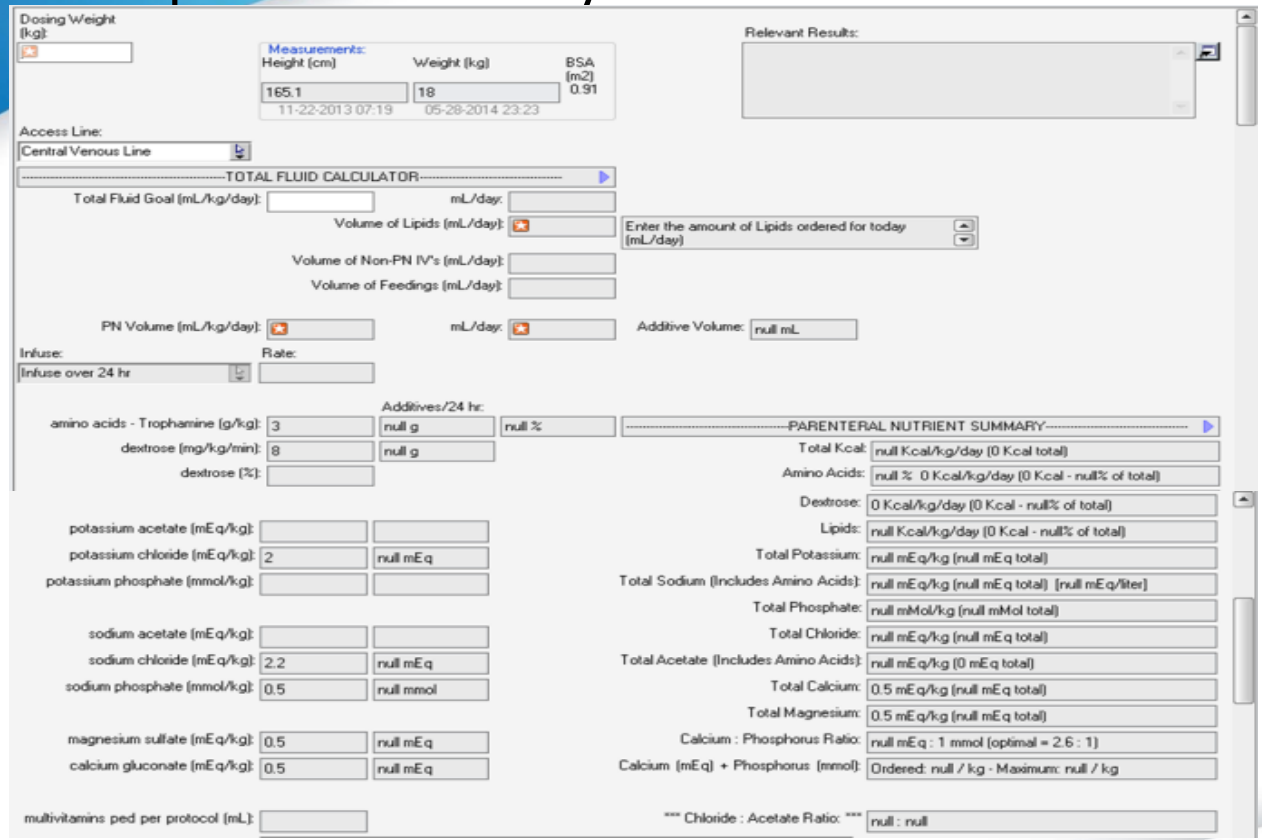
- Vendor-specific design considerations
  - Major differences among EHR vendors in support of PN design and configuration
    - Allscripts
      - Provides an extensively customizable format and tools to design PN order layout
      - Ordering form fields can be created from scratch, provide custom input (e.g., mg/kg/min dextrose), and placed anywhere on form. CDS can be layered in and integrated with ordering form fields, so based on users input, additional fields and appear, disappear, vary input, etc. Fields can
      - Extensive CDS capabilities (Medical Logic Modules) to allow custom calculations for neonatal fluid requirements, programming hard-stops based on order- or patient-specific information (e.g., lock-out ordering after 2 PM).
      - Transmission to CAPS via flat file upload or real-time HL7 interface

PN Workflow in EHR

- Vendor-specific design considerations
  - Major differences among EHR vendors in support of PN design and configuration
    - Epic
      - Order from based on template (i.e., fields and layout more restricted to system-supplied configuration - limited customizability of layout and cannot built customized fields)
        - » Cannot configure a custom-fluid calculator for neonates to guide PN order volume based on fluid requirements
        - » Cannot build a field to input Dextrose based on mg/kg/min or auto-calculate mg cysteine based on grams of amino acid
      - Provides for incorporation of calcium-phosphate solubility curve CDS based on Trissel's (starting with version 2014)
      - CDS not as customizable (e.g., cannot easily program formulas for various fluid macro-/micronutrient checks)
      - Challenges with cyclic-PN
      - Transmission via flat file upload or real-time HL7 interface

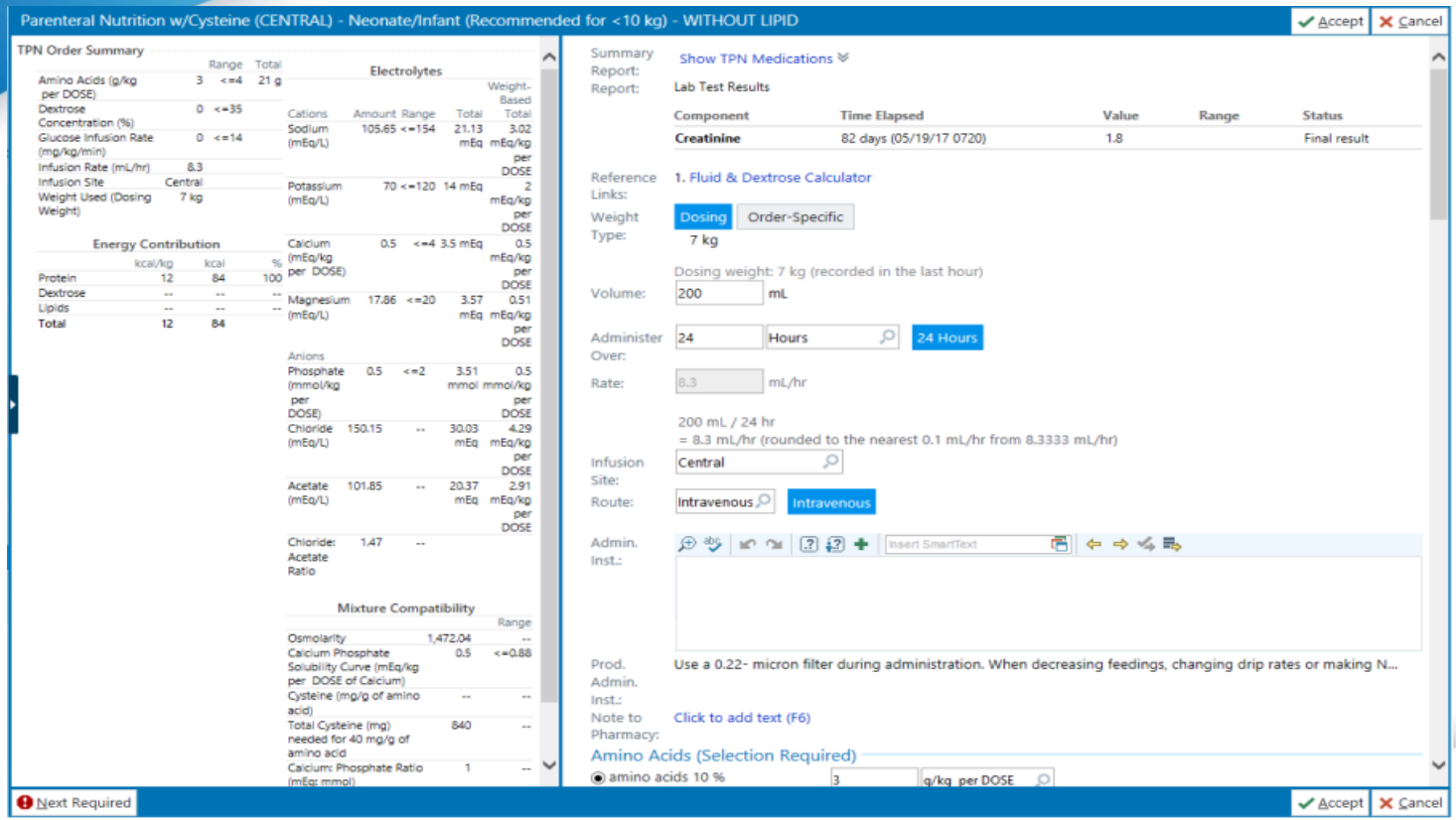
PN Workflow in EHR

Allscripts PN Order Layout



PN Workflow in EHR

Epic PN Order Layout



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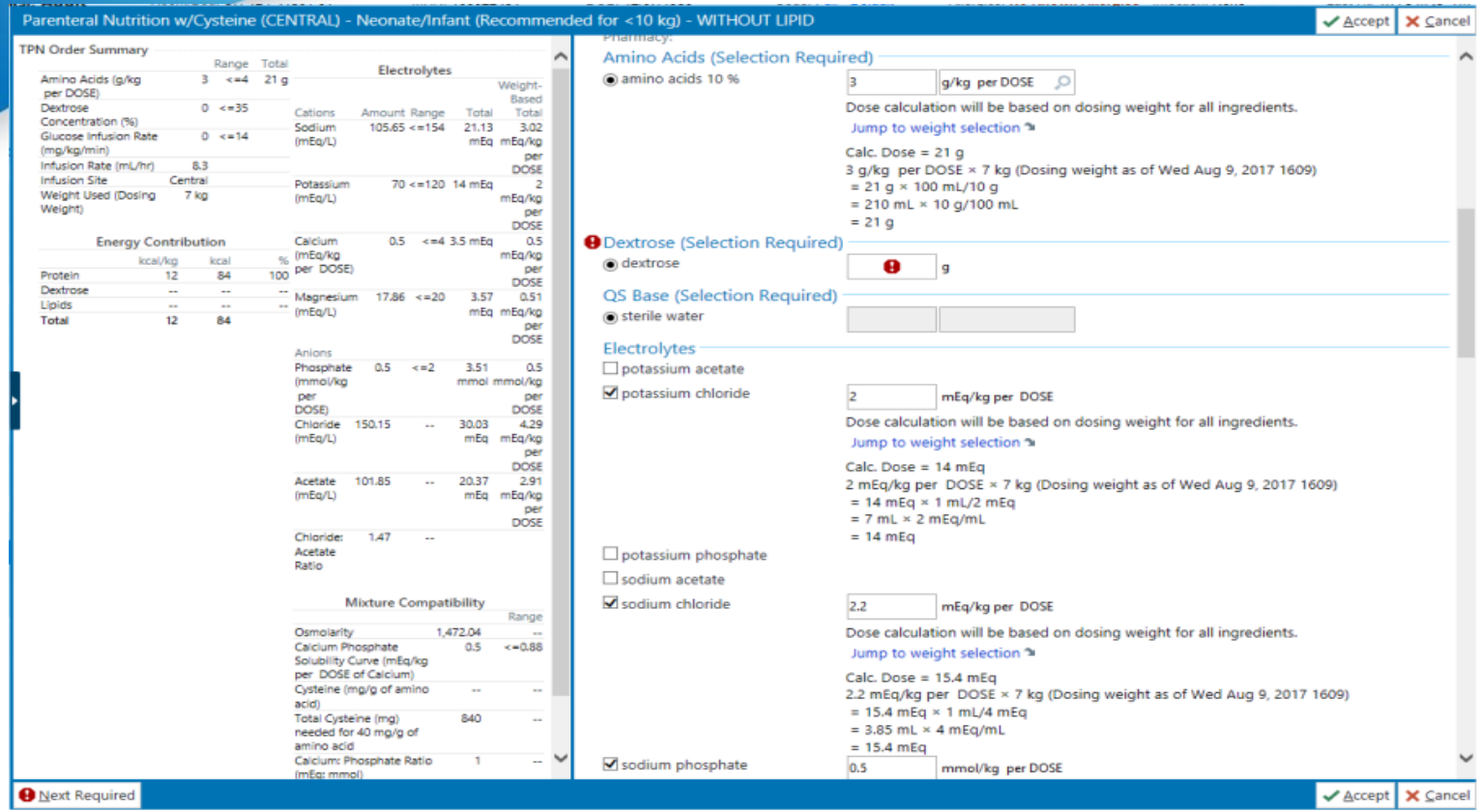
PN Workflow in EHR

Epic PN Order Layout



PN Workflow in EHR

- Overall impact on design / re-design between EHRs
  - Re-evaluate neonatal PN order entry workflow on impact of not having fluid calculator integrated as part of order
  - Conversion of hard- to soft-stop on due time for PN order entry
  - No longer able for system to directly evaluate dose checking across all micronutrients (e.g., checking for total dose of between distinct trace elements in trace elements solution and amounts additionally added) → required embedding directions on order
  - Legacy EHR allowed entry of dextrose in gram or mg/kg/min and conversion to new EHR only allowed entry in gram
  - Additional versions of PN order templates in order set to accommodate cyclic PNs

PN Workflow in EHR

- Key considerations during EHR PN design
  - Work closely with Information Technology
    - Informatics pharmacist to help translate clinical to IT workflow in consideration with EHR features and limitations
    - Establish a multidisciplinary team of clinical subject matter experts in parenteral nutrition (e.g., adult and pediatric) and informatics pharmacist
  - Close relationship with vendor
    - Help understand, translate workflow and adapt to EHR design
    - Communication of EHR limitations based on best practices
      - Enhancements to future EHR versions (e.g., Ca-Phos solubility curve checking, CDS on trace elements, etc.)

Learning Assessment Question #2

Which of the following is a barrier or challenge when designing PN workflow in an EHR or changing EHR vendors?

A. Limited active clinical decision support capabilities (e.g., alerts)

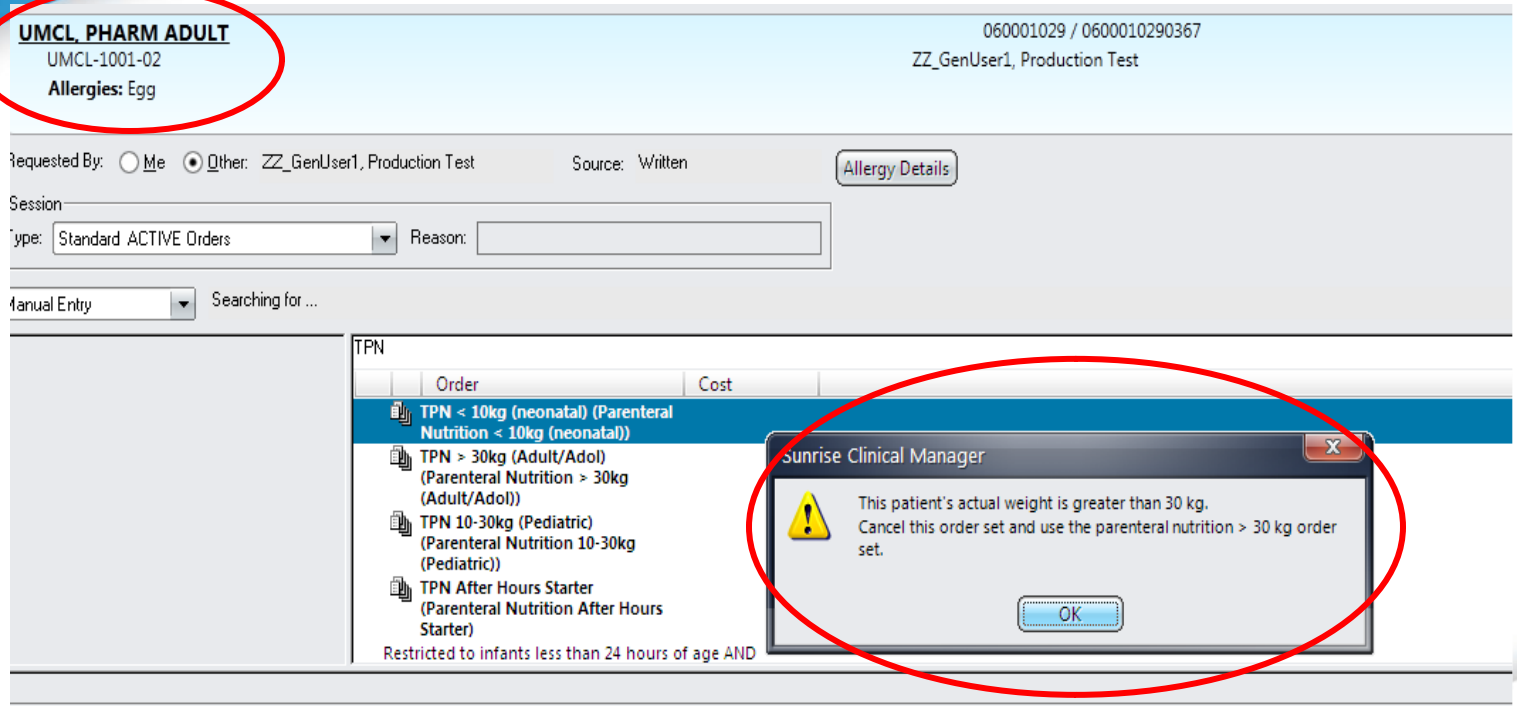
B. Limited passive clinical decision support capabilities (e.g., display of relevant results or protein / calorie information as order summary information)

C. Inability to customize order entry fields as appropriate for macro- or micronutrient

D. Limited options to customize layout of PN order entry form / order composer

E. All the above

Optimizing CDS and PN Orders in EHRs: Achieving the Unachievable?



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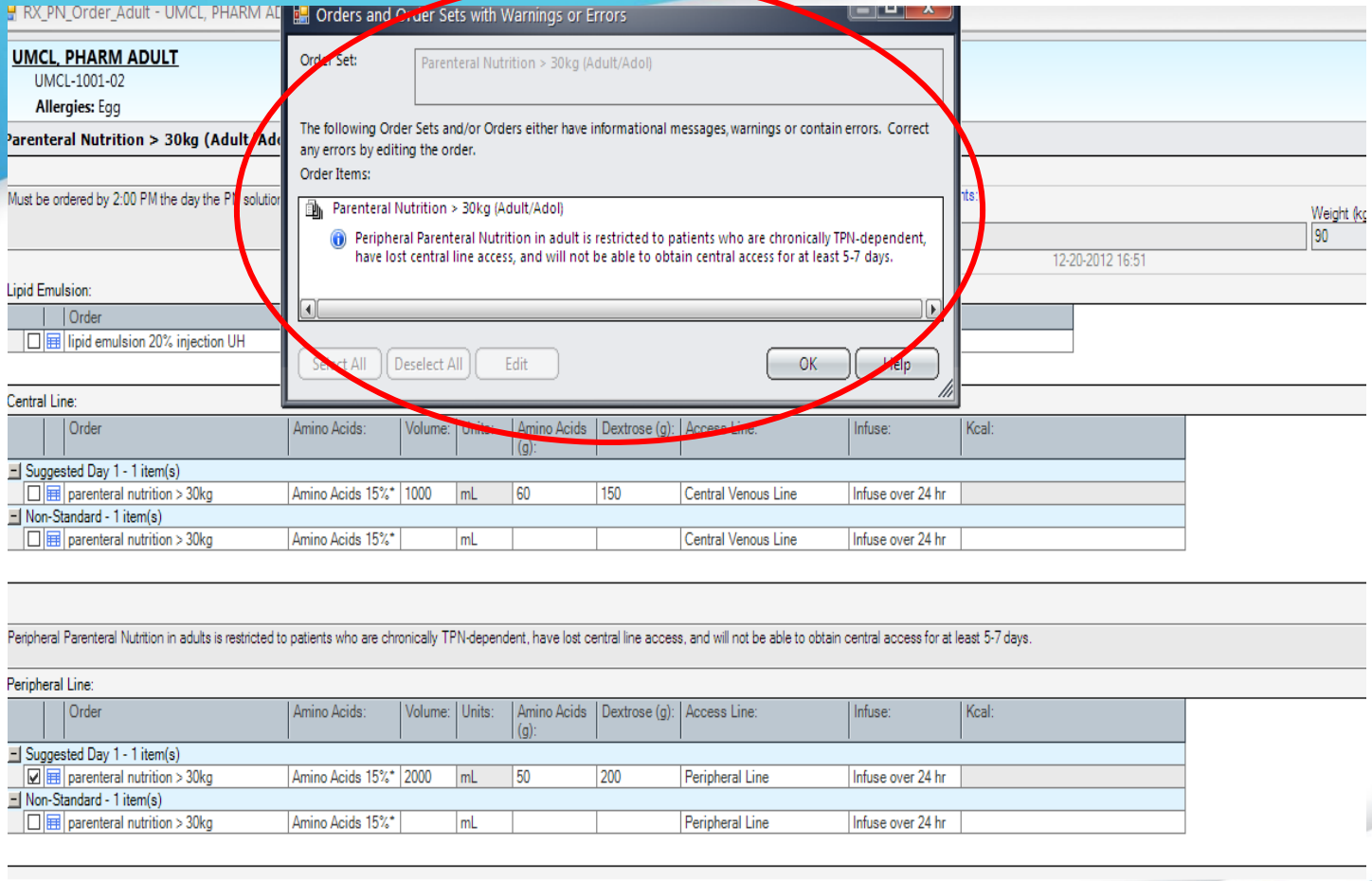

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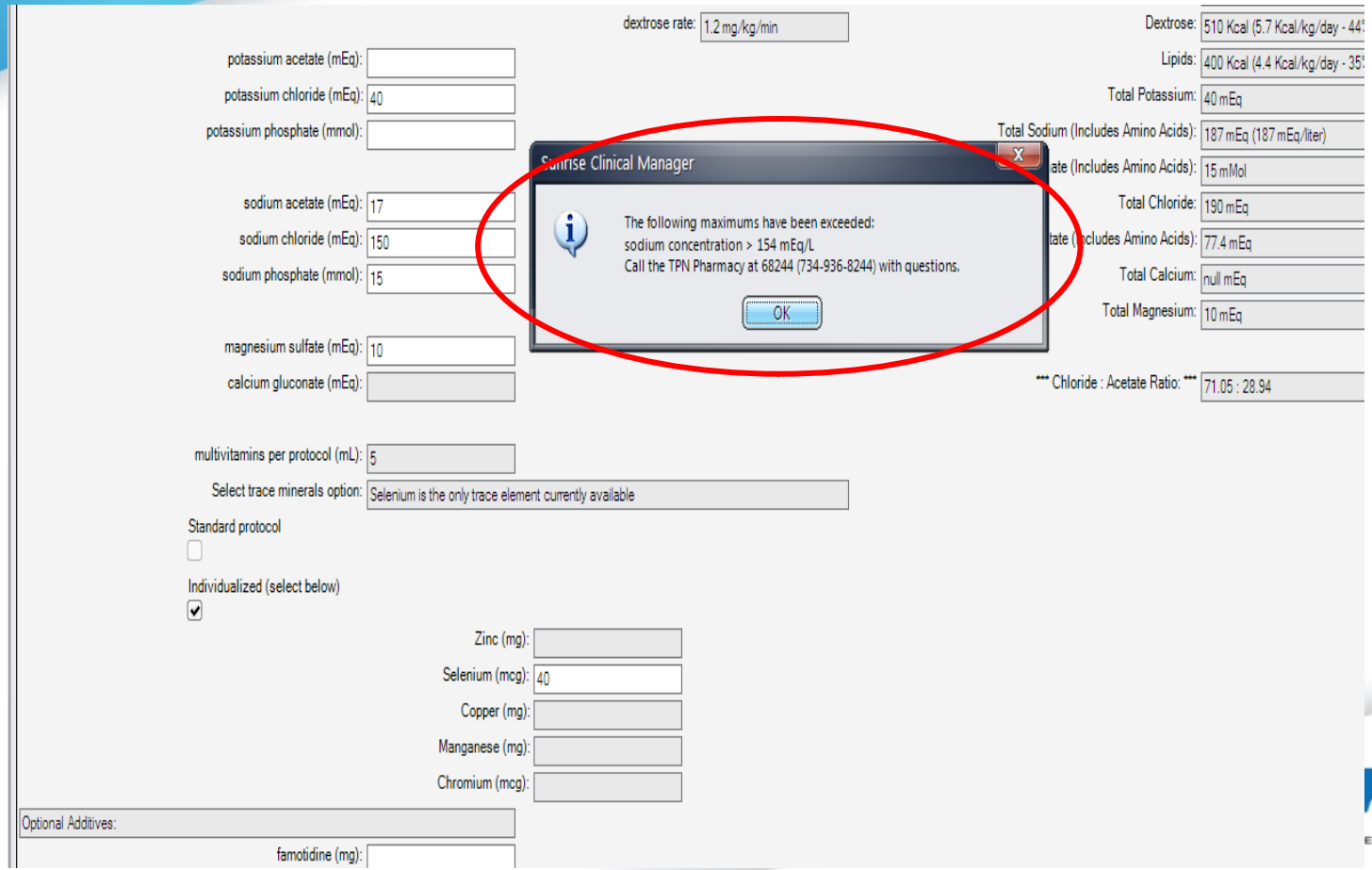

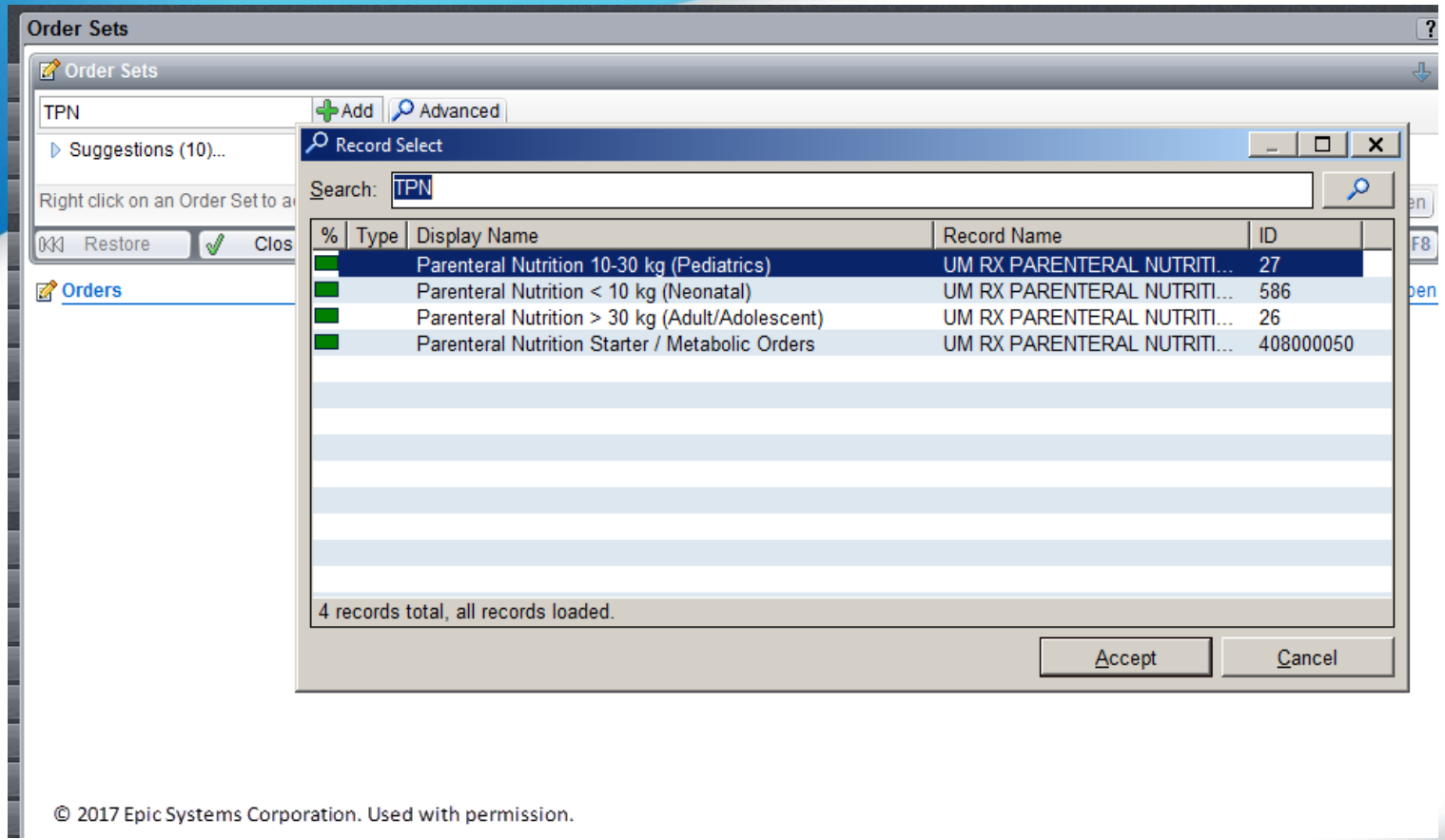

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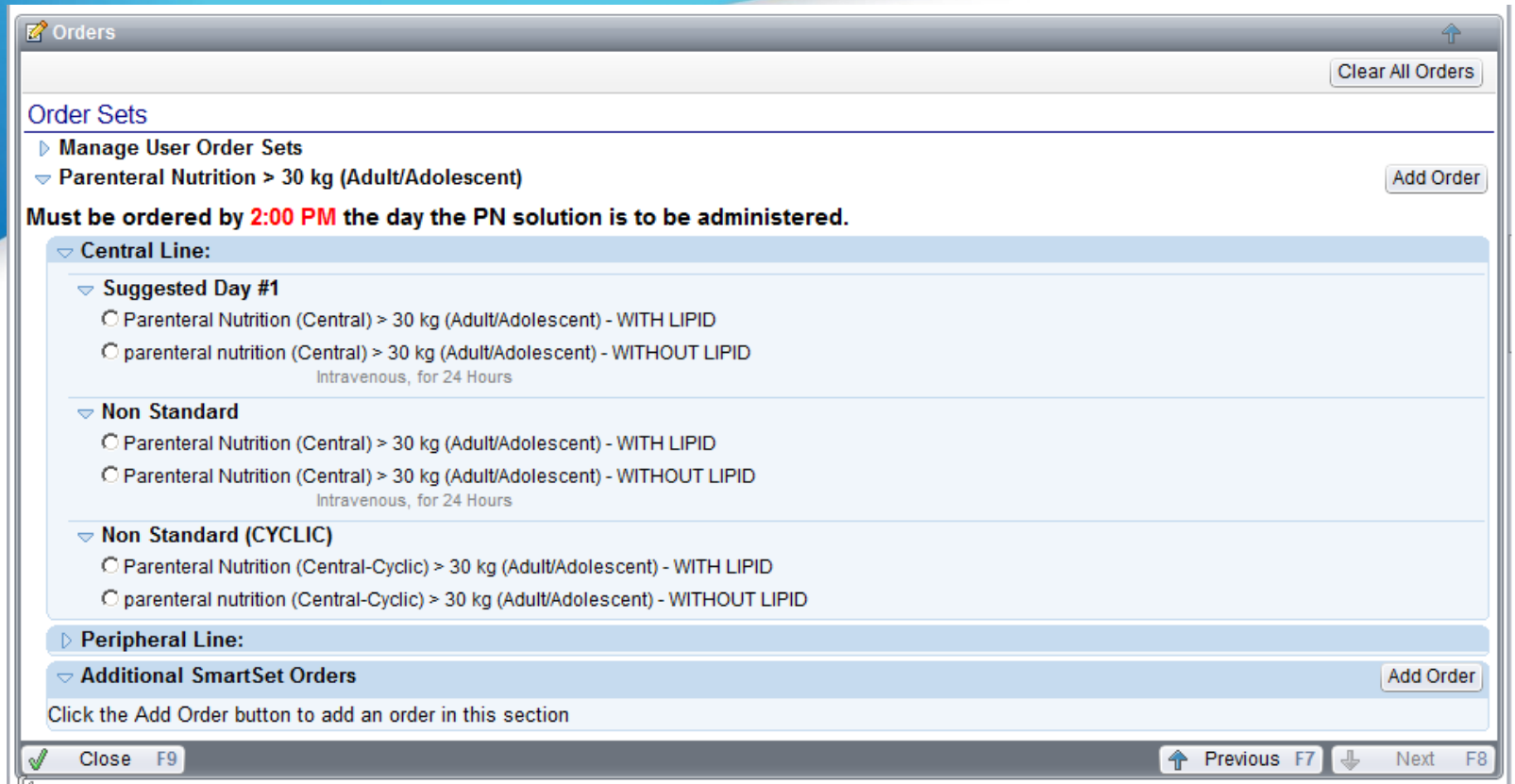

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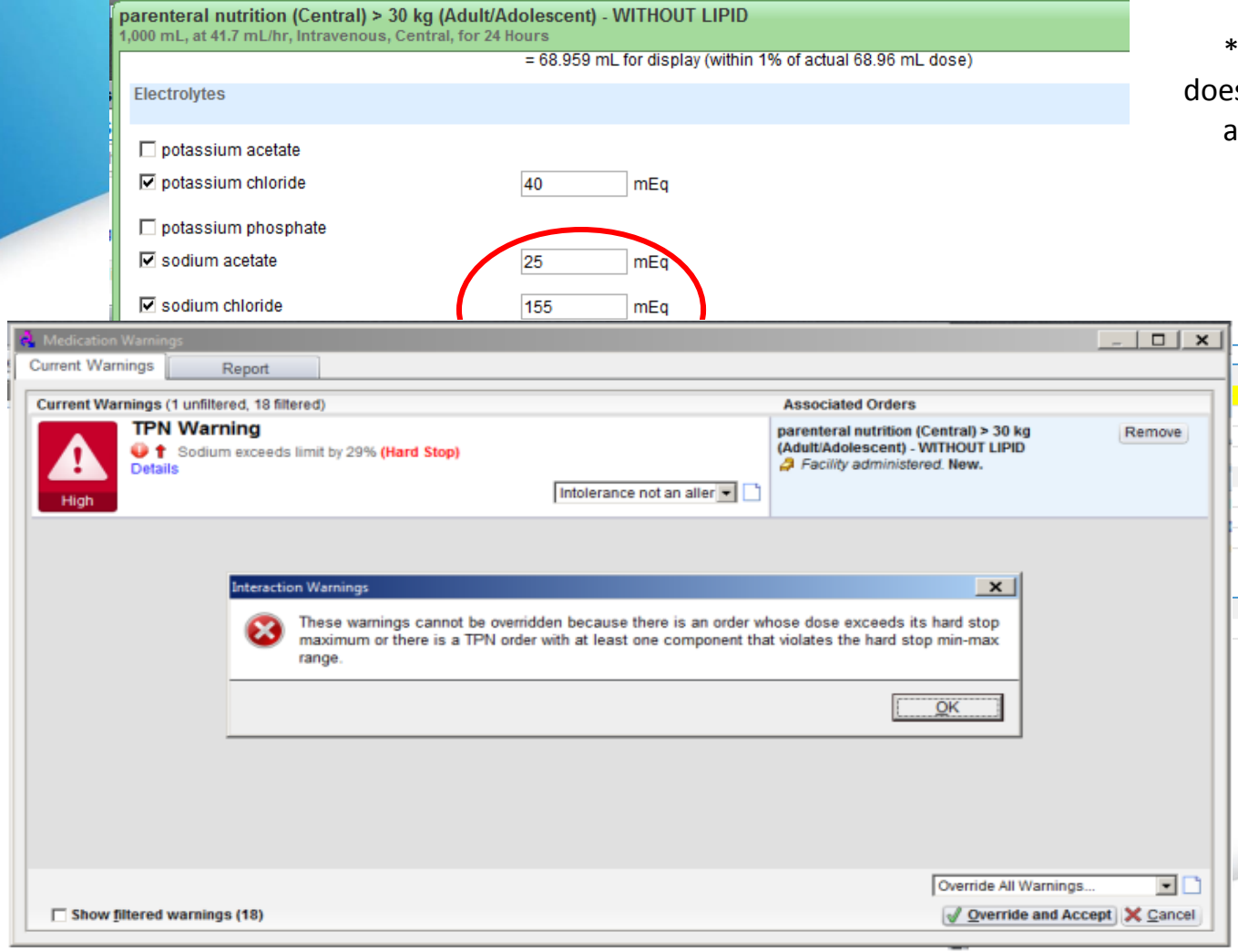

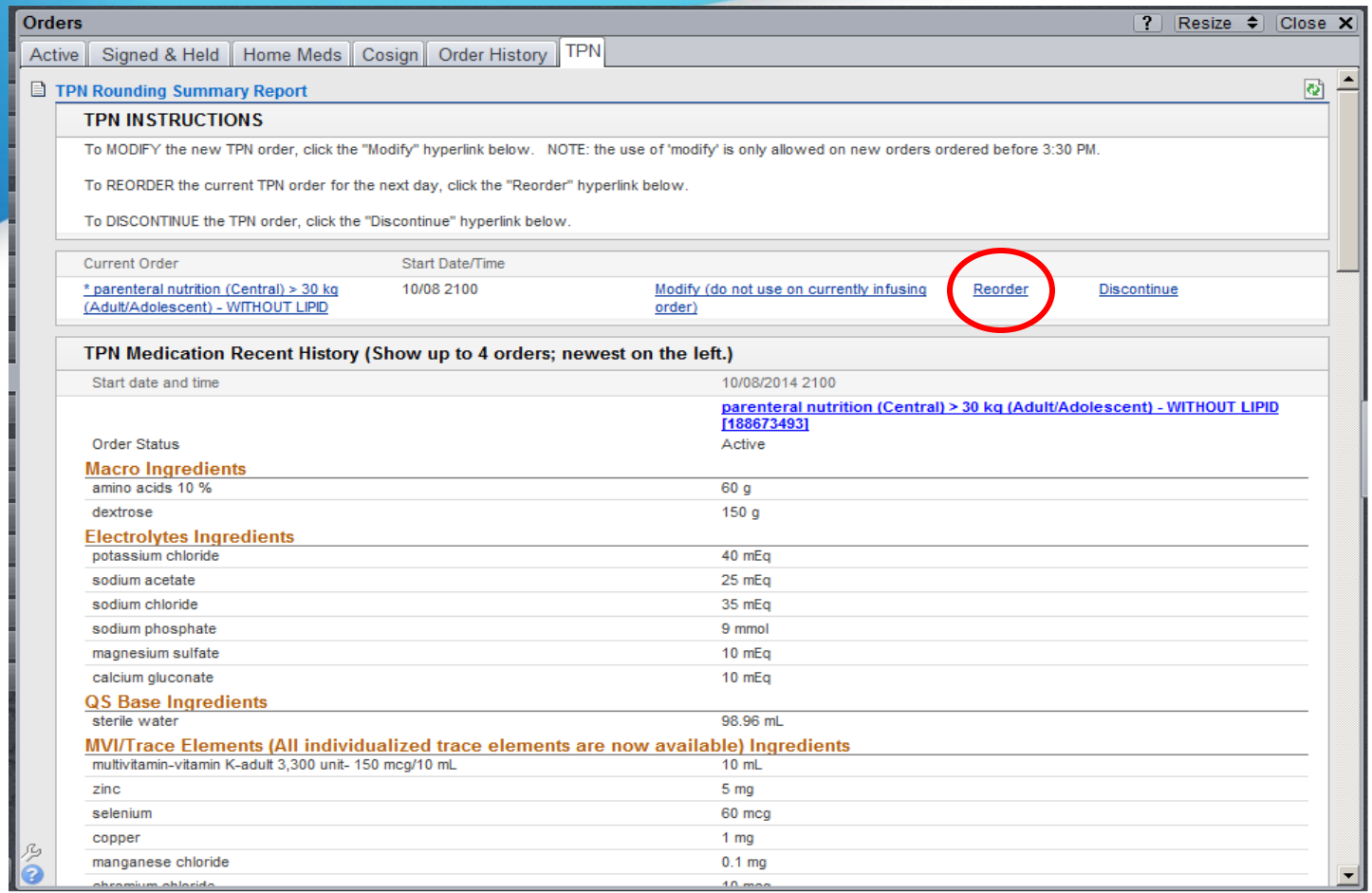

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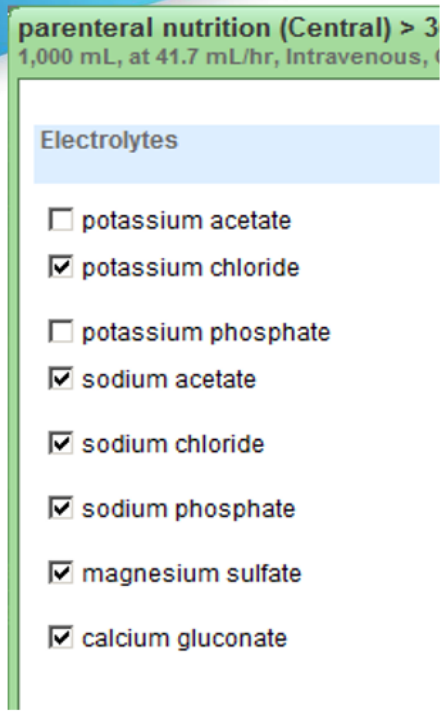
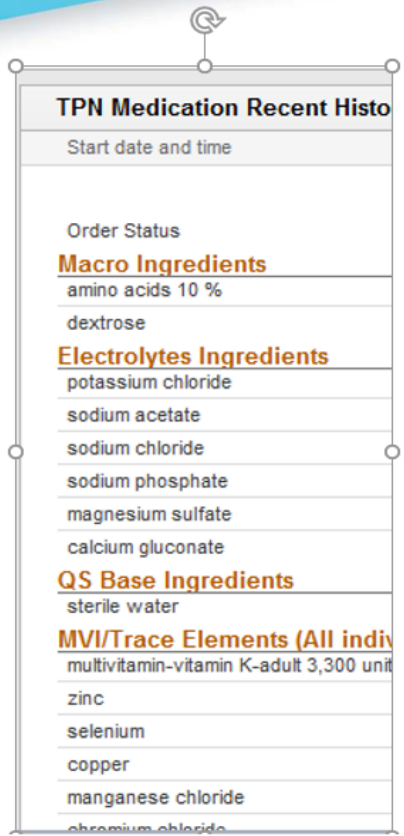
New Vendor → New Challenges

- CDS available, but more limitations (e.g., can check vs. one field/limit but not multiple)
- Order set functionality
  - Order date (ordering for future)
  - "Modify" on currently infusing orders
- Ca-Phos solubility
- Cyclic PN orders: Rate/schedule – requires separate order set (order re-entry when changing to/from cycle); POC glucose also challenging
- PN orders for neonatal patients
- IV lipids
  - "Linked" orders – alternating days
  - Split IV lipids (neonates, syringes)
- Charting of infusion rates/intake





POTASSIUM CHLORIDE
SODIUM ACETATE
SODIUM CHLORIDE
SODIUM PHOSPHATE
MAGNESIUM SULFATE
CALCIUM GLUCONATE
MVI-ADULT
ZINC SULFATE
SELENIUM
COPPER
MANGANESE
CHROMIUM

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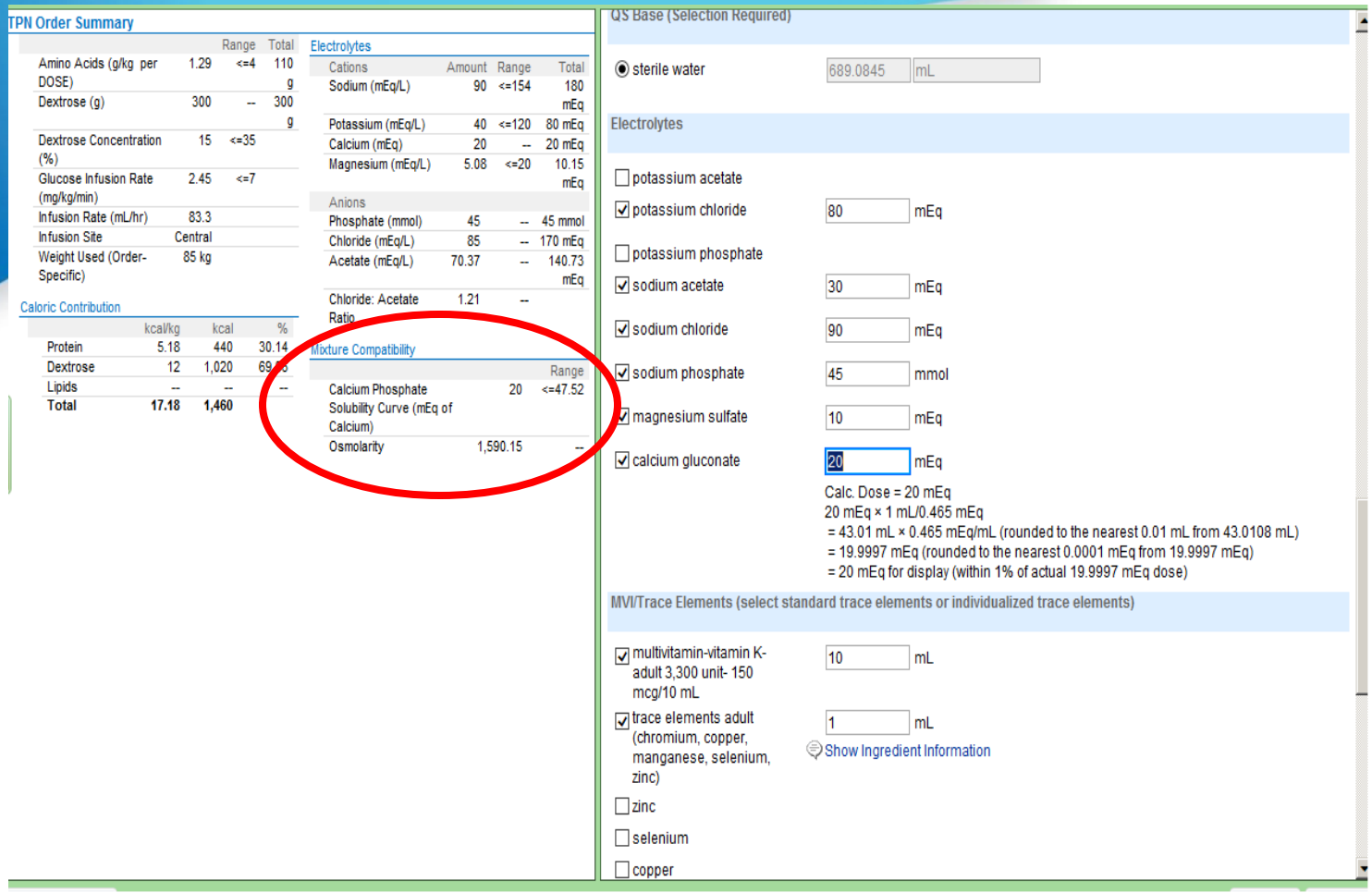

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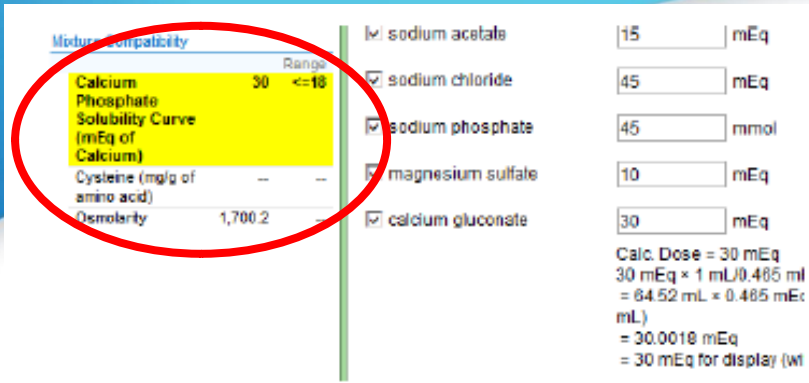

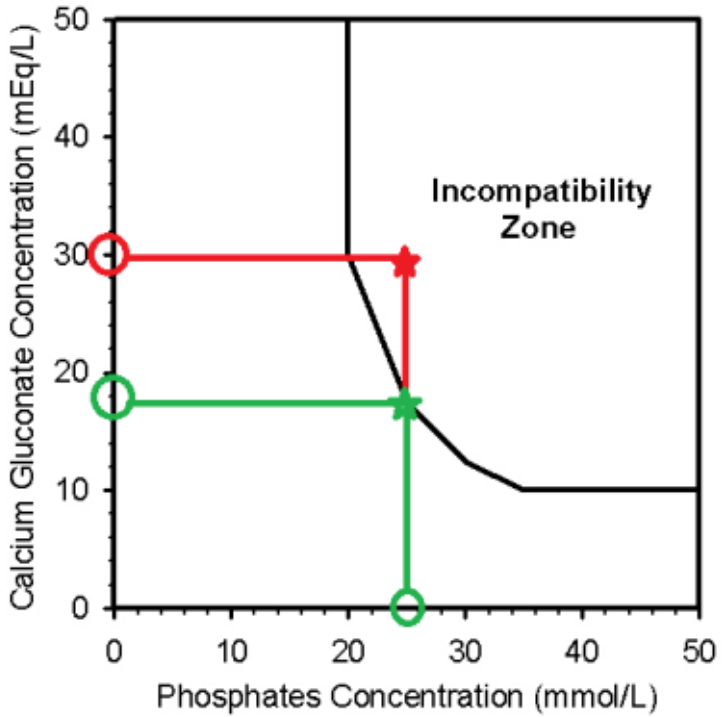

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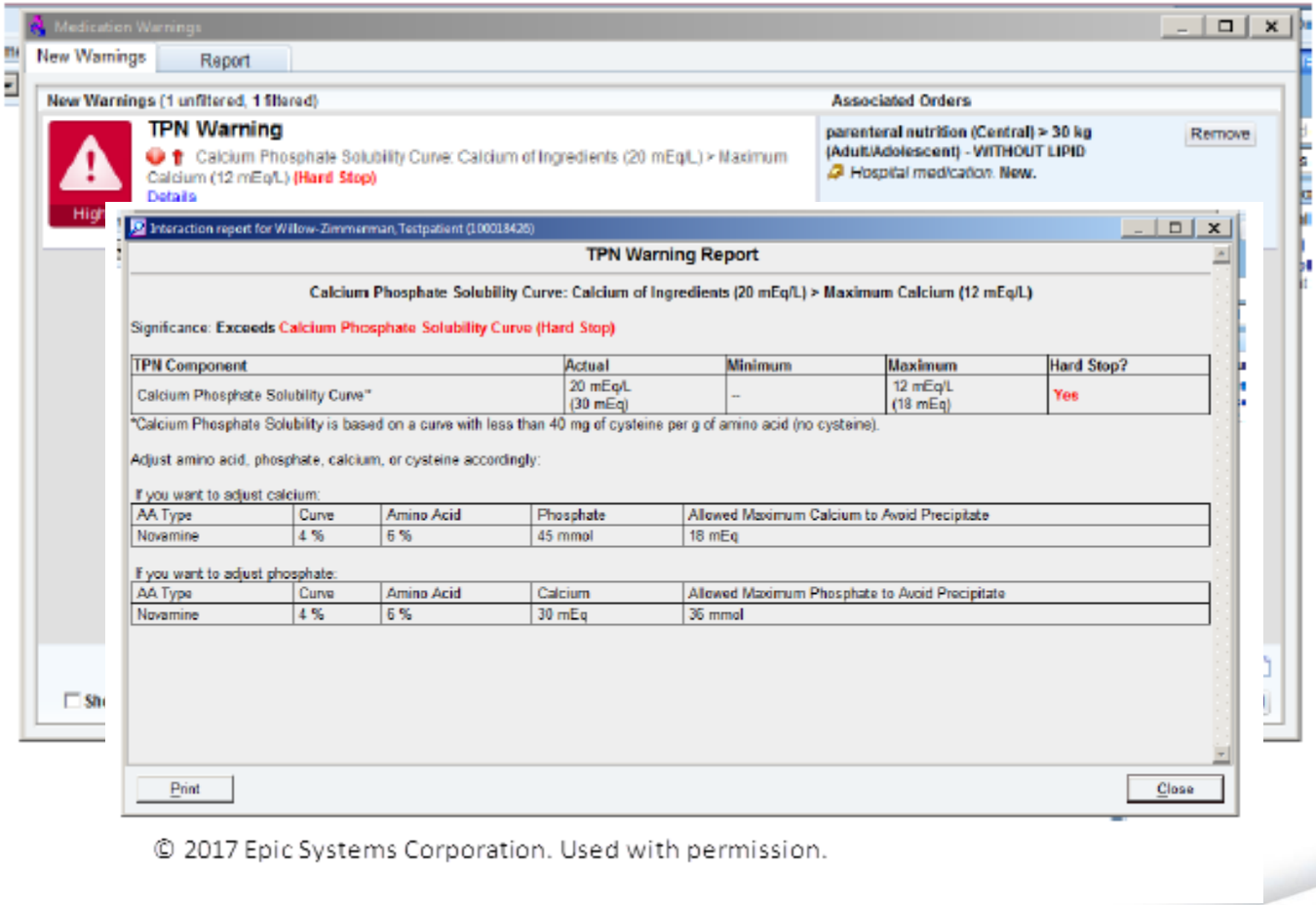

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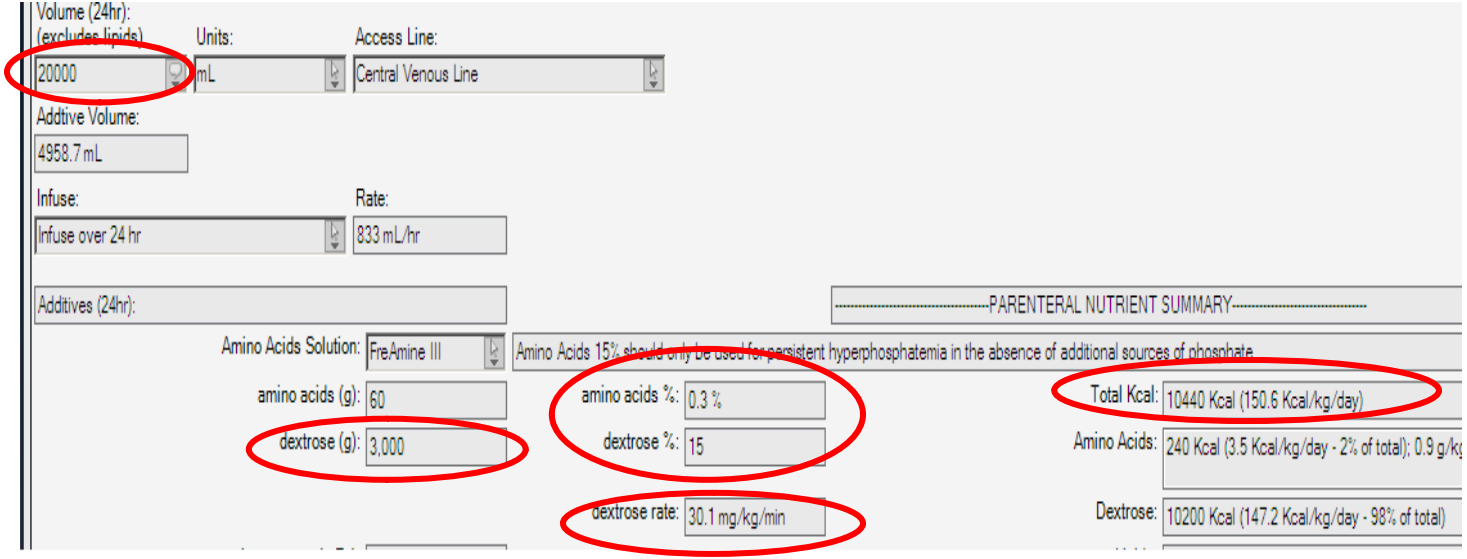
EHR Systems Are Not Perfect!

Still Requires Expertise of Nutrition Support Clinicians!



*Does not contain patient identifiers

EHR Systems Are Not Perfect!

Still Requires Expertise of Nutrition Support Clinicians!

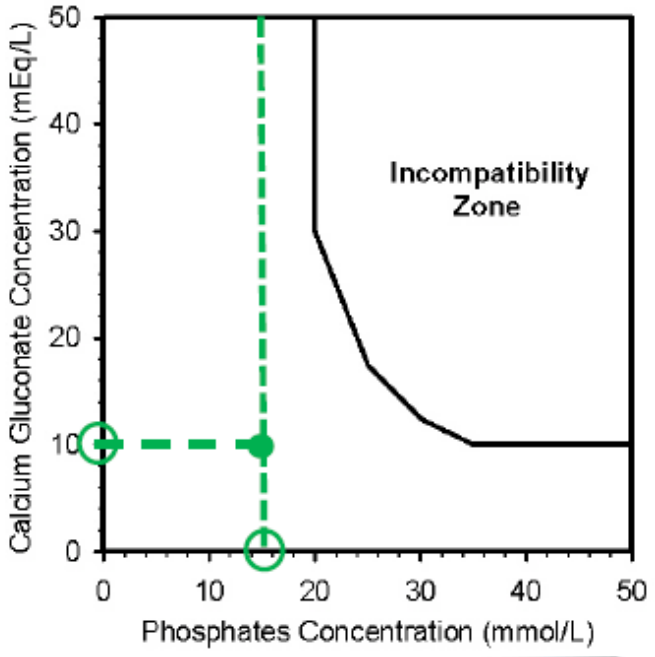
Adult PN (> 30 kg) admixture
1000 mL
AA = 60 g/day (6%)
Dex 150 g/day (15%)
Sodium phos = 15 mmol/day (15 mmol/L)
CaGluconate = 10 mEq/day (10 mEq/L)

Mixture Compatibility

		Range
Calcium Phosphate Solubility Curve (mEq of Calcium)	10	<=10,650
Cysteine (mg/g of amino acid)	--	--
Osmolarity	1,639.3	--

sodium acetate	15	mEq
sodium chloride	45	mEq
sodium phosphate	15	mmol
magnesium sulfate	10	mEq
calcium gluconate	10	mEq

Calc. Dose = 10 mEq
10 mEq × 1 mL/0.465 mE



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INFORMATICS SOLUTIONS TO KEY PN WORKFLOW CHALLENGES

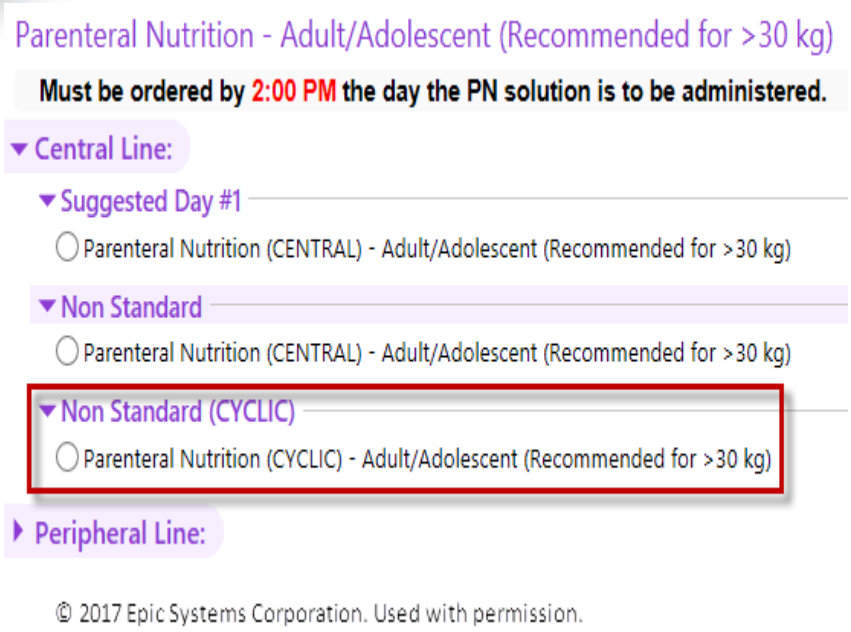
- Cyclic PN Orders
- Order modification/re-ordering
- Split lipid syringes
- Medication Shortages
- Neonatal dosing and fluid calculator

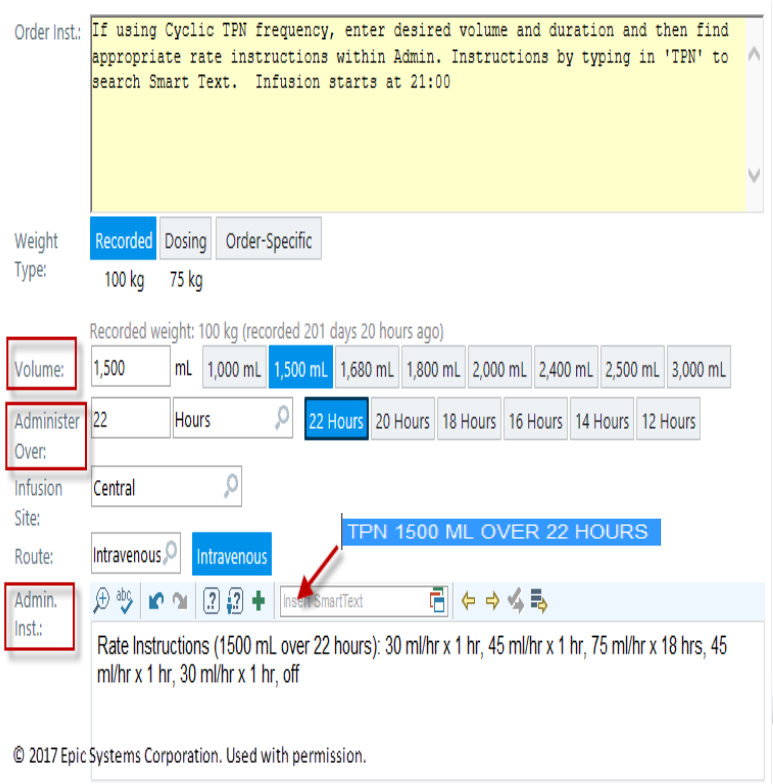
Informatics Solutions to Key PN Workflow Issues

- Cyclic PNs
  - Previous ability with legacy EHR to auto-calculate PN rate and display cyclic directions for durations < 24 hours
  - With conversion to Epic, required several changes:
    - Several field manipulations (rather than one field) to properly associate cyclic PNs (*volume, administer over and SmartText in Admin. Instructions*)
    - Remove rate field given display of fixed rate on MAR
    - Order Set adjusted with an additional order option for cyclic PNs with administer over field not defaulted to 24 hours and providing additional standard administer over options
  - Epic has provided enhancement starting with version 2017 to better handle symmetric cycle ordering (ramp up and taper down buttons)

Informatics Solutions to Key PN Workflow Issues

- Cyclic PNs

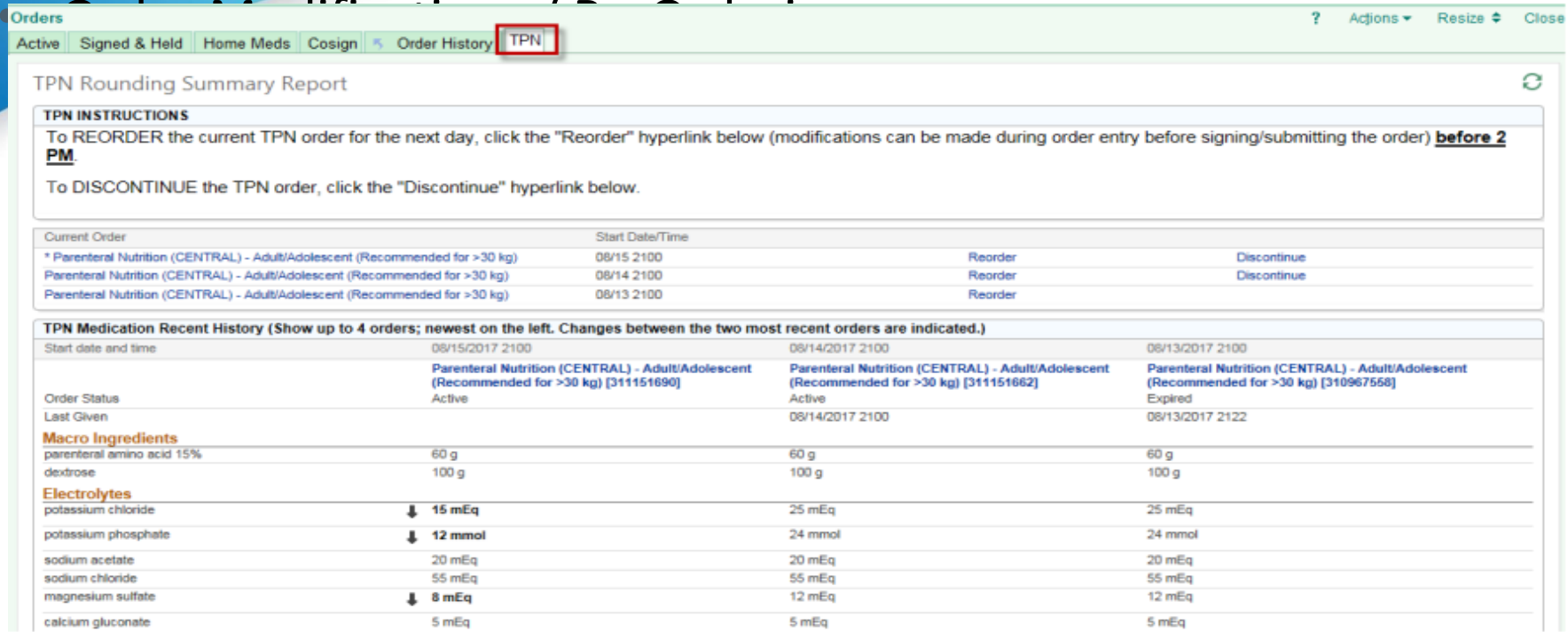




Informatics Solutions to Key PN Workflow Issues

- Order Modifications / Re-Ordering
  - Display of PN orders in active medications order tab in Epic may lead to inadvertently modifying or prematurely discontinuing the currently infusing or new order. (The current and new PN orders display next to each other)
  - Use of an additional tab 'PN Navigator' to specifically address PN ordering workflow (PN orders are filtered from the active medications order tab)
    - The tab provides guidance on how/when to use reorder and more clear organization of PN orders
    - Modification hyperlink was removed. Conversion to 3-in-1 PNs resulted in modification button persisting past cut-off time on new orders

Informatics Solutions to Key PN Workflow Issues



Orders

Active | Signed & Held | Home Meds | Cosign | Order History | TPN

? Actions Resize Close

TPN Rounding Summary Report

TPN INSTRUCTIONS

To REORDER the current TPN order for the next day, click the "Reorder" hyperlink below (modifications can be made during order entry before signing/submitting the order) **before 2 PM**.

To DISCONTINUE the TPN order, click the "Discontinue" hyperlink below.

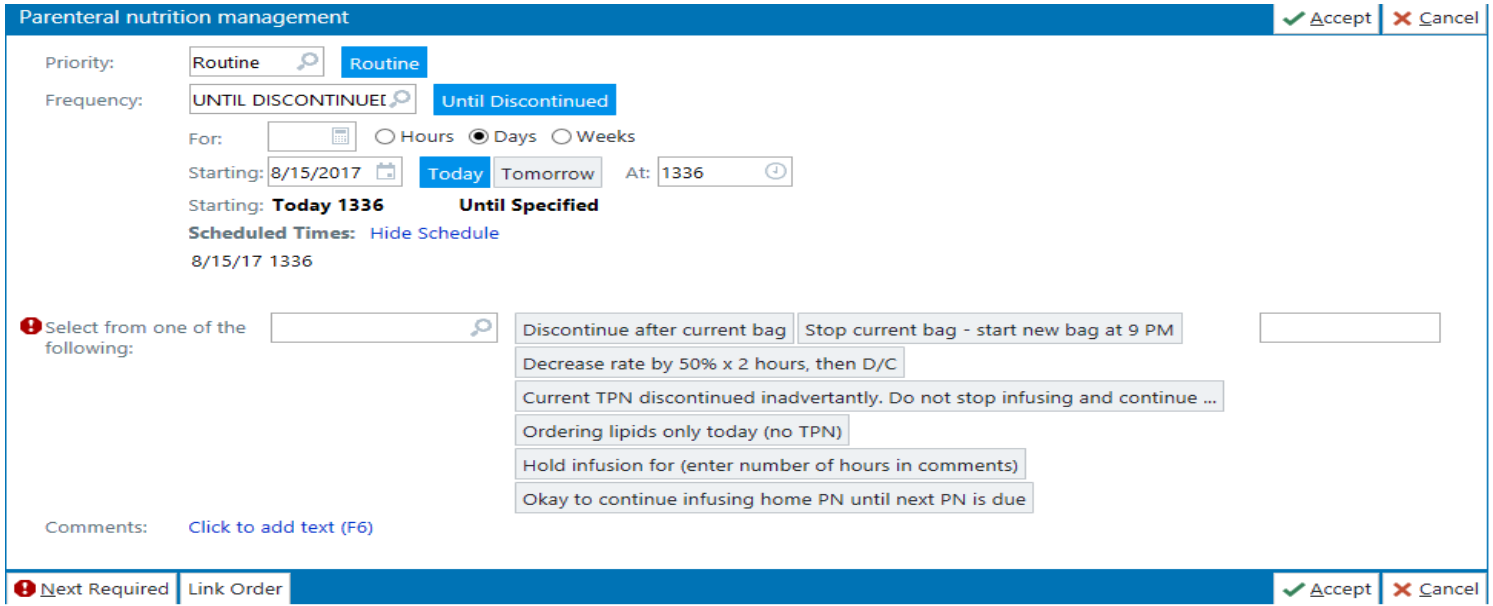
Current Order	Start Date/Time		
* Parenteral Nutrition (CENTRAL) - Adult/Adolescent (Recommended for >30 kg)	08/15 2100	Reorder	Discontinue
Parenteral Nutrition (CENTRAL) - Adult/Adolescent (Recommended for >30 kg)	08/14 2100	Reorder	Discontinue
Parenteral Nutrition (CENTRAL) - Adult/Adolescent (Recommended for >30 kg)	08/13 2100	Reorder	

TPN Medication Recent History (Show up to 4 orders; newest on the left. Changes between the two most recent orders are indicated.)

Start date and time	08/15/2017 2100	08/14/2017 2100	08/13/2017 2100
	Parenteral Nutrition (CENTRAL) - Adult/Adolescent (Recommended for >30 kg) [311151690]	Parenteral Nutrition (CENTRAL) - Adult/Adolescent (Recommended for >30 kg) [311151662]	Parenteral Nutrition (CENTRAL) - Adult/Adolescent (Recommended for >30 kg) [310967558]
Order Status	Active	Active	Expired
Last Given		08/14/2017 2100	08/13/2017 2122
Macro Ingredients			
parenteral amino acid 15%	60 g	60 g	60 g
dextrose	100 g	100 g	100 g
Electrolytes			
potassium chloride	↓ **15 mEq**	25 mEq	25 mEq
potassium phosphate	↓ **12 mmol**	24 mmol	24 mmol
sodium acetate	20 mEq	20 mEq	20 mEq
sodium chloride	55 mEq	55 mEq	55 mEq
magnesium sulfate	↓ **8 mEq**	12 mEq	12 mEq
calcium gluconate	5 mEq	5 mEq	5 mEq

Informatics Solutions to Key PN Workflow Issues

- PN Management Order
  - Address and communicate changes to currently infusing PN order

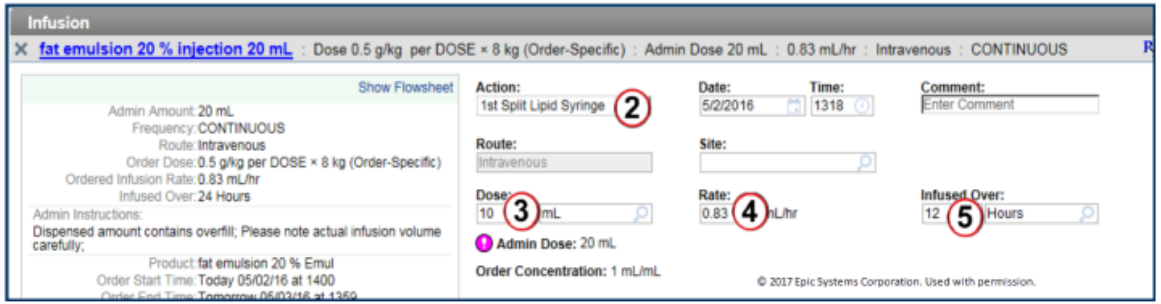


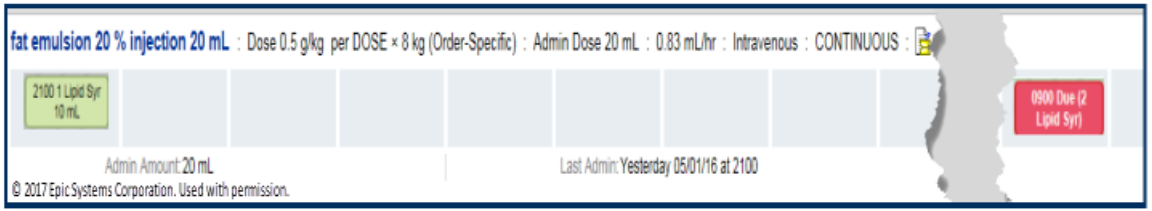
Informatics Solutions to Key PN Workflow Issues

- Split Lipid Syringe Workflow
  - Lipid dose split into two syringes if < 100 mL (continuous) or 50 mL (cyclic)
  - Original workflow with Epic: Pharmacy dispenses two syringes, and Nurses have to remember to add a 2nd task 12 hours later and adjusted the infused over field so will accurately reflect on MAR at the end of the PN infusion interval.
  - Modified workflow: BPA reminder when scanning syringe and use of MAR actions to auto-schedule 2nd syringe 12 hours later
  - New Epic enhancement for split dose workflow to auto-generate MAR tasks during verification and better reflect infused over information

Informatics Solutions to Key PN Workflow Issues

- Split Lipid Syringe Workflow





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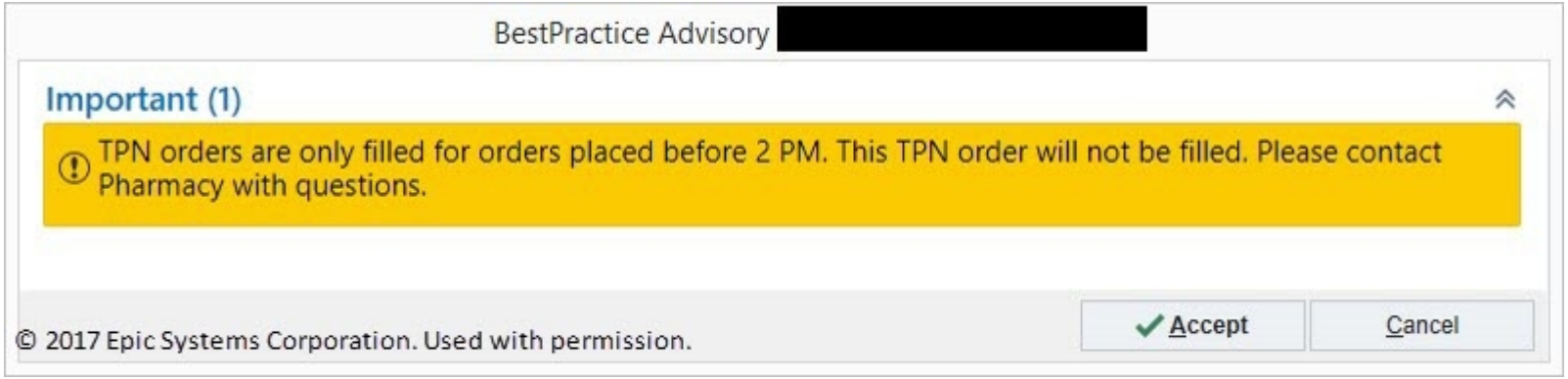
Informatics Solutions to Key PN Workflow Issues

- Other Challenges
  - Medication shortages
    - Require quick-turnaround on configuration changes / testing in EHR
      - Existing configuration may need to be backed-out to accommodate changes and the replicated/tested in other EHR environments (development, testing, production)
      - Additional testing when interfacing to compounding vendor (i.e., CAPS) or automated compounding device
    - PN orders may need to be discontinued and re-entered to accurately reflect changes which creates additional work and transcription errors
  - 3-in-1 PN conversion (adult and some pediatric)
    - CDS may not be fully support
      - Minimum lipid concentration (20 gm / liter). To support, needed to use pre-configured alert using 200 kcal/liter (could not customize to gm/liter)

Informatics Solutions to Key PN Workflow Issues

- Order Modifications / Re-Ordering
  - No hard-stop to prevent ordering after cut-off times; use of a best practice advisory (BPA) to provide warning (soft-stop)

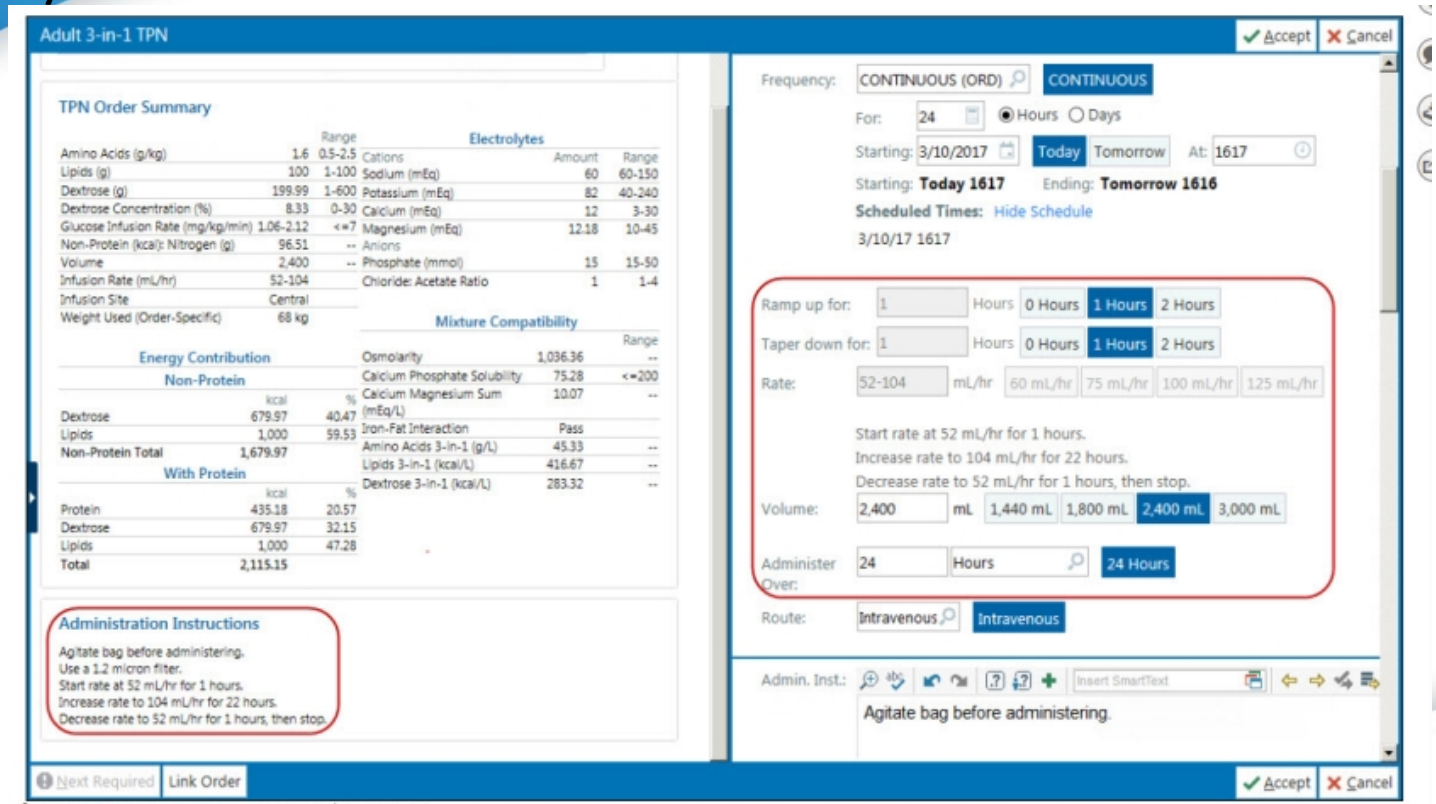


Continued Challenges to Key PN Workflow Issues

- Cyclic PN Workflow
  - Currently rely on user selecting and syncing volume, administer over and rate instructions to properly convey cyclic PN order information
  - MAR does not provide the rate given initiation and taper adjustments required (i.e., MAR can only provide a set rate)
  - With version 2017, Epic has provided functionality to better reflect the cyclic PN ordering process
    - Can indicate 1-2 steps (initiation & taper) for symmetric and asymmetric rate adjustments which will automatically translate to administration instructions
    - Will simplify orders (i.e., do not need to create specific cyclic PN order)
    - Dynamic population of MAR rate in future release

Continued Challenges to Key PN Workflow Issues

- Cyclic PN workflow



Continued Challenges to Key PN Workflow Issues

- Fluid Management and Dextrose Requirements (Neonates/Pediatrics)
  - Precise calculation of fluid and intake requirements critical to neonatal and pediatric care
  - Dextrose requirements for PN typically dosed by mg/kg/min
  - Ability to incorporate and dynamically show required PN volume based on daily fluid goal and intake sources (e.g., lipid, IV fluid, etc.) greatly facilitates PN ordering process and reduces error
  - Currently rely on a hyperlink from order to launch Excel-based fluid calculator in order to calculate PN volume and convert dextrose into g/day
    - "Clunky" and can cause transcription errors when copy and pasting in amounts to volume and dextrose order fields
  - Optimally, to build in 'fluid calculator' directly on PN order to pre-populate with appropriate PN volume
  - Allow ability to enter dextrose based on mg/kg/min

Continued Challenges to Key PN Workflow Issues

- Externally linked fluid calculator & dextrose rate converter

Total Fluid Calculator	
Dosing Weight (kg)	7
Total Fluid Goal (mL/kg/day)	70
Total Fluid Goal (mL/day)	490
Volume of Lipids (mL/day)	50
Volume of Non-PN IV's (mL/day)	0
Volume of Feedings (mL/day)	0
PN Volume (mL/kg/day)	62.86
PN Volume mL/day	440
	Copy PN Volume (mL/day) into TPN order

Dextrose Rate Converter	
Dosing Weight	7
Dextrose (mg/kg/min)	4
Dextrose (g/day)	40.32

Learning Assessment Question #3

Which of the following would be the preferred functionality to optimize safety of cyclic PN orders?

A. Manually typing the rate instruction information for initiation- and discontinuation taper in the administration instructions field

B. Selecting from a list of pre-configured instructions to populate the administration instructions field based on ordered PN volume and administer over fields

C. Provide fields on the existing PN order that can be used to indicate initiation and taper rates, which all automatically translate into the PN cycle administration instructions, and which allows clinicians to reorder a PN order and carry all components forward (i.e. avoids manual transcription)

D. None of the above – Cyclic PNs should not be entered into an EHR given the complexity of their change in administration rate requirements

E. Any of the above

Key Takeaways

- Key Takeaway #1
  - Following A.S.P.E.N. and ISMP Recommendations for PN Safety can reduce PN-associated errors and improve safety
- Key Takeaway #2
  - PN use process is complex, requires input and expertise of clinicians from multiple disciplines, including experts in informatics, to optimize PN orders in EHR systems
- Key Takeaway #3
  - Challenges remain to optimize PN orders in EHR systems, share best practices, advocate for change with your vendor, work with A.S.P.E.N. and other organizations to advocate for standards and improvements

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Clinical Meeting & Exhibition

A Call to Action: Optimizing the Electronic Health Record for Parenteral Nutrition

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Assistant Director-Education & Research, Dept of Pharmacy, Michigan Medicine (University of Michigan Health System)
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