Kids, Kidney Injury, and Malnutrition

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Nephrotoxic AKI in Kids: A Quality Improvement/CDI Project

Valerie Bica, BSN, RN
Presented By

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CDI Specialist for Clinical Documentation Integrity
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Valerie Bica is the lead CDI specialist for clinical documentation integrity at Nemours/A.I. duPont Hospital for Children in Wilmington, Delaware. She has 40 years of pediatric/NICU nursing experience, including case management, care management, managed Medicaid, acute care pediatrics, pediatric ICU, neonatal ICU, and high-tech pediatric homecare. Bica helped establish the clinical documentation integrity program for the A.I. duPont Hospital for Children, a 200-bed, freestanding pediatric facility. She is a co-leader of APDIS, the Association of Pediatric Documentation Improvement Specialists, an ACDIS networking group, and served on the 2015–2016 ACDIS Pediatric Respiratory Failure Work Group.
Nemours/A.I. duPont Hospital for Children
DOB: 1941 to 1984 to 2014
Learning Objectives

• At the completion of this educational activity, the learner will be able to:
  – Discuss the frequency and risk of nephrotoxic medication exposure
  – Explain the function of SPS and quality improvement projects in pediatrics
  – Recognize AKI from nephrotoxic exposure and the ability to decrease this occurrence through monitoring
  – Describe the newest hospital-acquired condition being monitored by SPS
Background

Nephrotoxic medication (NTMx)–associated acute kidney injury (AKI) is one of the most common causes of AKI in hospitalized children.

Most common ARF causes
- ATN – dehydration (21%)
- Nephrotoxic drugs (16%)
- Unknown (14%)
- Sepsis (11%)
- Primary renal disease (7%)

Hui-Stickle et al, 2005; *Pediatric ARF Epidemiology in a Tertiary Care Center from 1999 to 2001*
Dr. Stuart Goldstein, Nemours/A.I. duPont Hospital for Children
Background

Nephrotoxic medication (NTMx)-associated acute kidney injury (AKI) is one of the most common causes of AKI in hospitalized children.

Recent studies demonstrate that NTMx-AKI occurs at higher than previously recognized rates.

A proportion of NTMx-AKI goes unnoticed due to lack of kidney function surveillance in susceptible children.
Background

Nephrotoxic medication (NTMx)-associated acute kidney injury (AKI) is one of the most common causes of AKI in hospitalized children.

Recent studies demonstrate that NTMx-AKI occurs at higher than previously recognized rates.

A proportion of NTMx-AKI goes unnoticed due to lack of kidney function surveillance in susceptible children.

**Hypothesis:**

More reliable surveillance of NTMx exposure and injury would demonstrate that rates of AKI are high, that ... an epidemic exists.
Objectives of the Study

• Quantify the rate of *high NTMx exposure* and *NTMx-AKI* in the non–critical care population

• Determine if this EHR-based AKI screening intervention led to changes in AKI prevalence or duration (intensity)
Methods

- Find NTMx-exposed patients prospectively
- Reliably monitor serum creatinine (SCr) for evidence of injury
- Measure exposure and injury rates, changes over time
- Use electronic triggers within the electronic health record (EHR) and automated reports to make the process more efficient and complete
Who Qualifies as ‘Exposed’ to Nephrotoxics?

• Non-ICU patients
• No active renal transplants
• 3 days of IV aminoglycoside administration
• 3 or more nephrotoxic medications simultaneously
Injury (AKI) Criteria*

pRIFLE criteria
- **p** (pediatric)
- **R** = Risk, at 150% of baseline creatinine value (SCR)
- **I** = Injured, at 200% of baseline SCR
- **F** = Failure, >= 300% of baseline SCR
- **L** = Loss, persistent failure > 4 weeks
- **E** = End-stage renal disease, > 3 months

*KDIGO AKI guideline criteria

Stuart Goldstein, MD, Children’s Hospital of Cincinnati
Injury (AKI) Criteria*

pRIFLE criteria

or

>= 0.3 mg/dL increase in SCr in 48 hours
The Process

Pharmacists create/receive daily reports, verify & validate

Provide SCR screening suggestions if necessary

Data analyst compiles registry from pharmacist reports ...

... and generates metrics, runs charts

Share with AKI team, leadership, other stakeholders
### Distribution of Exposure and Injury

2.9% of all admitted patients were high-NTMx exposed

AKI occurred in 25% of highly exposed unique patients; 31% of all exposed admissions developed AKI

<table>
<thead>
<tr>
<th>Services</th>
<th>High NTMx Exposure Cases n = 945</th>
<th>Developed AKI</th>
<th>Gender</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Count</td>
<td>% of cohort</td>
<td>No n = 655</td>
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<tr>
<td>Bone Marrow Transplant</td>
<td>263</td>
<td>27.83</td>
<td>142</td>
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<tr>
<td>Liver Transplant</td>
<td>131</td>
<td>13.86</td>
<td>84</td>
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<td>Oncology</td>
<td>105</td>
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<tr>
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<td>8.15</td>
<td>54</td>
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<td>Cystic Fibrosis</td>
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<td>7.51</td>
<td>65</td>
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<td>General Pediatrics</td>
<td>64</td>
<td>6.77</td>
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<td>GI Surgery, Trauma</td>
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<td>18</td>
</tr>
<tr>
<td>Urology</td>
<td>27</td>
<td>2.86</td>
<td>25</td>
</tr>
</tbody>
</table>
Limitations

• External validity; data from only one site
  – Future work to spread project to other large pediatric institutions

• AKI attribution to NTMx exposure
  – Possible that other etiologies of AKI were present, but patients had to be susceptible (exposed to NTMx) to be included in our study cohort
Take-Home Points

• A reliable prediction and detection system detected high numbers of NTMx-exposed and NTMx-AKI patients
• NTMx-AKI is a relatively common phenomenon in hospitalized non-ICU children
• Sub-populations have been identified as targets for future interventions
• Large potential for preventing AKI and saving healthcare dollars
Outcomes NINJA Study

• Rates of nephrotoxic AKI in children are higher than those of CLABSI, CAUTI, and VAP
  — 25% of non-ICU kids exposed to NTX meds develop AKI
  — 50% chance of developing CKD
• When given outcomes, AKI rates decreased by 64% during study
• Nephrotoxic exposures decreased due to awareness
• SPS (Solutions for Patient Safety), formerly known as Ohio Collaborative, has adapted nephrotoxic AKI as their new hospital-acquired condition for monitoring in pediatric hospitals
Participating Pediatric Centers

- Children’s Hospital Cincinnati
- UCLA-Mattel’s Children’s
- Boston Children’s
- Mercy
- Children’s Alabama
- Devos Children’s
- Hopkins Children’s
- Stanford-Lucille Packard
- Seattle Children’s
- University of Iowa
- Nemours-A.I. duPont and Nemours Children’s Hospital
Stuart Goldstein, MD
Center for Acute Care Nephrology

Eric Kirkendall, MD, MBI
James M. Anderson Center for Health Systems Excellence
Division of Biomedical Informatics

2015
Children’s Hospital’s
SOLUTIONS FOR PATIENT SAFETY

• The Children’s Hospitals’ Solutions for Patient Safety National Children’s Network represents the most herculean effort to date by children’s hospitals to create a universally safe and healing environment for all children who are in our care.

• With the creation of the SPS National Children’s Network – funded in part by the Cardinal Health Foundation, Children’s Hospital Association and the federal Partnership for Patients initiative – leaders from 100+ children’s hospitals stepped forward and committed to clear, shared network goals of harm reduction by December 31, 2018:
  – 40 percent reduction in Hospital-Acquired Conditions (HACs)
  – 20 percent reduction in 7-Day Readmissions
  – 50 percent reduction in Serious Safety Events (SSEs)
  – 25 percent reduction in DART—Days Away Restricted or Transferred (by June 2019)
Reduction of Nephrotoxic Acute Kidney Injury (NAKI)

RE: Welcome Packet for the NAKI Accelerated Pioneer Cohort

0. CHECK LIST – ACTIONS TO COMPLETE
AKI Statistics AIDHC

- Prior to study (ICD-9) (584.9) – 189 total in 1 year
- 2016–2017 combined AKI and AKI with ATN –
  - (N17.9) 148 + (N17.0) 63 = 211 individual patients

Attending response to clarifications much improved
Nephrology attending team knowledgeable and will add both AKI and ATN

Participation in the NINJA research project has improved our recognition of nephrotoxic AKI in children and has had major impact on documentation
Impact on CDI

• Opportunity to educate – detecting NTX AKI
• Identifying hospital-acquired condition
• Improving safety for hospitalized children
• Early identification of AKI and opportunities to have them documented accurately and alter treatment
• In my hospital:
  – Documentation of AKI in our hospital increased incrementally with education
  – Hard data available to ask for AKI if not documented
  – Impact on relative weight, SOI, and ROM in APR-DRG
Pediatric Malnutrition

Michelle Limo, RN, MSN, MSMIT, CCDS, CCS
Learning Objectives

• At the completion of this educational activity, the learner will be able to:
  – Define malnutrition in the pediatric population and identify the difference between mild, moderate, and severe malnutrition
  – Understand when it is appropriate to query for malnutrition
  – Understand the impact of not capturing malnutrition
  – Identify opportunities to use EMR for malnutrition capture
  – Learn simple malnutrition diagnosis audit techniques
Malnutrition Basics
Did You Know?

• 1 in 3 patients are malnourished?
• Patients diagnosed with malnutrition have a LOS that is 3 times higher?
• Surgical patients with malnutrition have 4 times higher risk of pressure ulcer development?
• The annual burden of disease-associated malnutrition across 8 diseases in the U.S. is $156.7 billion?

Source -
https://www.nutritioncare.org/Continuing_Education/Programs/Malnutrition_Awareness/Malnutrition/
Malnutrition Diagnosis

• Proposal to address on a national level

Source –


The Joint Commission Journal on Quality and Patient Safety

Forum

Addressing Disease-Related Malnutrition in Hospitalized Patients: A Call for a National Goal

Peggi Guenter, PhD, RN, FAAN; Gordon Jensen, MD, PhD, FASPEN; Vihas Patel, PharmD, BCNSP; Kris M. Mogensen, MS, RD, LDN, CNSC; Ainsley Malone, MD, SPR, CNSC, FAAP; Cindy Hamilton, MS, RD; Rose Ann DiMaria-Ghalili, PhD, RD, CD, FADA, FAND

It is estimated that at least one third of patients in developed countries are malnourished on admission to the hospital, and, if left untreated, approximately two thirds of those patients will experience a further decline in their nutrition status during their hospitalization. Malnutrition continues to be under-diagnosed in many hospitals and approximately one third of patients who are not malnourished on admission may become malnourished while hospitalized. A recently published study
Malnutrition Basics

- Pediatric malnutrition is an imbalance between nutrient requirement and intake resulting in cumulative deficits of energy, protein, or micronutrients that may negatively affect growth, development, and other relevant outcomes.

Source: *Journal of Parenteral and Enteral Nutrition*

[http://pen.sagepub.com/](http://pen.sagepub.com/)

- Malnutrition goals
  - Short term: Stop the weight loss process & gradually rebuild child’s stores and muscle
  - Long term: Meet developmental milestones and stages
Malnutrition Criteria

Minimum Criteria for Pediatric Protein-Calorie Malnutrition Diagnoses:

- **MILD**
  - wt:length or BMI:age z-score < -1
  - OR z-score decrease < 1 in wt:age or length/height: age

- **MODERATE**
  - wt:length or BMI:age z-score < -2
  - OR z-score decrease > 1 in wt:age or length/height: age

- **SEVERE**
  - wt:length or BMI:age z-score < -3
  - OR z-score decrease > 2 in wt:age or length/height: age

- Pediatric Malnutrition Diagnoses indicated for those at least 1 month of age or corrected gestational age
- Using **WHO growth charts** for 1 month through 2 years of age or corrected gestational age
- Using **CDC 2000 growth charts** for 2-20 years of age
- Other considerations that can worsen a malnutrition status include (but not limited to):
  - Presence of severe inflammation
  - Poor/Delayed wound healing
  - Loss of lean body mass
- Acute Malnutrition defined as < 3 months duration
- Chronic Malnutrition defined as ≥ 3 months duration
- Hospital-acquired Malnutrition defined as nutrient imbalance during hospitalization and may occur with or without preexisting malnutrition

Corrected Gestational Age

• Term infant = 40 weeks
  – A 36 weeker at 1 month of life will have a corrected gestational age of 0 days
  – At 2 months, will have a corrected gestational age of 30 days
• ASPEN indicators of malnutrition begin at one month corrected gestational age and continue to 18 years of age
Documenting Malnutrition

• Not always documented by provider
• Providers may ...
  – Not be trained in defining malnutrition severity
  – Not have malnutrition criteria available to them
  – Not always read (or be able to find) RD notes
  – Be uncomfortable labeling a patient with malnutrition
    • Stigma attached to diagnosis
    • Who caused the malnutrition?
When to Query
Malnutrition Considerations

• Anthropometric accuracies
• Feeding changes in frequency and formula concentrations – prevention or treatment?
• Failure to thrive (FTT) – when does a child with FTT have a true diagnosis of malnutrition?
  – FTT describes the failure of infants, children, and adolescents to grow and develop normally compared to standardized growth charts. It may be caused by acute or chronic illnesses known to interfere with normal metabolism, excretion, nutrition intake, or absorption.
Malnutrition Interventions

• **Mild**
  – Additional snacks
  – Oral supplements
  – NG tube

• **Moderate and severe**
  – Parenteral nutrition
  – Enteral nutrition
  – Tube placement
Obvious Signs for Severe Malnutrition

• Cachectic wasting
• Glazed eye look
• Hollowed face/temples
• Pale/dull appearance
• Loose skin
• Effort seen to speak and move
Clinical Nutrition Partnership

• Get educated on malnutrition
• Confirm malnutrition diagnosis and severity
• Echo same message to providers
Who Is At Risk for Malnutrition?

- NPO/CLD > 3 days
- Intake < 50% for > 3 days
- Weight loss
- Intubation
- High-risk disease or medical condition

Source:
Missed Malnutrition by Division

- Hepatology – biliary atresia
- Cardiology – tetralogy of Fallot
- Orthopedics – CP patients admitted for spinal fusions
- Gastroenterology – intestinal malabsorption, multiple food allergies
- Pulmonology – CF patients with respiratory difficulties
Case Examples
# Tetralogy of Fallot

<table>
<thead>
<tr>
<th></th>
<th>MALNUTRITION NOT DOCUMENTED</th>
<th>MILD OR MODERATE MALNUTRITION</th>
<th>SEVERE MALNUTRITION</th>
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</thead>
<tbody>
<tr>
<td>Principal Dx</td>
<td>Q213 Tetralogy of Fallot</td>
<td>Q213 Tetralogy of Fallot</td>
<td>Q213 Tetralogy of Fallot</td>
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<tr>
<td>Secondary Dx</td>
<td>Z931 Gastrostomy status Z6851 BMI &lt; 5&lt;sup&gt;th&lt;/sup&gt; %ile for age</td>
<td>E440 Moderate malnutrition Z931 Gastrostomy status Z6851 BMI &lt; 5&lt;sup&gt;th&lt;/sup&gt; %ile for age</td>
<td>E43 Severe malnutrition Z931 Gastrostomy status Z6851 BMI &lt; 5&lt;sup&gt;th&lt;/sup&gt; %ile for age</td>
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<tr>
<td>Principal Px</td>
<td>3E0436Z Intro of nutr subst into central vein, perc approach</td>
<td>3E0436Z Intro of nutr subst into central vein, perc approach</td>
<td>3E0436Z Intro of nutr subst into central vein, perc approach</td>
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<tr>
<td>Secondary Px</td>
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<td></td>
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<tr>
<td>APR-DRG</td>
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<td>200 Card Struct &amp; Valve Dis</td>
<td>200 Card Struct &amp; Valve Dis</td>
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<tr>
<td>SOI</td>
<td>2</td>
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<td>3</td>
</tr>
<tr>
<td>ROM</td>
<td>1</td>
<td>1</td>
<td>2</td>
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<tr>
<td>RW</td>
<td>0.6783</td>
<td>0.6783</td>
<td>1.0470</td>
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<tr>
<td>GLOS</td>
<td>2.25</td>
<td>2.25</td>
<td>3.21</td>
</tr>
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</table>
## Intestinal Malabsorption

<table>
<thead>
<tr>
<th></th>
<th>Malnutrition Not Documented</th>
<th>Mild Malnutrition</th>
<th>Severe Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Principal Dx</strong></td>
<td>K909 Intestinal malabsorption, unsp</td>
<td>K909 Intestinal malabsorption, unsp</td>
<td>K909 Intestinal malabsorption, unsp</td>
</tr>
<tr>
<td><strong>Secondary Dx</strong></td>
<td></td>
<td>E441 Mild malnutrition</td>
<td>E43 Severe malnutrition</td>
</tr>
<tr>
<td><strong>Principal Px</strong></td>
<td>3E0436Z Intro of nutr subst into central vein, perç approach</td>
<td>3E0436Z Intro of nutr subst into central vein, perç approach</td>
<td>3E0436Z Intro of nutr subst into central vein, perç approach</td>
</tr>
<tr>
<td><strong>Secondary Px</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>APR-DRG</strong></td>
<td>254 Other Digestive System Dx</td>
<td>254 Other Digestive System Dx</td>
<td>254 Other Digestive System Dx</td>
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<tr>
<td><strong>SOI</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>ROM</strong></td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>RW</strong></td>
<td>0.5308</td>
<td>0.6987</td>
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<tr>
<td><strong>GLOS</strong></td>
<td>1.93</td>
<td>2.54</td>
<td>3.68</td>
</tr>
</tbody>
</table>
“Raise Your Hands” Question

Malnutrition Diagnosis Appropriate?

• 7-year-old boy with ALL on chemo, previously obese with recent weight loss of 18 lbs within the last 2 months. Patient is now within appropriate weight range for age and height.
  – Yes
  – No
  – Don’t know
“Raise Your Hands” Question

Malnutrition Diagnosis Appropriate?
• 4-year-old girl with CLD and DD admitted twice within the last 6 months. She is growing but not meeting growth velocity standards.
  – Yes
  – No
  – Don’t know
Electronic Medical Record
Solution #1

• Import RD screening & assessment into provider progress notes

**OBJECTIVE:**
Vital Signs (24 h):

**Measurements:**
(No weight on file for this encounter.) \| (No height on file for this encounter.) \| (No unique date with height and weight on file.)
Dose Calc Weight: 45 kg (99 lb 3.3 oz)

**PHYSICAL EXAM:** (Time of Exam: )

Intake and Output: No intake or output data in the 24 hours ending

Active Diet Orders:

**Malnutrition Screening (per Registered Dietitian):** Moderate Malnutrition, Acute
**Nutrition Assessment (per Registered Dietitian):** resolved inadequate oral intake related to hx of prematurity as evidenced by meeting estimated energy and protein needs PO.

**Medications:**
I have reviewed the medications in the EHR.

**Labs:**
Solution #2

- Insert AutoQueries in provider progress notes

```
ADDITIONAL COMMENTS REGARDING DIAGNOSIS
SPECIFICITY: (Reference) Please update Problem List.
Anemia <Choose an item>
Neutropenia <Choose an item>
```

- Anemia Choices:
  - due to chemotherapy
  - due to neoplastic disease
  - due to acute blood loss
  - due to chronic blood loss
  - due to acute and chronic blood loss
  - due to iron deficiency
  - due to CKD
  - due to ESRD
  - due to chronic disease, <specify>
  - due to <insert text>
  - unspecified

- Neutropenia Choices:
  - due to chemotherapy
  - due to infection, <specify>
  - due to <insert text>
  - disease process of unknown etiology
  - due to <insert text>
Solution #1 Results

MALNUTRITION CLARIFICATIONS SENT
OCTOBER 2015 - AUGUST 2016

Clarifications (#)

Malnutrition DataLink Implemented
Malnutrition Audits
Audit Tips

• Review patient records with
  – LOS > 14 days
  – Tube placements or tube feedings
  – Z-scores < -1
  – LOS > APR-DRG GLOS
Takeaways

- Educate yourselves and your providers on malnutrition definitions and criteria
- Partner with your registered dietitians
- Optimize your EMR to support the capture of malnutrition dx
Addendum
EMR Instructions

• Solution #1:
  – RD’s nutrition assessment is captured in RD’s clinical notes
  – Severity is captured in malnutrition screen in flowsheet
  – When providers create progress notes using templates, severity data from RD’s malnutrition screen in flowsheet and nutrition assessment from RD’s note are imported

• Solution #2:
  – Use rules in notes to provide prompts for a more specific dx
  – Dependent on problem list (PL) maintenance
  – How it works:
    • When target generic dx is in the PL, a rule criterion is met
    • Using a rule-based datalink, able to insert AutoQuery
  – Text with drop-down lists is added to bottom of progress note
  – Provider refines dx by selecting appropriate modifiers from drop-down list
  – Definitions can also be included in the drop-down choices
Thank you. Questions?

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mlimo@mlhealthcareconsulting.com

In order to receive your continuing education certificate(s) for this program, you must complete the online evaluation. The link can be found in the continuing education section at the front of the program guide.