

Every Milliliter Matters: Early Recognition of Pediatric Clinical Deterioration

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BACKGROUND

Accurate intake and output (I&O) monitoring is a fundamental nursing responsibility in pediatric inpatient care. Due to children's limited physiologic reserves, even small fluid imbalances can result in significant clinical deterioration. Acute kidney injury (AKI) is increasingly recognized as a common and potentially preventable complication among hospitalized pediatric patients. Delayed recognition of abnormal fluid balance, decreased urine output, and rising risk factors may contribute to adverse outcomes. Nurses are uniquely positioned to identify early warning signs through assessment and accurate documentation.

PURPOSE

The purpose of this knowledge enhancement project is to increase pediatric nurses' understanding of accurate intake and output monitoring and improve awareness of early indicators of acute kidney injury in hospitalized children.

METHODS

A review of current evidence-based literature, pediatric nephrology guidelines, and best practices for fluid balance monitoring was conducted. Educational content was developed focusing on age-specific urine output expectations, weight-based fluid assessment, recognition of fluid overload and dehydration, documentation accuracy, and early AKI warning signs. Educational materials were presented to pediatric nursing staff through unit-based education and poster dissemination.

Staff Educational Poster

Image generated using Chat GPT

PEDIATRIC AKI QUICK REFERENCE

Every Milliliter Matters

Early recognition. Accurate monitoring. Better outcomes.



1 PATIENTS AT RISK FOR AKI



Dehydration, vomiting, diarrhea, poor oral intake



Sepsis or serious infections



Recent surgery or procedures



Hypotension or poor perfusion



Nephrotoxic medications



Kidney disease (history or congenital)



Cardiac disease



Oncology diagnosis

Also consider: diabetes, complex chronic illness, secondary organ dysfunction, iodinated contrast exposure, and any child with a significant change from baseline.

2 URINE OUTPUT

Expected Urine Output (general ranges)

Neonates (0-28 days)	≥ 1 mL/kg/hr (Use neonatal-specific criteria/unit policy)
Infants (1-12 months)	≥ 1 mL/kg/hr
Children (1-12 years)	Varies with age. Monitor trend. < 0.5 mL/kg/hr for ≥ 6 hours is concerning for AKI.
Adolescents (>12 years)	Varies with age. Monitor trend. < 0.5 mL/kg/hr for ≥ 6 hours is concerning for AKI.

NOTIFY PROVIDER IF:

- Urine output < 0.5 mL/kg/hr for ≥ 6 hours
- No urine output for 6-8 hours (or anuria ≥ 12 hours)
- Significant decrease from baseline
- New dark, bloody, or cloudy urine
- Any acute concern or clinical deterioration

3 URINE OUTPUT CALCULATION

Formula:

$$\text{Urine output (mL/kg/hr)} = \frac{\text{Total urine output (mL)} + \text{Weight (kg)} \times \text{Time (hr)}}{\text{Time (hr)}}$$

Example:

$$\frac{120 \text{ mL urine in 8 hours}}{20 \text{ kg}} \div 8 \text{ hours} = 0.75 \text{ mL/kg/hr}$$

120 ÷ 20 ÷ 8 = 0.75 mL/kg/hr (Within expected range)

Always trend over time and compare to the patient's baseline.

4 POSSIBLE CLINICAL SIGNS OF AKI OR FLUID IMBALANCE

- Decreased urine output
- Edema or puffiness
- Sudden or unexplained weight gain
- Hypertension
- Tachycardia (may indicate hypovolemia)
- Delayed capillary refill
- Respiratory symptoms (with fluid overload)
- Dry mucous membranes (dehydration)
- Nausea or vomiting
- Fatigue or irritability
- Positive fluid balance

5 DAILY WEIGHT MATTERS

Daily weight is an important objective measure for trending fluid status.

Report:

- Rapid weight gain
- Unexpected weight loss
- Weight changes with edema or poor urine output

6 COMMON NEPHROTOXIC MEDICATIONS

- Vancomycin
- Aminoglycosides (Gentamicin, Tobramycin)
- NSAIDs (Ibuprofen, Ketorolac)
- Acyclovir
- Amphotericin B
- Iodinated IV contrast
- Some chemotherapy agents (e.g., cisplatin, methotrexate, ifosfamide)

Review medication list, ensure renal dosing, and discuss concerns with provider/pharmacy.

7 INTAKE & OUTPUT ACCURACY

Accurate documentation is critical!

Include all (when applicable):

- Oral intake
- IV fluids
- Tube feeds
- Flushes
- IV medications
- Urine output
- Emesis
- Stool output
- Drain output
- Other losses (insensible, etc.)

Small volumes matter in pediatrics!

8 ESCALATE IMMEDIATELY FOR:

- Urine output < 0.5 mL/kg/hr for ≥ 6 hours (or anuria ≥ 12 hours)
- New or worsening edema
- Rising serum creatinine or worsening renal function trend
- Hyperkalemia
- Positive fluid balance with respiratory symptoms (e.g., increased work of breathing, oxygen requirement)
- Signs of dehydration or poor perfusion
- Concern for nephrotoxic medication exposure or dosing

9 THE NURSE'S ROLE

- Measure and document I&O accurately
- Trend urine output by weight and time
- Obtain accurate daily weights
- Assess for signs of dehydration or fluid overload
- Review nephrotoxic medication exposure
- Report abnormal trends early
- Educate families on signs to watch for

KEY TAKEAWAY

Every milliliter matters.

Accurate intake and output monitoring helps us recognize early signs of fluid imbalance and acute kidney injury—before the patient deteriorates.

Early recognition. Early action. Better outcomes.

SELECTED PEDIATRIC REFERENCES

- Kopac M. Acute Kidney Injury in Children: Classification, Recognition and Treatment Principles. Children. 2024;11(11):1308.
- Basu RK, et al. Renal Dysfunction Criteria in Critically Ill Children: The PODUM Consensus Conference. Pediatrics. 2022.
- Selwiski DT, et al. Fluid assessment, fluid balance, and fluid overload in sick children. PEDIQ. 2023.
- Goldstein SL, et al. Reduction in nephrotoxic AKI in hospitalized children (NRIIA). Kidney Int. 2020.

RESULTS

The literature consistently demonstrates that accurate intake and output documentation supports earlier identification of fluid imbalance and acute kidney injury. Educational interventions have been associated with improved nursing knowledge, increased recognition of abnormal urine output trends, enhanced clinical assessment, and more timely provider notification when concerns arise. Key findings highlighted the importance of weight-based calculations, trending urine output, and early recognition of patients at risk for AKI.

CONCLUSIONS

Pediatric nurses play a critical role in preventing complications associated with fluid imbalance and acute kidney injury. Increased awareness of accurate intake and output monitoring practices and early AKI indicators can support earlier intervention, improve interdisciplinary communication, and promote safer patient care. Ongoing education regarding pediatric fluid assessment remains an important strategy for enhancing patient safety and clinical outcomes.

REFERENCES



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