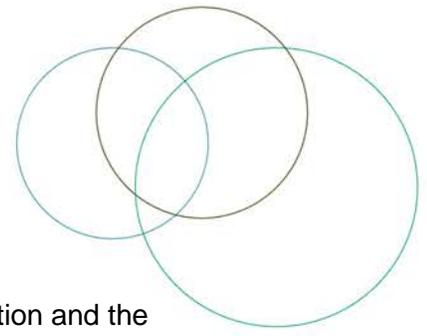


HOSPITAL HARM IMPROVEMENT RESOURCE

# Electrolyte and Fluid Imbalance



## ACKNOWLEDGEMENTS



Canadian Institute  
for Health Information  
Institut canadien  
d'information sur la santé

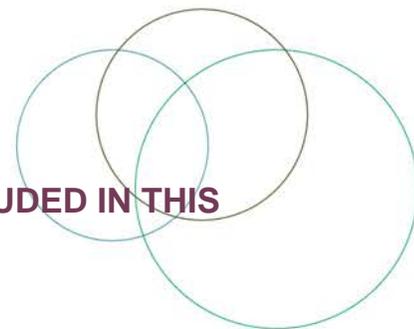


Canadian  
Patient  
Safety  
Institute  
Institut  
canadien  
pour la sécurité  
des patients

The Canadian Institute for Health Information and the Canadian Patient Safety Institute have collaborated on a body of work to address gaps in measuring harm and to support patient safety improvement efforts in Canadian hospitals.

The Hospital Harm Improvement Resource was developed by the Canadian Patient Safety Institute to complement the Hospital Harm measure prepared by the Canadian Institute for Health Information. It links measurement and improvement by providing resources that will support patient safety improvement efforts.



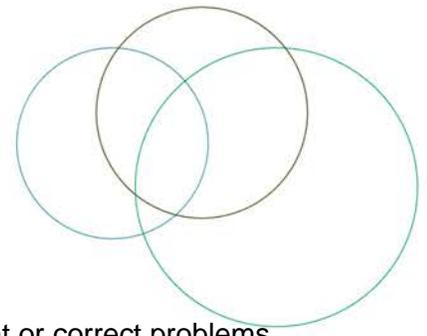


## DISCHARGE ABSTRACT DATABASE (DAD) CODES INCLUDED IN THIS CLINICAL CATEGORY:

### A09: Electrolyte and Fluid Imbalance

<b>Concept</b>	Electrolyte, fluid or acid–base imbalance identified during a hospital stay
<b>Notes</b>	This clinical group excludes procedure-associated hypovolemic shock (refer to D25: Post-Procedural Shock)
<b>Selection criteria</b>	
E86.– E87.–	Identified as diagnosis type (2)
E87.7	Identified as diagnosis type (3) <b>AND</b> T80.8 as diagnosis type (2) <b>AND</b> Y60–Y84 <b>in the same diagnosis cluster</b>
R57.1	Identified as diagnosis type (2) <b>not in a diagnosis cluster</b>
<b>Codes</b>	<b>Code descriptions</b>
<b>E86.–</b>	Volume depletion
<b>E87.–</b>	Other disorders of fluid, electrolyte and acid-base balance
<b>E87.7</b>	Fluid overload
<b>R57.1</b>	Hypovolemic shock
<b>Additional Codes</b>	<b>Inclusions</b>
<b>T80.8</b>	Other complications following infusion, transfusion and therapeutic injection
<b>Y60-Y84</b>	Complications of medical and surgical care (refer to <a href="#">Appendix A</a> of the <a href="#">Hospital Harm Indicator General Methodology Notes</a> )





## OVERVIEW AND IMPLICATIONS

### Electrolyte and Fluid Imbalance

Many adult hospital inpatients require intravenous (IV) fluid therapy to prevent or correct problems with their fluid and/or electrolyte status. This may be because they cannot meet their normal needs through oral or enteral routes (related for example to swallowing problems or gastrointestinal dysfunction) or because they have unusual fluid and/or electrolyte deficits or demands caused by illness or injury (e.g., high gastrointestinal or renal losses). Deciding on the optimal amount and composition of IV fluids and the best rate at which to administer them can be a difficult task. Decisions must be based on careful assessment of the patient's individual needs (National Institute for Health and Care Excellence (NICE) 2013)

Although mismanagement of fluid therapy is rarely reported as being responsible for patient harm, it is likely that as many as one in five patients who receive intravenous (IV) fluids and electrolytes suffer complications or morbidity due to their inappropriate administration. (National Institute for Health and Care Excellence (NICE) 2013/2017),

Potential complications of fluid and electrolyte therapy include:

- hyponatremia,
- hypernatremia
- hypokalemia
- hyperkalemia
- hyperchloraemic acidosis
- volume overload
- volume depletion (NICE 2013)

Hospitalized patients require intravenous (IV) fluid and electrolytes for one or more of the following reasons (the 4Rs):

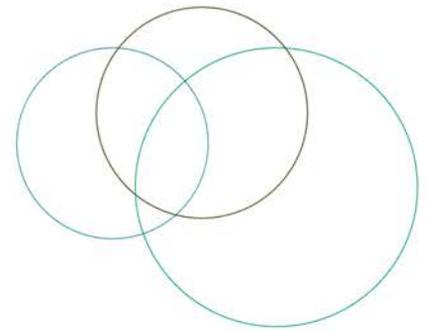
- Fluid resuscitation
- Routine maintenance
- Replacement
- Redistribution (NICE 2013/2017)

Despite the almost ubiquitous need for, and use of intravenous fluids in acutely ill patients, there has been little consensus on the most appropriate rate of administration and composition of intravenous fluids, and practice patterns with respect to maintenance fluids vary widely (Moritz & Ayus 2015).

According to NICE (2013/2017) the principles underpinning safe and effective IV fluid and electrolyte therapy are:

- physiological principles that underpin fluid prescribing
- pathophysiological changes that affect fluid balance in disease states
- indications for IV fluid therapy





- reasons for the choice of the various fluids available and
- principles of assessing fluid balance

### **Fluid overload**

Fluid overload is a relatively frequent occurrence in critically ill patients and is often a consequence of critical care intervention. It may lead to pulmonary edema and in critically ill patients, fluid overload is independently associated with increased morbidity and mortality as well as increased hospital costs (NICE 2013; Ogbu et al. 2015).

### **Transfusion-associated circulatory overload (TACO)**

TACO is a complication of blood transfusion that is due to impaired cardiac function and/or an excessively rapid rate of transfusion. It occurs in one in 700 transfusion recipients and patients over 70 years of age, infants, and patients with severe euvoletic anemia (hemoglobin <50 g/L), renal impairment, fluid overload, and cardiac dysfunction are particularly susceptible (Callum et al. 2016). The risk factors for TACO include, age over 70 years, history of heart failure, left ventricular dysfunction, history of myocardial infarction, renal dysfunction, and positive fluid balance. The clinical presentation includes: dyspnea, orthopnea, cyanosis, tachycardia, increased venous pressure and hypertension (Callum et al. 2016).

### **Hypovolemic shock**

In hypovolemia, a patient's fluid needs are not met by oral, enteral or IV intake and the patient will demonstrate features of dehydration on clinical exam, low urine output or concentrated urine and biochemical indicators, such as more than 50 per cent increase in urea or creatinine with no other identifiable cause (NICE, 2013). Patients may exhibit thirst, vomiting, diarrhea, weight loss, dizziness, confusion, somnolence, reduced skin turgor, dry mucous membranes, sunken eyes, reduced capillary refill, tachycardia and postural hypotension (Frost 2015). Hypovolemic shock is an emergency condition in which severe blood and fluid loss make the heart unable to pump enough blood to the body.

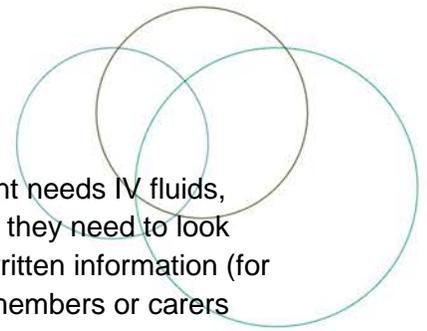
## **GOAL**

Reduce the incidence of harm associated with electrolyte and fluid imbalance.

## **IMPORTANCE FOR PATIENTS AND FAMILIES**

Fluid and electrolyte imbalances are associated with numerous complications, including increased morbidity and mortality, as well as increased hospital length of stay. Hospital patients needing IV fluids are very variable in terms of their fluid and electrolyte status and their likely responses to IV fluid therapy. Therefore, a full assessment is required by a competent clinician regarding the best content, volume and rate of IV fluids to be administered in order to minimize risks associated with fluid and electrolyte therapy (NICE 2013).





Patients have a valuable contribution to make to their fluid balance. If a patient needs IV fluids, the decision should be explained to them along with the signs and symptoms they need to look for if their fluid balance needs adjusting. If possible or when asked, provide written information (for example, NICE's Information for the public), and involve the patient's family members or carers (as appropriate) (NICE 2013).

### Patient Stories

- **Near Fatal: A Patient Safety Story** (Saskatchewan Health Authority - Saskatoon area, 2015)
- **Medication Error in the Hospital Kills Two-Year Old Emily Jerry. As told by Christopher S. Jerry** (Patient Safety Movement, 2014)

*Emily Jerry was diagnosed with a yolk sac tumor about the size of a grapefruit when she was about 18 months old. Her doctors and nurses assured me that Emily's cancer was not only treatable, but curable...Sunday, Feb. 26, after the third day of her last chemotherapy treatment, Emily awoke from her nap groggy. She kept trying to sit up and asked her mom to hold her in her lap. She kept grabbing her head and moaning that it hurt.... She cried some more before she started screaming, "Mommy, my head, my head hurts! MY HEAD HURTS!"...Emily went completely limp and the nurses began to resuscitate her. Within the hour, my precious daughter was on life support. Emily wound up brain dead and on life support – essentially dead due to the massive brain damage she had incurred. Our Emily was killed by an overdose of sodium chloride in her chemotherapy IV bag.....read the full story [here](#).*

## CLINICAL AND SYSTEM REVIEWS, INCIDENT ANALYSES

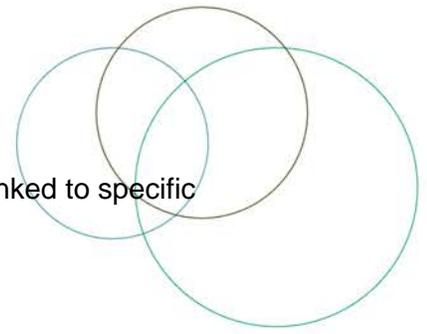
Given the broad range of potential causes of electrolyte and fluid imbalance, clinical and system reviews should be conducted to identify potential causes and determine appropriate recommendations.

Occurrences of harm are often complex with many contributing factors. Organizations need to:

1. Measure and monitor the types and frequency of these occurrences.
2. Use appropriate analytical methods to understand the contributing factors.
3. Identify and implement solutions or interventions that are designed to prevent recurrence and reduce risk of harm.
4. Have mechanisms in place to mitigate consequences of harm when it occurs.

To develop a more in-depth understanding of the care delivered to patients, chart audits, incident analyses and prospective analyses can be helpful in identifying quality improvement opportunities. Links to key resources for [conducting chart audits](#) and [analysis methods](#) are included in the [Hospital Harm Improvement Resources Introduction](#).





If your review reveals that your cases of fluid and electrolyte imbalance are linked to specific processes or procedures, you may find these resources helpful:

- Institute for Healthcare Improvement (IHI). <http://www.ihl.org/>
  - Reduce Adverse Drug Events Involving Electrolytes  
[www.ihl.org/resources/Pages/Changes/ReduceAdverseDrugEventsInvolvingElectrolytes.aspx](http://www.ihl.org/resources/Pages/Changes/ReduceAdverseDrugEventsInvolvingElectrolytes.aspx)
  - How- to guide: prevent harm from high-alert medications. 2012  
<http://www.ihl.org/resources/Pages/Tools/HowtoGuidePreventHarmfromHighAlertMedications.aspx>
- Institute for Safe Medication Practice: <https://www.ismp.org/>
  - Targeted Medication Safety Best Practices for Hospitals.  
<https://www.ismp.org/guidelines/best-practices-hospitals>
  - High-Alert Medications in Acute Care Settings.  
<https://www.ismp.org/recommendations/high-alert-medications-acute-list>
- National Institute for Health and Care Excellence (NICE) <https://www.nice.org.uk/>
  - Intravenous fluid therapy in adults in hospital: Clinical guideline [CG174]  
<https://www.nice.org.uk/guidance/cg174>
  - Intravenous fluid therapy in adults in hospital: Quality standard [QS66]  
<https://www.nice.org.uk/guidance/qs66>
- Ontario Regional Blood Coordinating Network: Bloody Easy for Healthcare Professionals.  
[https://transfusionontario.org/en/documents/?cat=bloody\\_easy](https://transfusionontario.org/en/documents/?cat=bloody_easy)

## **MEASURES**

Vital to quality improvement is measurement, and this applies specifically to implementation of interventions. The chosen measures will help to determine whether an impact is being made (primary outcome), whether the intervention is actually being carried out (process measures), and whether any unintended consequences ensue (balancing measures).

In selecting your measures, consider the following:

- Whenever possible, use measures you are already collecting for other programs.
- Evaluate your choice of measures in terms of the usefulness of the final results and the resources required to obtain them; try to maximize the former while minimizing the latter.
- Try to include both process and outcome measures in your measurement scheme.
- You may use different measures or modify the measures described below to make them more appropriate and/or useful to your particular setting. However, be aware that modifying measures may limit the comparability of your results to others.





- Posting your measure results within your hospital is a great way to keep your teams motivated and aware of progress. Try to include measures that your team will find meaningful and exciting (IHI, 2012).

## **GLOBAL PATIENT SAFETY ALERTS**

[Global Patient Safety Alerts](#) (GPSA) provides access and the opportunity to learn from other organizations about specific patient safety incidents including alerts, advisories, recommendations and solutions for improving care and preventing incidents. Learning from the experience of other organizations can accelerate improvement.

### **Recommended search terms:**

- Hyponatremia
- Hypernatremia
- Sodium
- Hypokalemia
- Hyperkalemia
- Potassium
- Fluids
- Electrolytes
- Fluid and Electrolytes

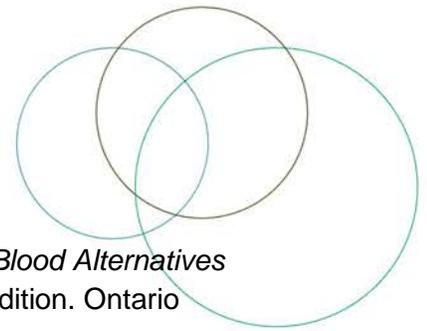
## **SUCCESS STORIES**

### **St. Paul's Hospital, Vancouver BC**

Physicians at St. Paul's Hospital in Vancouver recognized that hyperkalemia occurs in up to 10 per cent of hospitalized patients, and that although it is a life-threatening condition, there is little consistency in the management of high serum potassium. They conducted a quality improvement project aimed at increasing the proportion of hyperkalemia cases managed according to the best available evidence and reducing the cost of treatment. A pocket-sized guideline outlining the management of hyperkalemia according to the best available evidence was distributed to internal medicine residents. Cases of hyperkalemia occurring in a two-week period before the guideline was distributed (observational phase) were reviewed retrospectively and compared with cases occurring in two 2-week periods after the guideline was distributed (intervention phase). A review of paper charts and electronic health records indicated that before the intervention, hyperkalemia was managed according to the best available evidence in 63 per cent of cases. After the intervention, cases were managed according to the best available evidence in 94 per cent of cases. In addition, the overall cost incurred per case declined from \$16.74 to \$7.51.

In summary, providing residents with a user-friendly guideline for hyperkalemia increased the proportion of cases managed according to best available evidence and significantly reduced the cost associated with treatment. (Rajan et al. 2012)





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