



Measure Fact Sheet – The AHRQ-CMS Pediatric Quality Measures Program (PQMP)

Measure: Appropriateness of Red Cell Transfusions in the Pediatric Intensive Care Unit (PICU)

Measure Developer: Pediatric Measurement Center of Excellence (PMCoE)

Numerator	Denominator	Exclusions	Data Source(s)
Number of transfusions in PICU patients who have a hemoglobin of less than or equal to 7 grams/deciliter (rounding down for 7.5 g/dL or less). Note: one transfusion equals one blood bank transfusion record.	Number of transfusions performed in the PICU during the reporting period.	<ul style="list-style-type: none"> All patients with cyanotic heart disease. All patients with unstable shock.* All patients who are actively bleeding or have acute hemolysis. All patients who are on extracorporeal membrane oxygenation (ECMO). All patients with sickle cell disease. 	Electronic health record. Paper medical record.

*The addition of or an increase in a continuous infusion of any cardioactive drug within the preceding 24 hours.

Measure Importance

Between 15 and 49 percent of PICU patients receive at least one red blood cell (RBC) transfusion during their PICU admission, and more than 60 percent of children who are transfused receive more than one transfusion.¹

Growing evidence has shown that RBC transfusions may be associated with more harm than benefit, with the most recent data indicating that using a hemoglobin (Hgb) transfusion threshold of >7 g/dL does not yield improved outcomes. One study reported a rate of complications of 10.7 per 1,000 units transfused.² Other studies have suggested that PICU patients may be at an increased risk for morbidity and mortality when undergoing transfusion.³ Blood transfusions are also well documented to be associated with other risks, such as hospital-associated infection, gut ischemia, transfusion reactions, and stimulation of the inflammatory response.



Pediatric RBC transfusions have been shown to increase resource utilization and costs. Resource use in terms of length of stay (LOS) and costs was higher in patients who received transfusion.² A study in 2010⁴ calculated that the cost per unit of RBCs transfused at two U.S. hospitals averaged \$1,182.32 at one of the hospitals and \$726.05 at the other. Additionally, blood product acquisition costs contributed to only 21-32 percent of total blood transfusion expenditures, with direct and indirect overhead costs accounting for roughly double that percentage at U.S. hospitals.⁴

Evidence Base for Focus of the Measure

Current transfusion practices vary widely, both within and between PICUs.⁵ The results from a 2013 case-based survey showed significant variation among pediatric intensivists in the Hgb that would trigger an order for transfusion of RBCs. Most transfusions occurred at Hgb values that were higher than recommended by applicable guidelines.⁵

Advantages of the Measure

- This measure is specified for construction in electronic health records (EHRs).
- This measure has also been specified to be constructed to assess performance through manual chart review.
- This measure captures important exclusion criteria that are necessary to factor in when considering a pediatric critical care population.
- This measure is unique in that it is physician-specific and capable of measuring quality based on an individual physician's performance.
- This measure fills a gap in the CHIPRA initial core set, which currently does not include any measures for the pediatric critical care unit.
- This measure is publicly available for noncommercial use.

Levels of Aggregation Applicable to the Measure

This measure is intended for aggregation and comparison at the State, regional, payment model, health plan, hospital, unit, and physician levels.

Reliability and Validity of the Measure

Parallel forms reliability testing was performed at one Chicago-area children's hospital in the Chicago Pediatric Quality and Safety Consortium (CPQSC). One site performed parallel-forms testing and compared the construction of this eMeasure against the results of manual chart reviews of the same patients, using a reporting period of January 1 – March 31, 2015.

One site assessed this eMeasure electronically, providing electronic output for 110 unique patients representing 121 events; this same site also performed five chart reviews and compared the results of the electronic output with the results of the manual chart reviews on the same patients.

The face validity of the measure was also assessed by an Expert Technical Panel of key stakeholders and through a public comment and was determined to have both understandability and face validity for key pediatric critical care stakeholders.

Measure Development and Testing

- Feasibility testing of the eMeasure was conducted at four Chicago area hospitals that are a part of the CPQSC. A Data Element Table (DET) tool was used to assess sites' EHR systems, which included Epic and Cerner.
- At three of the sites, the measure was determined to be "technically feasible, can do today." At the fourth site, the measure was determined to be "technically feasible with workflow modifications or changes to the EHR" because (1) the variable type for two denominator elements, occurrence of a blood transfusion and the associated date, could not be determined by the informaticist, and (2) some denominator exceptions, including unstable shock and patients on ECMO, were captured only in free text fields, if at all.
- Among the three sites determined to be technically feasible, the measure had implementation feasibility at only one site. At the other sites, the measure was determined to be "technically feasible with workflow modifications or changes to the EHR" because of the way denominator exceptions were captured through documentation. For example, structured fields for the exceptions were not always utilized when available, making it difficult to identify patients with the denominator criteria.
- Reliability assessment was conducted at the one site in which the measure was considered feasible; the measure was implemented in the EHR using an electronic algorithm. Manual chart abstraction was then compared to the automated report of the constructed measure to determine the reliability of the overall measure and individual measure elements.
- The patient sample was identified using a reporting period of January 1 – March 31, 2015. Using an electronic algorithm, charts were identified that met the denominator criteria and stratified by age group (0 - < 6 years, 6 - < 12 years, 12 - < 18 years); charts were then randomly selected for abstraction within each age stratum.

Selected Results from Tests of the Measure

- Overall (N=181), the clinical performance of this eMeasure was fairly high, with 91 percent of transfusions meeting the numerator criteria of a transfusion occurring in PICU patients with a hemoglobin of less than or equal to 7 grams/deciliter (rounding down for 7.5 or less).
- Five chart abstractions were performed at this site. Of the five patients, 80 percent (N=4) met the measure criteria. Similarly, 80 percent (N=8) of unique transfusions met the measure criteria.

- Chart abstractions were performed for five patient charts for patient-level data included in the electronic output. Agreement for parallel-forms reliability testing was 100 percent for the measure elements: race, ethnicity, and payer. During the chart review process, the chart abstractor found that one patient was noted to have two transfusions in the electronic report; however, one of the orders was cancelled and only noted as such in the patient chart. As a result, the agreement for the denominator criteria was 90 percent. Aside from this discrepancy, overall agreement was 100 percent.
- Feasibility testing indicated that in order to increase feasibility of this measure, sites should change the workflow such that structured fields, when available, are used for these measure elements.

Caveats

- Use of the eMeasure is limited to sites documenting relevant clinical information in structured, queryable fields available in the EHRs and with all of the measure elements documented in structured fields.
- There is a possibility that missing data or ambiguous information from poor documentation of care can lead to calculation errors and low performance on the measure.
- Workflow modifications or changes to a site's EHR system may be necessary in order to calculate the measure.
- The safety of red blood cell transfusion is an important aspect of PICU care, and this measure is the first in what we recommend to be a family of measures on red blood cell transfusion.

More Information:

- AHRQ: CHIPRAqualitymeasures@ahrq.hhs.gov
- COE: Lisa Krams, lkrams@aap.org and Ramesh Sachdeva, rsachdeva@chw.org
- Coming soon: Link to measure details on AHRQ Web site.

For more information about the PQMP, visit www.ahrq.gov/chipra.

Notes

¹Nahum E, Ben-Ari J, Schonfeld T. Blood transfusion policy among European pediatric intensive care physicians. *J Intensive Care Med* 2004; 9(1):38-43.

²Armano R, Gauvin F, Ducruet T, et al. Determinants of red blood cell transfusions in a pediatric critical care unit: A prospective, descriptive epidemiological study. *Crit Care Med* 2005; 33(11):2637-44.

³Laverdière C, Gauvin F, Hébert PC, et al. Survey on transfusion practices of pediatric intensivists. *Pediatr Crit Care Med* 2002; 3(4):335.

⁴Shander A, Hofmann A, Ozawa S, et al. Activity-based costs of blood transfusions in surgical patients at four hospitals. *Transfusion* 2010; 50(4):753-65.

⁵Demaret P, Tucci M, Ducruet T, et al. Red blood cell transfusion in critically ill children. *Transfusion* 2013; 54(2): 365-75. Available at <http://onlinelibrary.wiley.com/doi/10.1111/trf.12261/abstract>. Accessed March 28, 2016.

The Children's Health Insurance Program Reauthorization Act (CHIPRA) called for establishment of a Pediatric Quality Measures Program (PQMP) as a followup to identifying the initial core set of children's health care quality measures. This measure fact sheet was produced by the Agency for Healthcare Research and Quality, based on information provided by the AHRQ-CMS CHIPRA Pediatric Measurement Center of Excellence (PMCoE), which was funded by an AHRQ-CMS award. A listing of all submitted CHIPRA Centers of Excellence measures can be found at www.ahrq.gov/chipra. All CHIPRA COE-developed measures are publicly available for noncommercial use.



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