

Clinical Decision Support for Transfusion Medicine

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SCHOOL OF MEDICINE



Disclosures

- I have no financial disclosures or conflicts of interest related to this presentation.

Learning objectives

- **Define** clinical decision support (CDS)
- **List** examples of CDS applied to transfusion medicine
- **Evaluate** the effectiveness of CDS tools

A tale of petrified wood

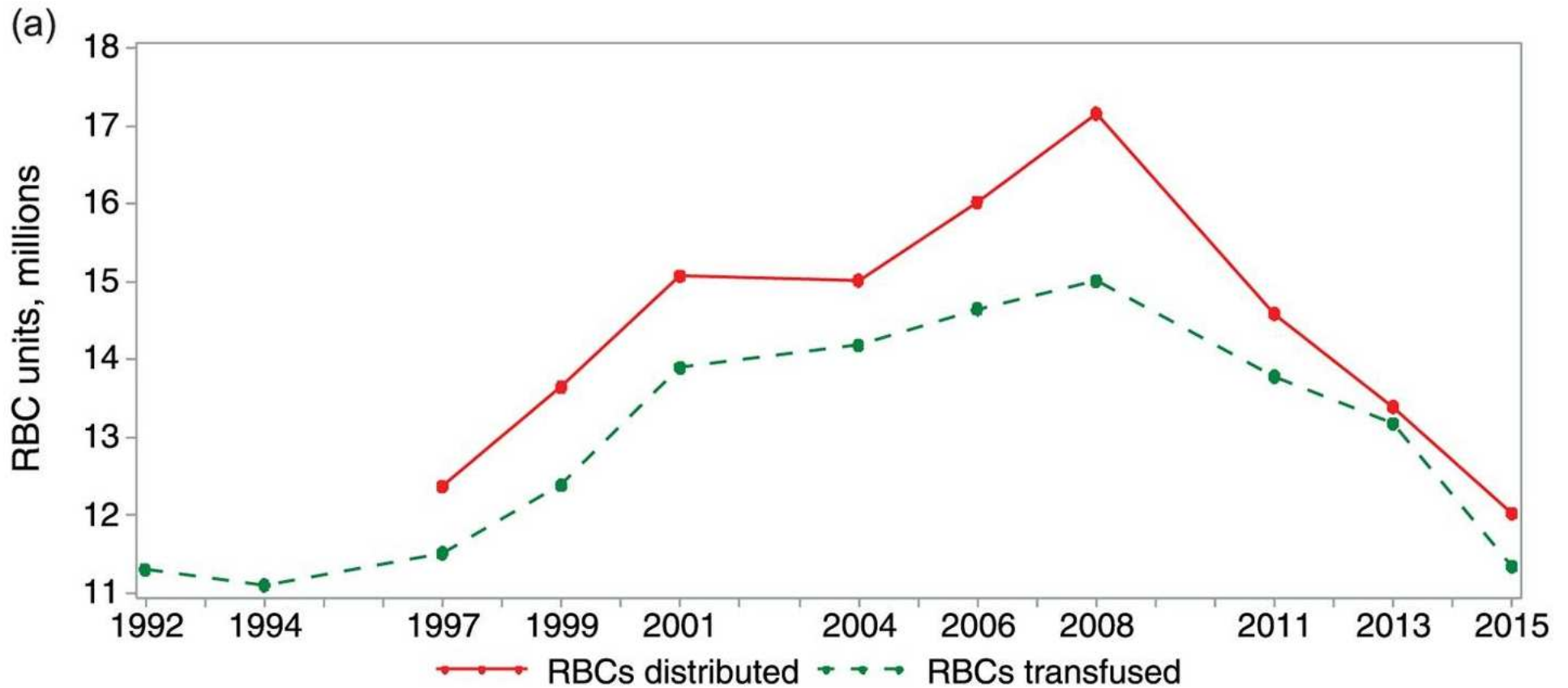
- Location: Petrified Wood National Park (Arizona)
- Problem: Visitors frequently removed petrified wood for souvenirs.
- Solution: Put up signs reading, “Your heritage is being vandalized every day by theft losses of petrified wood, mostly a small piece at a time.”
- Result: Theft *increased* from 5% to 8%.
- Conclusion: “Stealing petrified wood is a common and socially acceptable behavior.”



Grant A & Sandberg S. *New York Times*. Dec 6, 2014.

Images: nps.gov

RBC transfusion in the United States



Causes of sustained decrease in RBC transfusion

- Increased awareness of transfusion reactions and poor outcomes (e.g. TACO, TRALI)
- Costs of transfusion (>\$200/unit plus blood bank and ancillary costs)
- **Research and changes in medical culture supporting restrictive transfusion practices**

Current research in RBC transfusion utility

- 1999: First randomized controlled trial supporting a restrictive transfusion threshold (Hgb <7 g/dL)
- 2010-: Several more RCTs supporting restrictive transfusion in a variety of complicated patient populations
- 2012-: ABIM Foundation *Choosing Wisely* campaign recommends restrictive transfusion in several patient situations
- Advances in clinical decision support to reduce liberal ordering of blood products

RCTs supporting restrictive transfusion

Trial	Population	Transfusion thresholds (g/dL)	Primary outcome	Results
TRICC ^a	Stable, critically ill	Hb < 7 vs. Hb < 10	30-day mortality	18.7% vs. 23.3%
FOCUS ^b	Post hip fracture surgery, with cardiovascular disease history/risks	Hb < 8 vs. Hb < 10	60-day mortality or inability to walk across a room	35.2% vs. 34.7%
Villanueva <i>et al.</i> ^c	Severe upper GI bleeding	Hb < 7 vs. Hb < 9	45-day mortality	5.2% vs. 9.2% <i>p</i> < 0.02
TRISS ^d	Septic shock	Hb < 7 vs. Hb < 9	90-day mortality	43.0% vs. 45.0%
TITRe2 ^e	Post non-emergent cardiac surgery	Hb < 7.5 vs. Hb < 9	Ischemia or sepsis at 3 month	35.1% vs. 33.0%

^aHebert *et al.*, NEJM 1999;340:409-17

^bCarson *et al.*, NEJM 2011;365:2453-62

^cVillanueva *et al.*, NEJM 2013;368:11-21

^dHolst *et al.*, NEJM 2014;371:1381-91

^eMurphy *et al.*, NEJM 2015;372:997-1008

Overutilization of tests and procedures

- 2014 American Board of Internal Medicine (ABIM) Foundation survey of physician ordering practices (n = 600, primary care and specialists)

Figure 1: Do you think the frequency of unnecessary tests and procedures in the health care system is a...

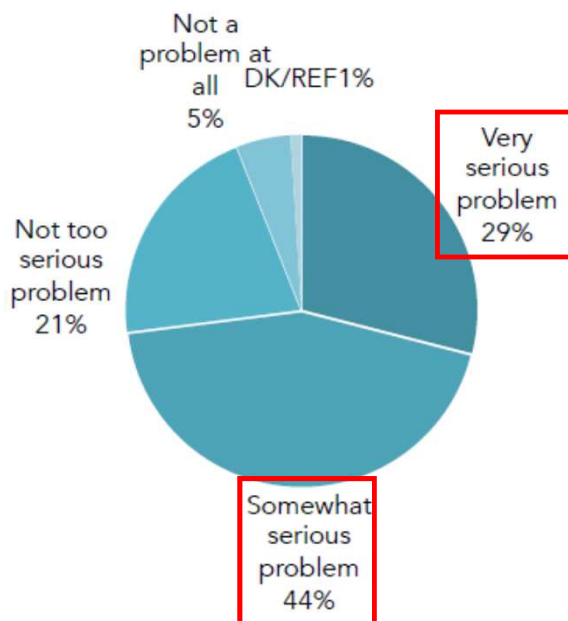


Figure 4: Let's say a patient came to you convinced he or she needed a specific test. You knew the test was unnecessary, but the patient was quite insistent. Would you:

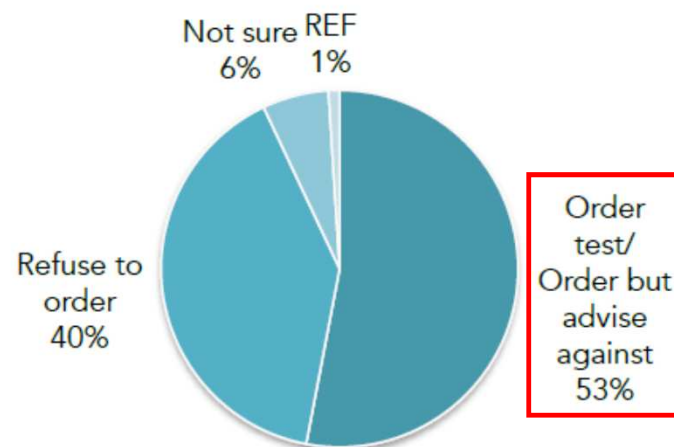
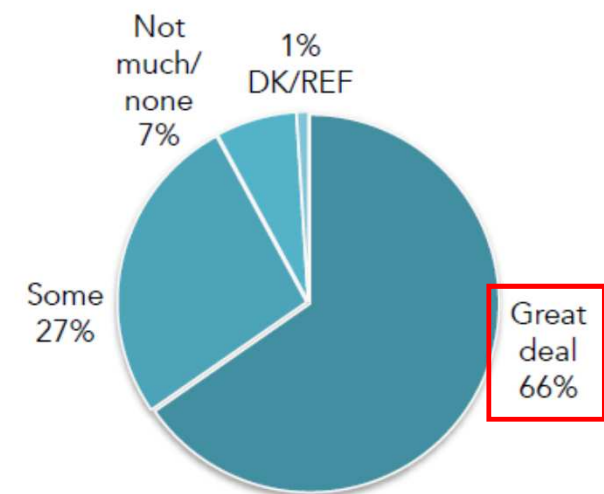
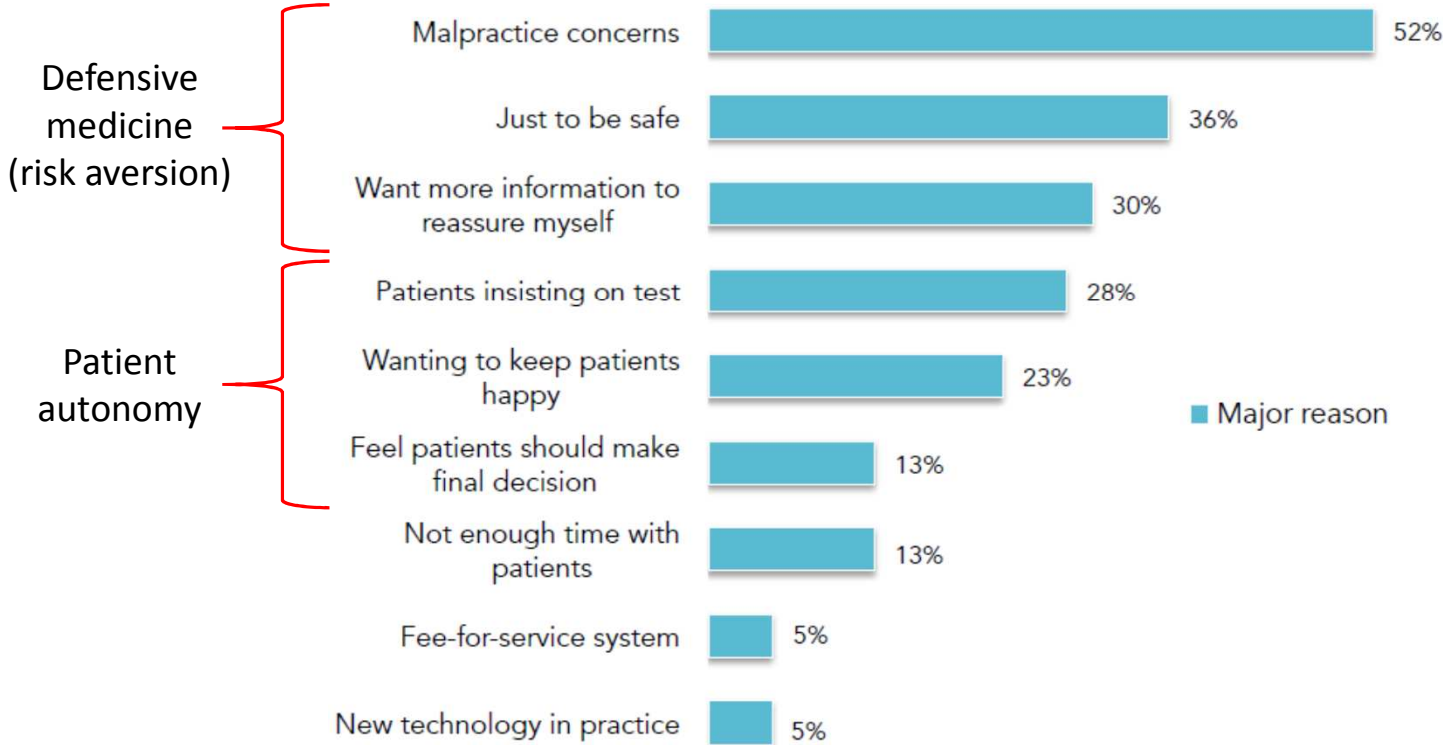


Figure 9: How much responsibility do you feel you have for making sure your patients avoid unnecessary tests and procedures?



Motivations for overutilization

Figure 5: In your own practice, is this a reason you sometimes end up ordering an unnecessary test or procedure? IF YES: Is this a major reason or minor reason?
Total n = 600



Choosing Wisely

- ABIM initiative involving >70 medical professional societies
- Recommendations for improved utilization of clinical resources
- Many related to laboratory testing and transfusion



Avoid transfusions of red blood cells for arbitrary hemoglobin or hematocrit thresholds and in the absence of symptoms of active coronary disease, heart failure or stroke.

Don't perform repetitive CBC and chemistry testing in the face of clinical and lab stability.

Choosing Wisely transfusion recommendations

American Association of Blood Banks

Don't transfuse red blood cells for iron deficiency without hemodynamic instability.

Critical Care Societies Collaborative – Critical Care

Don't transfuse red blood cells in hemodynamically stable, non-bleeding ICU patients with a hemoglobin concentration greater than 7 g/dL.

American Society of Hematology

Don't transfuse more than the minimum number of red blood cell (RBC) units necessary to relieve symptoms of anemia or to return a patient to a safe hemoglobin range (7 to 8 g/dL in stable, non-cardiac in-patients).

American Society of Anesthesiologists

Don't administer packed red blood cells (PRBCs) in a young healthy patient without ongoing blood loss and hemoglobin of ≥ 6 g/dL unless symptomatic or hemodynamically unstable.

Society of Hospital Medicine – Adult Hospital Medicine

Avoid transfusions of red blood cells for arbitrary hemoglobin or hematocrit thresholds and in the absence of symptoms of active coronary disease, heart failure or stroke.

American College of Obstetricians and Gynecologists

Don't routinely transfuse stable, asymptomatic hospitalized patients with a hemoglobin level greater than 7–8 grams.

American Society of Hematology

Don't routinely transfuse patients with sickle cell disease (SCD) for chronic anemia or uncomplicated pain crisis without an appropriate clinical indication.

The logo for 'Choosing Wisely' features the words 'Choosing' and 'Wisely' stacked vertically in a bold, black, sans-serif font. To the left of the text is a vertical bar composed of four colored squares: yellow, green, blue, and purple. A registered trademark symbol (®) is located to the upper right of the word 'Wisely'.

An initiative of the ABIM Foundation

choosingwisely.org

Encouraging effective use of transfusion

- Development of evidence-based guidelines
- Education (*e.g.* departmental meetings and conferences)
- Auditing of potentially inappropriate transfusions
- **Electronic clinical decision support**

Clinical decision support (CDS)

- **Definition:** “the use of information and communication technologies to bring relevant knowledge to bear on the health care and well-being of a patient” (Greenes RA ed. Clinical decision support: the road to broad adoption 2014)
- Requires expertise in several aspects of clinical informatics
 - Evidence-based medicine
 - Clinical decision-making
 - Health information technology, *e.g.* computerized provider order entry (CPOE) systems
 - Human-computer interaction
- When implemented properly, CDS is effective in guiding appropriate blood utilization in many clinical scenarios.

Common CDS tools to affect provider ordering behavior

	CDS intervention
Ordering	Order search menus
	Order templates and instructions
	Order sets
	Order reflexes and cascades
	Order alerts
	<ul style="list-style-type: none">• Interruptive• Non-interruptive
Education	Electronic reporting and interpretation
	Electronic references
	Electronic feedback and benchmarking
	<ul style="list-style-type: none">• Individualized• By department• By institution
Diagnostics	Decision algorithms
	<ul style="list-style-type: none">• Within electronic health record• On handheld/mobile devices
	Predictive analytics/machine learning

Current state of CDS in the United States

- Pharmacy: widespread use
 - Dosing errors
 - Drug-drug and drug-allergy interactions
- Federal mandates
 - *Meaningful Use*: financial incentives for use of CDS tools
 - *Protecting Access to Medicare Act (2014)*: Certified CDS *required* for reimbursement of certain outpatient imaging studies
- Laboratory & blood bank: value only beginning to be realized

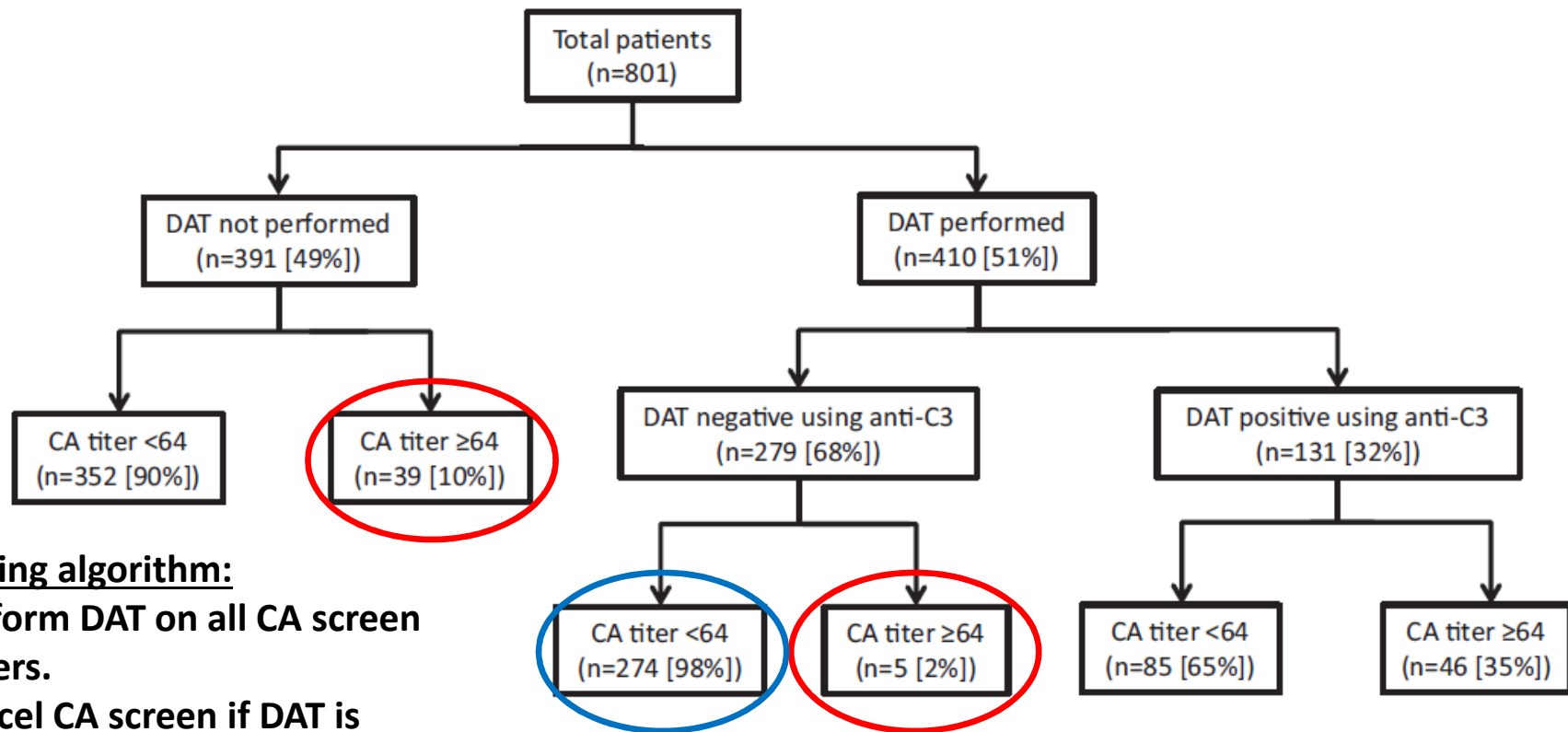
	Stage 1	Stage 2
Objective	Implement one clinical decision support rule relevant to specialty or high clinical priority along with the ability to track compliance that rule	Use clinical decision support to improve performance on high-priority health conditions
Measure	Implement one clinical decision support rule	<div style="border: 1px solid red; padding: 5px;"> 1. Implement <u>5</u> clinical decision support interventions <u>related to 4 or more clinical quality measures</u>, if applicable, at a relevant point in patient care for the entire EHR reporting period. </div> 2. The EP, eligible hospital, or CAH has <u>enabled the functionality for drug-drug and drug-allergy interaction</u> checks for the entire EHR reporting period

Meaningful Use CDS objectives

CDS applications in transfusion medicine

- Blood bank testing algorithms
- Indication menu in blood order
- Dashboards for blood utilization
- Educational initiatives on best practices in transfusion
- Maximum surgical blood order schedule (MSBOS)
- Feedback to providers on personal use of blood
- Alerts for potentially inappropriate transfusion orders


Cold agglutinin (CA) testing – evidence for algorithmic testing



CA testing algorithm:

1. Perform DAT on all CA screen orders.
2. Cancel CA screen if DAT is negative with anti-C3.

Indication menu in blood order

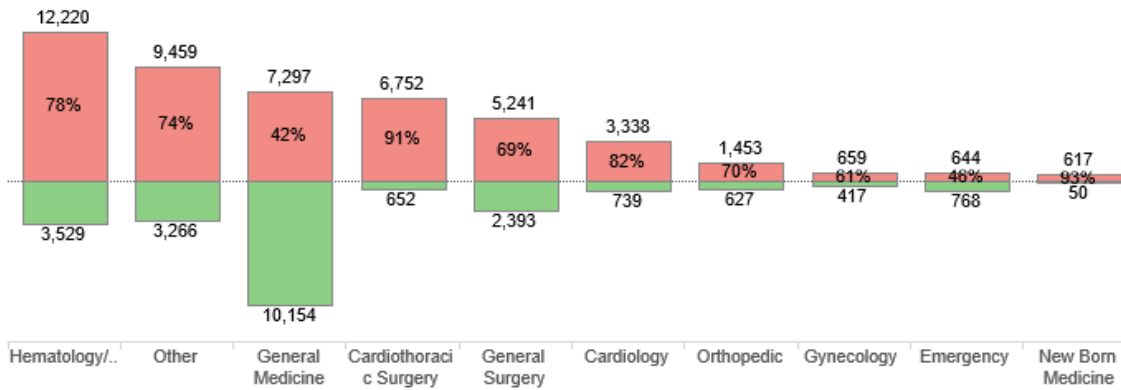


The screenshot shows a software interface for entering a blood order. At the top right, there are 'Accept' and 'Cancel' buttons. The form includes the following fields and options:

- Priority:** A dropdown menu with 'Routine' selected, and 'STAT' as an alternative option.
- Prepare:** A dropdown menu with a red warning icon, and buttons for 'Units', '1 Units', and '2 Units'.
- Date required:** A date field containing '2/21/2018'.
- Transfusion indications:** A list of selectable options including:
 - Hemorrhagic shock/Life-threatening bleeding
 - Active bleeding, Hgb <8 g/dL
 - Hgb <7 g/dL
 - Cardiovascular Disease, Hgb <8 g/dL
 - Pre-op Hgb <8 g/dL
 - Pre-op Hgb <9 g/dL, high risk of severe bleed
 - Hold for Procedure (specify procedure)
 - Intra-op transfusion
 - Sickle cell/Congenital anemia
 - BMT, Hgb <8 g/dL
 - Extracorporeal device priming
 - According to clinical research protocol
 - Other (specify)
- Are special requirements needed? (all products are leukoreduced):** Radio buttons for 'Yes' and 'No'.
- Comments:** A text area with a 'Click to add text (F6)' prompt.

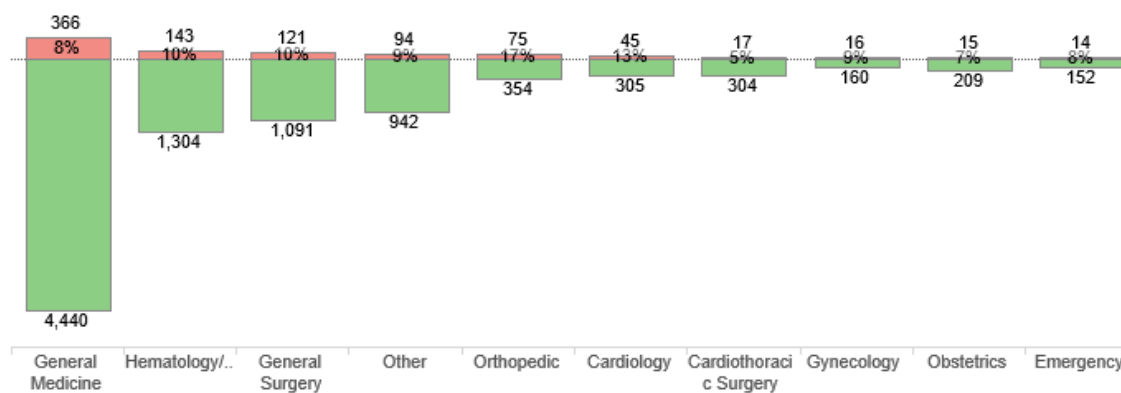
**A valid indication must be selected.
Requests outside indications must be justified.**

Dashboards for blood utilization



RBC transfusions with Hgb > 7

RBC transfusions with Hgb < 7



RBC transfusions with "Hgb < 7" indication selected on order

Educational initiatives on best practices (Johns Hopkins)

A.

"Why give 2 when 1 will do?"
Single Unit RBC Transfusion

Choosing Wisely

Single unit red cell transfusions should be the standard for non-bleeding, hospitalized patients.

- 7 g/dL threshold for stable patients
- 8 g/dL threshold for stable patients with cardiovascular disease

Don't transfuse more units of blood than absolutely necessary.

<http://www.choosingwisely.org/societies/american-association-of-blood-banks/>



Message appeared in newsletters and on computer screensavers.



Multi-unit transfusion orders decreased from 68% to 31%.

Maximum surgical blood order schedule (MSBOS)

Intra Op Blood Orders

Prepare (Crossmatch)
Place this order if there are no blood products available.

Surgical Blood Order Schedule - JHH
Surgical Blood Order Schedule - BMC

- Prepare Leukoreduced Red Blood Cells (Crossmatch)
- Prepare Leukoreduced Platelet, Pheresis Product
- Prepare Plasma
- Prepare Cryoprecipitate
- Prepare Granulocyte

Transfuse
Place this order if products are available in the blood bank.

- Transfuse Leukoreduced RBC
STAT, Transfuse 1 unit
- Transfuse Leukoreduced Platelet
STAT, Transfuse 1 dose
- Transfuse Plasma
STAT, Transfuse 1 unit
- Transfuse Cryoprecipitate
STAT, Transfuse 1 dose
- Transfuse Granulocyte

SURGICAL BLOOD ORDER SCHEDULE

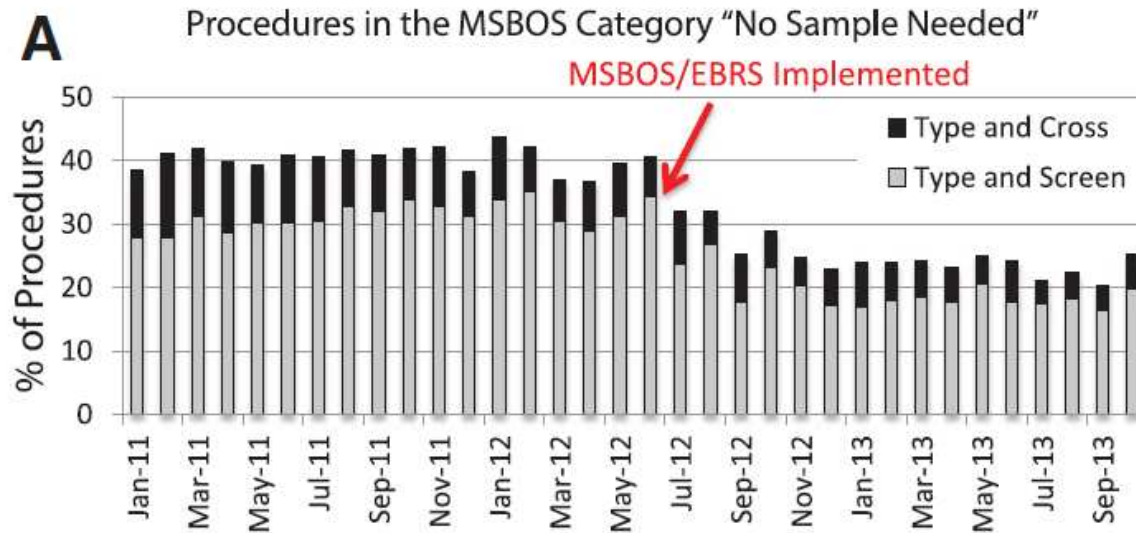
Cardiac Surgery		Obstetrics		Thoracic Surgery	
Case Category	Rec	Case Category	Rec	Case Category	Rec
Heart or lung transplant	T/C 4U	Complex Cesarean (Accrota, Placenta, Previa, etc.)	T/C 4U	Esophageal open	T/C 2U
Minimally invasive valve	T/C 4U	Repeat Cesarean	T/C 2U	Sternal procedure	T/C 2U
Revision stentotomy	T/C 4U	Routine Primary Cesarean	T/S	Chest wall	T/C 2U
CASG-valve	T/C 4U	Vaginal Delivery	T/S	Thoracotomy	T/C 2U
Open heart surgery	T/C 4U	D&C/D&E/Genetic Termination	T/S	Pectus repair	T/C 2U
Assist device	T/C 4U	Tubal Ligation	No Sample	VATS	T/S
Cardiac/major vascular	T/C 4U	Cerclage	No Sample	Mediastinoscopy	T/S
Open ventricle	T/C 4U			EGD/FOB	No Sample
CABG	T/C 2U			Central venous access	No Sample
Cardiac wound surgery	T/C 2U				
Percutaneous cardiac	T/C 2U				
Pericardium	T/C 2U				
Lead extraction	T/C 2U				
AICD/pacemaker placement	T/S				

General Surgery		Orthopedic Surgery		Urology	
Case Category	Rec	Case Category	Rec	Case Category	Rec
AP resection	T/C 2U	Thoracic/Lumbar/Sacral fusion	T/C 4U	Cystoprostatectomy	T/C 2U
Intra-abdominal GI	T/C 2U	Pelvic orthopedic	T/C 4U	Urology open	T/C 2U
Whipple or pancreatic	T/C 2U	Open hip	T/C 2U	Nephrectomy	T/C 2U
Liver resection	T/C 2U	Femur open	T/C 2U	Lap/Robotic kidney/adrenal	T/S
Retropitoneal	T/C 2U	Above/below knee amputation	T/C 2U	RRP	T/S
Substernal	T/C 2U	Humerus open	T/S	Percutaneous nephrolithotomy	T/S
Bone marrow harvest	T/S	Fasciotomy	T/S	Robotic RRP	No Sample
Hernia - Inguinal/Umbilical	No Sample	Shoulder Incision & Drainage	T/S	External genitalia/Penile	No Sample
Appendectomy	No Sample	Tibial/fibular	T/S	TURP	No Sample
Abdomen/chest/soft tissue	No Sample	Total knee replacement	T/S	Cysto/ureter/urethra	No Sample
Lap. or open cholecystectomy	No Sample	Shoulder open	T/S	TURBT	No Sample
Thyroid/parathyroid	No Sample	Knee open	T/S		
Central venous access	No Sample	Thigh soft tissue	No Sample		
Any Breast - except w/flaps	No Sample	Ortho external fixation	No Sample		
		Peripheral nerve/tendon	No Sample		
		Lower extremity I&D	No Sample		
		Hand orthopedic	No Sample		
		Upper extremity arthroscopy	No Sample		
		Upper extremity open	No Sample		
		Lap. or open cholecystectomy	No Sample		
		Podiatry/Foot	No Sample		
		Hip closed/percutaneous	No Sample		
		Lower extremity arthroscopic	No Sample		
		Shoulder closed	No Sample		
		Tibial/fibular closed	No Sample		

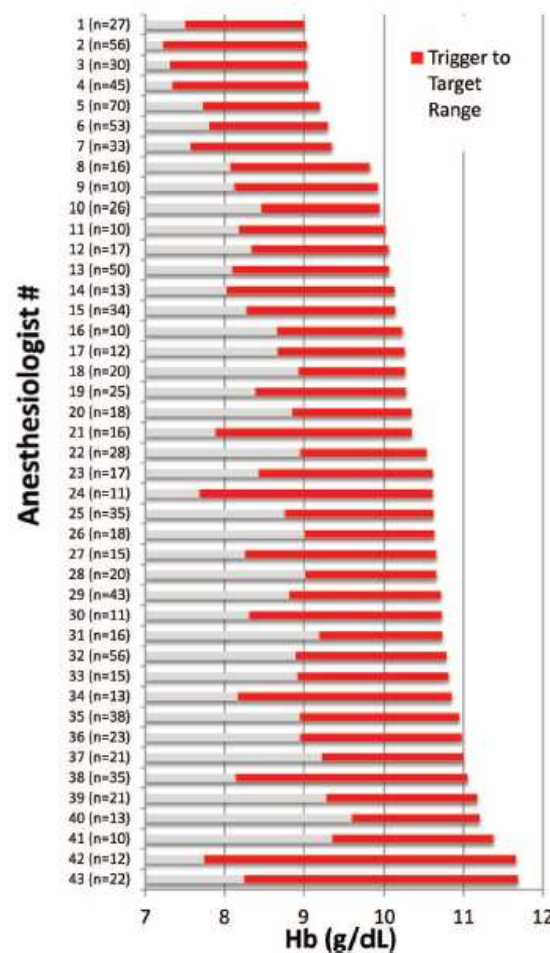
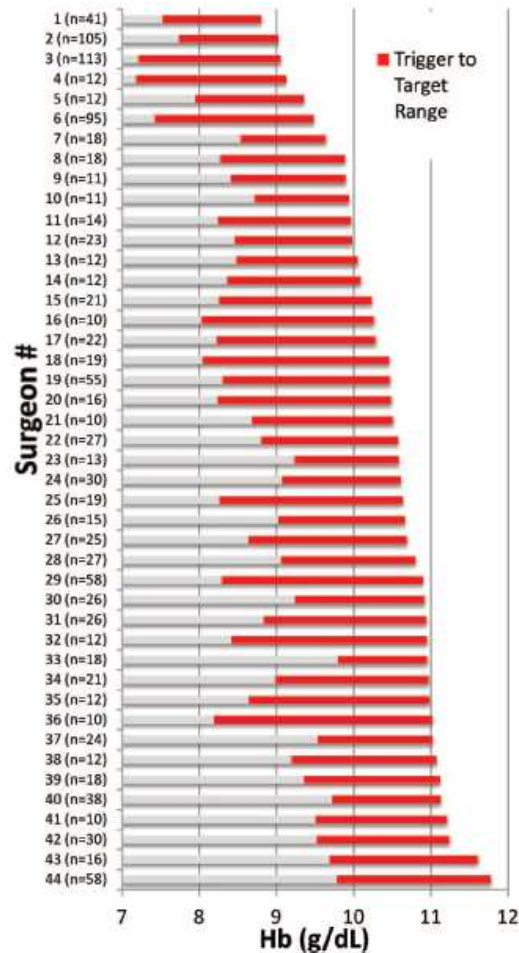
Gynecological Surgery		Otolaryngology Surgery		Vascular/Transplant Surgery	
Case Category	Rec	Case Category	Rec	Case Category	Rec
Uterus open	T/C 2U	Laryngectomy	T/C 2U	Liver transplant	T/C 15U
Open pelvic	T/C 2U	Facial reconstruction	T/C 2U	Thoracoabdominal aortic	T/C 15U
Uterus/ovary	T/S	Cranial surgery	T/C 2U	Major liver resection	T/C 4U
Total vaginal hysterectomy	T/S	Radical neck dissection	T/C 2U	Major vascular	T/C 4U
Cystectomy robotic assisted	T/S	Carcoid body tumor	T/C 2U	Exploratory lap. vascular	T/C 4U
Cystoscopy	No Sample	Mandibular surgery	T/S	Kidney pancreas transplant	T/C 2U
External genitalia	No Sample	Neck dissection	T/S	Major endovascular	T/C 2U
GYN cervix	No Sample	Mastoidectomy	No Sample	Above/below knee amputation	T/C 2U
Hysteroscopy	No Sample	Parotidectomy	No Sample	Nephrectomy/kidney transplant	T/C 2U
Superficial wound	No Sample	Facial plastic	No Sample	Organ procurement	T/C 2U
		Oral surgery	No Sample	Peripheral vascular	T/C 2U
		Sinus surgery	No Sample	Vascular wound I and D	T/C 2U
				Carotid vascular	T/S
				AV fistula	T/S
				Peripheral endovascular	T/S
				Angio/Arteriogram	No Sample
				Peripheral wound I&D	No Sample
				Ist rib resection/thoracic outlet	No Sample
				Superficial or skin	No Sample
				Foot/toe amputation/debride	No Sample
				Central venous access	No Sample

Urology	
Case Category	Rec
Cystoprostatectomy	T/C 2U
Urology open	T/C 2U
Nephrectomy	T/C 2U
Lap/Robotic kidney/adrenal	T/S
RRP	T/S
Percutaneous nephrolithotomy	T/S
Robotic RRP	No Sample
External genitalia/Penile	No Sample
TURP	No Sample
Cysto/ureter/urethra	No Sample
TURBT	No Sample

Effect of MSBOS on pre-transfusion testing and cross-matching



Feedback to providers on personal use of blood



Trigger: Hgb before first intra-op transfusion

Target: Hgb after last intra-op transfusion

Interruptive transfusion alert, Barne-Jewish Hospital

Alert Detail - TESTPATIENT, COMPASSIDONE - Type and Cross PRBCs

Alert Summary Acknowledged Alert listed on the Patient Info Tab

Ackn...	Vi...	Doc...	Alert	Priority	Type	Comment	Scope
✓	✓		Transfusion HGB Threshold Alert	HIGH	WARNING	!	Chart

**Triggered when RBC transfusion is ordered
and most recent Hgb > 8 g/dl**

Alert: Transfusion HGB Threshold Alert Message displays (1) Last HGB with Date/Time,
(2) Citation with link to the Article

Message: The patient hemoglobin is **13.5 g/dL** on Jun-21-2014 09:30 AM

[Expand](#)

Strong evidence suggests that in hemodynamically stable patients, a hemoglobin threshold of 7-8 g/dL can decrease transfusion exposure without increasing adverse outcomes.

Carson JL, Grossman BJ, et al. Red Blood Cell Transfusion: A Clinical Practice Guideline From the AABB*. Ann Intern Med. 2012;157:49-58. <<http://annals.org/article.aspx?articleid=1206681>>

Acknowledgement Comment:

Free Text disabled

! A comment must be added before clicking Proceed.

Acknowledge when seen
 Acknowledge all on Proceed

Unacknowledge << Previous Alert 1 of 1 Next >>

To view suggested actions for the Type and Cross PRBCs order click View Action

To continue with the Type and Cross PRBCs unchanged click Proceed.

To return to the Type and Cross PRBCs and discard alerts click Go Back.

User cannot Proceed with Order, if an 'Acknowledgement Comment' is not selected

Alert will trigger on the following locations

BJH - 10100, 10200, 11100, 11200, 12100, 12200, 13100, 14400, 14500

Approved by
Transfusion Committee
and Clinical Informatics
Committee on **general
medicine floors**

List of Acknowledgement Comments, the same list as the 'Reason' list on the Type & Cross PRBC order

- Anemia per Transfusion Guidelines: No Acute Cardiac Disease: Hct less than 19.5%: 2 units; Hct greater than 19.5% less than 22%: 1 unit
- Anemia per Transfusion Guidelines: Acute Active Cardiac Disease: Hct less than 27%: 2 units; Hct greater than 27% less than 30%: 1 unit
- Blood Product for Pheresis
- Blood Product for Surgery
- Document Hemorrhage ie: Visible bleeding
- Hemodynamic Instability Secondary to Suspected Hemorrhage
- Neonatal anemia with vital signs instability
- Neonatal anemia without vital sign instability, shock/hypotension or bleeding
- ScvO2 less than 70% AND Hct less than 30 AND Septic Shock (Mush have all 3)

View Actions... Proceed Go Back Help

View Actions... Proceed Go Back Help

Interruptive transfusion alert, Barne-Jewish Hospital

Alert Detail - TESTPATIENT, COMPASSIDONE - Type and Cross PRBCs

Alert will trigger on the following locations
BJH - 10100, 10200, 11100, 11200, 12100, 12200, 13100, 14400, 14500

Alert Summary
Acknowledged Alert listed on the Patient Info Tab

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✓	✓		Transfusion HGB Threshold Alert	HIGH	WARNING	!	Chart

Triggered when RBC transfusion is ordered and most recent Hgb > 8 g/dL

The patient hemoglobin is **13.5 g/dL** on Jun-21-2014 09:30 AM

Objective patient data

Strong evidence suggests that in hemodynamically stable patients, a hemoglobin threshold of 7-8 g/dL can decrease transfusion exposure without increasing adverse outcomes.

Description of "best practices"

Carson JL, Grossman BJ, et al. Red Blood Cell Transfusion: A Clinical Practice Guideline From the AABB*. Ann Intern Med. 2012;157:49-58. <<http://annals.org/article.aspx?articleid=1206681>>

Acknowledgement Comment:

Free Text disabled

A comment must be added before clicking Proceed.

Acknowledge when seen
 Acknowledge all on Proceed

Unacknowledge << Previous Alert 1 of 1 Next >>

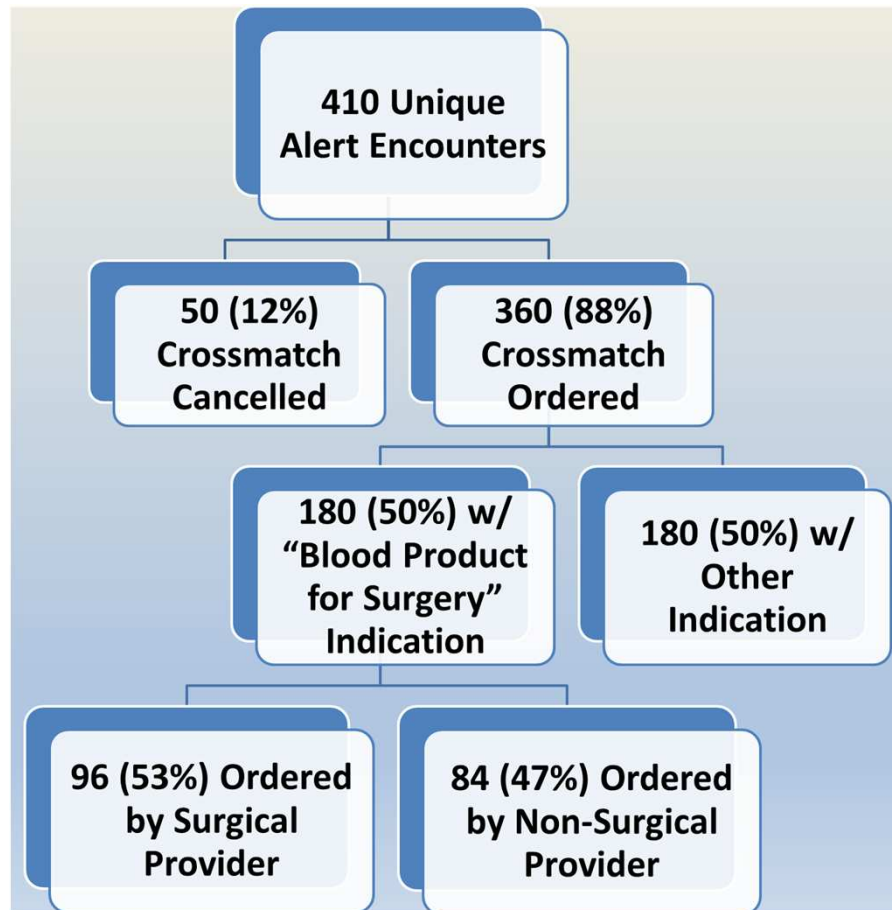
View Actions... Proceed Go Back Help

User cannot Proceed with Order, if an 'Acknowledgement Comment' is not selected

Physician acknowledgement and/or justification

- Anemia per Transfusion Guidelines: No Acute Cardiac Disease: Hct less than 19.5%: 2 units; Hct greater than 19.5% less than 22%: 1 unit
- Anemia per Transfusion Guidelines: Acute Active Cardiac Disease: Hct less than 27%: 2 units; Hct greater than 27% less than 30%: 1 unit
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- ScvO2 less than 70% AND Hct less than 30 AND Septic Shock (Must have all 3)

Transfusion alert responses (Apr – Oct 2015)



- **Lessons learned:**

- Almost half of blood ordered on medicine floors was in advance of a procedure.
- The provider placing the order was often not the provider who desired the transfusion.

Guidelines for effective CDS

The Five Rights of CDS
The right information
To the right person
In the right CDS intervention format
Through the right channel
At the right time in the workflow

Sirajuddin AM et al. *J Healthc Inf Manag* 2009

The Ten Commandments for Effective CDS
Speed is everything.
Anticipate needs and deliver in real time.
Fit into the user's workflow.
Little things can make a big difference.
Recognize that physicians will strongly resist stopping.
Changing direction is easier than stopping.
Simple interventions work best.
Ask for additional information only when you really need it.
Monitor impact, get feedback, and respond.
Manage and maintain your knowledge-based systems.

Bates DW et al. *J Am Med Inform Assoc* 2003

Focus group study on blood utilization and CDS alert

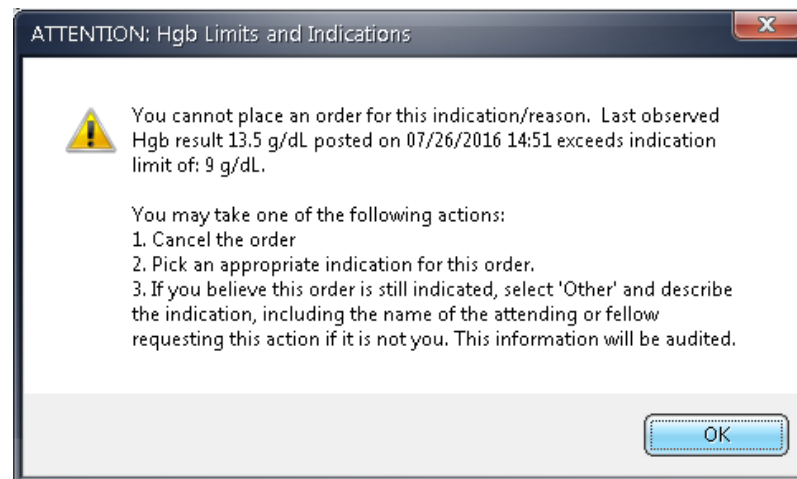
- 4 focus groups comprising 26 medicine residents and 14 attending hospitalists
- Resulting themes included:
 - Practice variation: attending & subspecialist preference, lack of evidence for appropriate indications
 - Challenges to improvement: education/remediation, transfusion transparency, prospective auditing

Updated transfusion alert

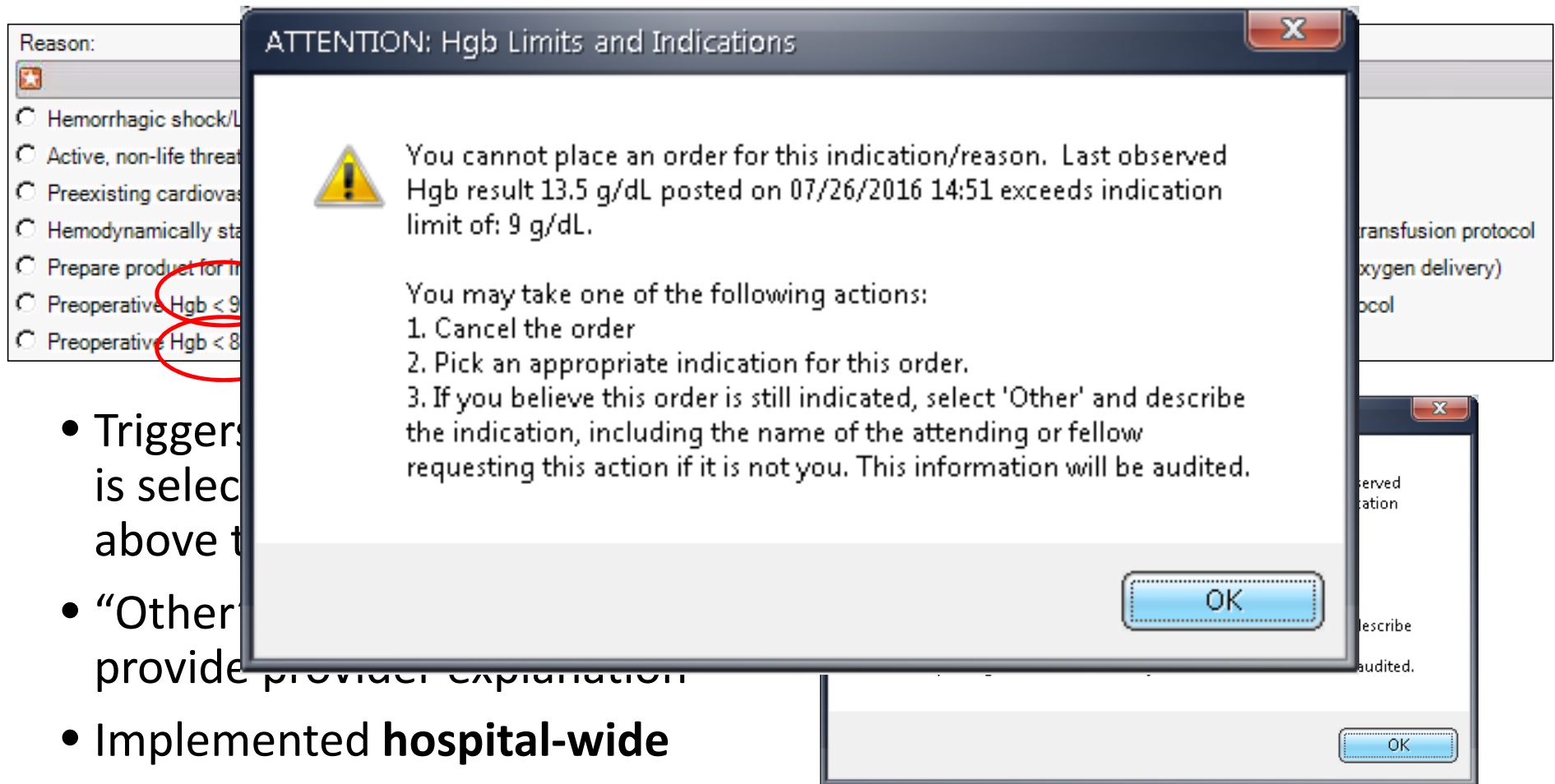
Reason:

<input type="radio"/> Hemorrhagic shock/Life-threatening bleeding	<input type="radio"/> Bone marrow transplant/Bone marrow failure
<input type="radio"/> Active, non-life threatening bleeding and Hgb < 8 g/dl	<input type="radio"/> Oncology patients
<input type="radio"/> Preexisting cardiovascular disease or complications and Hgb < 8 g/dl	<input type="radio"/> Sickle cell disease/Congenital anemia
<input type="radio"/> Hemodynamically stable and Hgb < 7 g/dl	<input type="radio"/> Blood exchange/Erythrocytapheresis/Chronic transfusion protocol
<input type="radio"/> Prepare product for intraoperative transfusion	<input type="radio"/> Symptomatic anemia (evidence of inadequate oxygen delivery)
<input type="radio"/> Preoperative Hgb < 9 g/dL if life-threatening intraoperative bleeding is expected	<input type="radio"/> Transfusion according to clinical research protocol
<input type="radio"/> Preoperative Hgb < 8 g/dL if life-threatening intraoperative bleeding is not expected	<input type="radio"/> Other

- Triggers when a Hgb threshold is selected, but the Hgb is above the threshold.
- “Other” indication added to provide provider explanation
- Implemented **hospital-wide**




Updated transfusion alert



Reason:

- Hemorrhagic shock/L
- Active, non-life threat
- Preexisting cardiovas
- Hemodynamically sta
- Prepare product for tr
- Preoperative Hgb < 9
- Preoperative Hgb < 8

ATTENTION: Hgb Limits and Indications

 You cannot place an order for this indication/reason. Last observed Hgb result 13.5 g/dL posted on 07/26/2016 14:51 exceeds indication limit of: 9 g/dL.

You may take one of the following actions:

1. Cancel the order
2. Pick an appropriate indication for this order.
3. If you believe this order is still indicated, select 'Other' and describe the indication, including the name of the attending or fellow requesting this action if it is not you. This information will be audited.

OK

- Triggers is selected above the
- “Other” provide provider explanation
- Implemented **hospital-wide**

Response to new alert (Aug 2016 – Feb 2017)

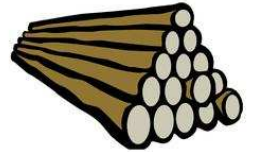
Indication	#Alerts	%Canceled	Proceed Hgb	Cancel Hgb
Hemodynamically stable and Hgb < 7 g/dL	527	14.7	7.1	7.4
Active, non-life threatening bleeding and Hgb < 8 g/dL	468	11.5	8.6	8.9
Preexisting cardiovascular disease and Hgb < 8 g/dL	220	8.7	8.4	8.4
Preoperative Hgb < 9 g/dL if life-threatening bleeding is expected	65	5.8	9.2	10.7
Preoperative Hgb < 9 g/dL if life-threatening bleeding is not expected	133	8.9	10.4	9.6
Total	1413	11.9	8.2	8.3

168 (new alert) vs. **50** (old alert) crossmatches cancelled.

Conclusions

- Transfusions have decreased in use with the increased popularity of restrictive transfusion practices.
- Several methods exist to encourage appropriate use of transfusion.
- **Clinical decision support** is a promising tool to reduce unnecessary transfusions and inform future quality improvement efforts.

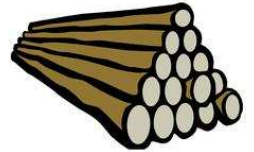
Back to petrified wood...



- Behavioral time-course study of 2655 visitors to PWNP
- Signage was randomized, locations baited with loose pieces of wood

Message type	Message text
Negative command	"Please don't remove the petrified wood from the park."
Positive command	"Please leave petrified wood in the park."
Negative descriptive	"Many past visitors have removed the petrified wood from the park, changing the state of the Petrified Forest."
Positive descriptive	"The vast majority of past visitors have left the petrified wood in the park, preserving the natural state of the Petrified Forest."

Back to petrified wood...



- Behavioral time-course study of 2655 visitors to PWNP
- Signage was randomized, locations baited with loose pieces of wood

Message type	Message text	Theft (%)
Negative command	"Please don't remove the petrified wood from the park."	1.67
Positive command	"Please leave petrified wood in the park."	5.33
Negative descriptive	"Many past visitors have removed the petrified wood from the park, changing the state of the Petrified Forest."	7.92
Positive descriptive	"The vast majority of past visitors have left the petrified wood in the park, preserving the natural state of the Petrified Forest."	5.00

Conclusion: Short, direct messages work best (just like *Choosing Wisely!*)

Questions?

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