



## BLOOD BELONGS IN THE PATIENT, NOT IN A TUBE

By Jennifer Rhamy, MBA, MA, MT(ASCP)SBB, HP

St. Mary's Regional Blood Donor Center

Iatrogenic, or hospital-acquired, anemia is a grave concern for patients who are already fragile due to underlying health conditions. During a stay in an intensive care unit (ICU), patients can lose up to 41 mL of blood each day for diagnostic tests, with a median blood loss of 200 mL during admission.<sup>1</sup> The normal daily production of red blood cells (RBC) in a healthy adult is only 0.25 mL/kg, which is insufficient to compensate.<sup>2</sup> This could make the difference in determining whether a blood transfusion is needed for some patients.

As many as 90% of patients develop hospital-acquired anemia by their third day in the ICU<sup>3</sup>. A study published in the *Annals of Thoracic Surgery*<sup>4</sup> examined the frequency and volume of blood drawn for lab tests in patients undergoing cardiac surgery throughout the course of 6 months. The study's researchers calculated that there were 115 tests per patient. The most commonly performed lab tests were blood gases, coagulation studies, complete blood counts and metabolic panels. The median volume of blood drawn was 332 mL in the ICU and 118 mL in other hospital units. Cumulative median blood draw volume per hospital stay was 454 mL, equivalent to the volume of a unit of whole blood.

Patients undergoing more complex surgeries had higher overall blood losses associated with phlebotomy. For example, a median of 653 mL was seen in patients undergoing combined coronary artery bypass grafting (CABG) with valve procedure. For isolated CABG, it was 448 mL; for isolated valve procedures, it was 338 mL. Average daily phlebotomy volume in transfused patients was 61 to 70 mL. The authors noted that their volume of test orders was higher than benchmarks, which suggests that they may need to better monitor ordering patterns. The researchers also intended to evaluate non-invasive alternatives to blood gases such as pulse oximetry.

### BEST PRACTICES

The Centers for Disease Control and Prevention (CDC) developed a Laboratory Medicine Best Practices group that performed an A6 systematic review/meta-analysis.<sup>3</sup> It identified interventions that included reduction of phlebotomy-related blood loss. Moderate, consistent evidence demonstrated that devices returning blood from flushing of venous or arterial lines may reduce blood loss by 25%. The decrease was seen in both neonatal and adult patients. The researchers found suggestive, but not conclusive, evidence that smaller test tubes may help reduce the risk of anemia.

The American Society for Clinical Pathology (ASCP) released its *Choosing Wisely* guidelines in 2014. New recommendations have since been added, most recently in 2020.<sup>5,6</sup> The guidelines are directed

toward improved test selection. The recommendations state that forgoing a test may be optimal compared with using a smaller tube if it will not impact patient care. The most recent *Choosing Wisely* list has 35 items that physicians and patients should question when ordering tests. These recommendations include, but are not limited to, reducing the ordering preoperative tests for low-risk surgeries and eliminating orders for outdated tests such as CK-MB and sedimentation rates that are of minimal clinical use, targeted test ordering versus screening panels with little diagnostic value, not ordering a type and screen when risk of bleeding in surgery is low, and numerous recommendations for appropriate coagulation test ordering.

## REDUCING UNNECESSARY TESTING

Unnecessary lab testing can be a wasteful practice that may contribute to a patient's risk for iatrogenic anemia. According to a survey performed by researchers at Memorial Sloan Kettering Cancer Center<sup>6</sup>, 60% of medical personnel said daily testing should be done for hospitalized patients. But 37% said that they had ordered unnecessary tests and 60% said that they had observed unnecessary tests being conducted. When the researchers looked at the type of medical professionals ordering the tests, 54% said it was the attending physicians who wanted more testing and that some unnecessary orders had been placed at their direction. However, only 28% of attending physicians said they believed that patients needed daily testing. In addition, nurses were more likely than other health care professionals to value many routine tests and 80% said patients should have testing daily. Among advanced practice providers (APP), 63% said that patients should have daily laboratory testing and 55% said it enhanced safety. (Table)

Examples of successful interventions to reduce unnecessary test orders include computerized alerts including hard stops. A study performed at Yale New Haven Hospital<sup>7</sup> focused on the impact of computer interventions designed by a laboratory utilization formulary committee. The study's researchers engaged a multidisciplinary group who modified order entry, designed dashboards and provided education. Patients were also asked for feedback. The group began by eliminating the CK-MB and free thyroxine panel, and directing practitioners to more value-added tests. They also implemented an inpatient duplicate test check system examining time periods between 30 minutes and lifetime. The researchers determined that checking routine labs for 10 consecutive days approximated one unit of whole blood removed. They delivered education and dashboards to collect data on complete blood count (CBC), complete metabolic panel (CMP) and basic metabolic panel (BMP) ordering patterns. These interventions were effective and reduced the liters of blood lost/1,000 patient days significantly.

There is some evidence that reducing the volume of each draw may prevent iatrogenic anemia. Much of the early data in this area examined the neonatal population. A Stanford study looked at the use of a smaller blood gas device for neonates and found that it reduced transfusion volumes by 43%.<sup>8</sup> However, there is limited data on benefits in the adult population. While the data is not strong for reduction of test sample volume using point-of-care testing (POCT) devices or pediatric test tubes, it still is a measurable reduction of blood draw that should benefit patients especially in conjunction with other interventions.<sup>9</sup>

A goal for PBM programs should include reduction of blood loss while hospitalized. They should develop strategies to minimize the amount of blood removed from patients that do not add clinical value. Keeping the blood in the patient instead of the test tube improves patient outcomes while saving resources.

## REFERENCE 6

**TABLE.** Attitudes Toward Laboratory Testing by Health Care Provider Type

ATTITUDE	STRONGLY AGREE OR SOMEHWAT AGREE, NO. (%)*					P Value
	MD					
	All (n=837)	Attending (n=197)	Trainee (n=139)	APP (n=154)	RN (n=347)	
Hospitalized patients should have daily laboratory testing.	491 (59)	55 (28)	63 (46)	97 (63)	276 (80)	<.001
Hospitalized patients should have laboratory testing on discharge day.	434 (52)	62 (32)	52 (37)	73 (48)	247 (71)	<.001
Daily laboratory testing generally enhances patient safety.	459 (55)	50 (26)	51 (37)	84 (55)	274 (79)	<.001
Daily laboratory testing generally helps avoid malpractice litigation.	400 (48)	54 (27)	56 (41)	66 (43)	224 (65)	<.001
Asking for laboratory testing protects me from criticism.	281 (34)	47 (24)	56 (41)	54 (35)	124 (36)	.007
I would be comfortable if my hospitalized patients received less laboratory testing.	566 (68)	166 (84)	119 (86)	106 (69)	175 (51)	<.001

**Abbreviations:** APP, advanced practice health care provider; MD, doctor of medicine; RN, registered nurse.

\* Agreement was measured on a 4-point scale; sample sizes vary slightly for each statement due to missing data.

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1. Quinn JG et al. A contemporary description of patients' estimated blood losses from diagnostic phlebotomy in a census of hospital episodes from a Canadian tertiary care center. *Transfusion* 2019;59;2849-2856.
  2. Vincent JL, Baron JF, Reinhart K, et al. Anemia and blood transfusion in critically ill patients. *JAMA*. 2002;288(12):1499-1507.
  3. Whitehead NS, et al. Interventions to prevent iatrogenic anemia: a Laboratory Medicine Best Practices systematic review. *Critical Care* 2019; 23: 278.
  4. Koch CG, et al. Contemporary bloodletting in cardiac surgical care. *Ann Thor Surg*. 2015 Mar;99 (3):8779-8784.
  5. Choosing Wisely. Thirty-five things physicians and patients should question. American Society of Clinical pathology. 2014-2020. <https://www.choosingwisely.org/societies/american-society-for-clinical-pathology/> (Accessed March 6, 2021)
  6. Roman BR, et al. Association of Attitudes Regarding Overuse of Inpatient Laboratory Testing With Health Care Provider Type. *JAMA Intern Med*. 2017;177(8):1205-1207.
  7. Harb R et al. Improving laboratory test utilisation at the multihospital Yale New Haven Health System. *BMJ Open Qual*. 2019; 8(3). e000689. Doi. [10.1136/bmjoq-2019-000689](https://doi.org/10.1136/bmjoq-2019-000689)
  8. Madan A, et al. Reduction in Red Blood Cell Transfusions Using a Bedside Analyzer in Extremely Low Birth Weight Infants. *Journal of Perinatology* 2005; 25:21-25.
  9. Garcia B, J, Xian JZ, Pedroza, C. et al. Pediatric size phlebotomy tubes and transfusions in adult critically ill patients: a pilot randomized controlled trial. *Pilot Feasibility Stud* 2020; 6:112. DOI. [10.1186/s40814-020-00657-3](https://doi.org/10.1186/s40814-020-00657-3)