

# Total Hemoglobin

# SpHb

Total Hemoglobin (SpHb®) is a breakthrough measurement that allows clinicians to noninvasively and continuously monitor hemoglobin—facilitating earlier and better clinical decisions, improved patient safety, and reduced cost of care.

Noninvasive > Continuous



*Trend hemoglobin with confidence between invasive blood samples*



# TRANSFUSION MANAGEMENT CHALLENGES

Growing clinical evidence points to the need for more restrictive blood transfusion management practices to improve patient safety and reduce costs

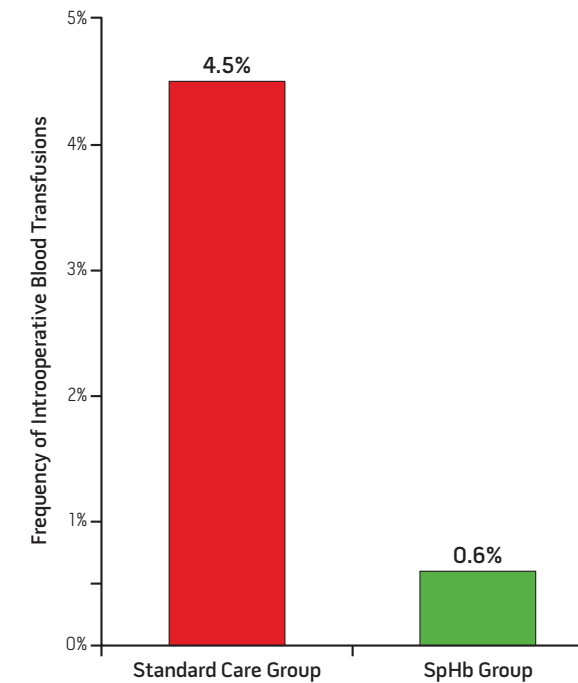
- > **Blood transfusions are common**, with up to 20% of surgical patients and 35% of ICU patients receiving one or more units of blood.<sup>1,2</sup>
- > **Transfusions increase morbidity and mortality.**<sup>3,4,5</sup>
  - > As much as 40% increase in 30-day morbidity due to nosocomial infections, sepsis, pneumonia, wound infections and transfusion related injuries.
  - > As much as 38% increase in 30-day mortality and 67% increase in 6-month mortality.
- > **Blood transfusions are costly**, with blood being one of the largest cost centers in a hospital.
  - > \$522 to \$1,183 per unit,<sup>6</sup> linked to an increase of two or more ICU days per transfusion.<sup>7</sup>
- > **Some blood transfusions are unnecessary**, especially when given in stable anemia or when bleeding is perceived but not significant.<sup>8</sup> Inappropriate transfusions account for between 9 and 44% of all transfusion costs.<sup>9</sup>
- > **Experts advocate implementing restrictive transfusion practices** and use of appropriate indicators for blood transfusion. New Joint Commission blood management measures track hemoglobin documentation prior to each unit of blood transfused.<sup>10,11,12,13</sup>

“The current practice of using intermittent, invasive measurements of hemoglobin to help guide transfusion decisions may contribute to unnecessary blood transfusions. Blood transfusion should not simply be based on any particular level of hemoglobin, but rather a thorough evaluation of the patient, including whether hemoglobin levels are stable or changing.”

ARYEH SHANDER, MD  
Clinical Professor of Anesthesiology, Medicine and Surgery at Mt. Sinai School of Medicine, New York, NY



# SpHb IS SHOWN TO HELP CLINICIANS REDUCE BLOOD TRANSFUSIONS DURING SURGERY<sup>14</sup>



- > In a randomized controlled trial in orthopedic surgery at a major U.S. teaching hospital, clinicians using SpHb transfused their patients 87% less often than clinicians not using SpHb (0.6% vs. 4.5%).

# SpHb MAY REDUCE BLOOD TRANSFUSION COSTS

Range of Total Cost Estimates per RBC Unit Transfused <sup>14</sup>	Potential Cost Savings per Patient with SpHb Monitoring <sup>14</sup> (Based on results from a randomized controlled trial)
\$500	\$45
\$1,000	\$90
\$1,500	\$135

**Note:** Estimates of RBC cost vary due to consideration of direct, indirect, and RBC-related complications.

<sup>1</sup> DeFrances et al. 2006 National Hospital Discharge Survey. *Advance Data*. 2008;51:20. <sup>2</sup> Von Anshel N et al. *Crit Care Med*. 1999;12:2630-2639. <sup>3</sup> Taylor RW et al. *Crit Care Med*. 2006;34(9):2302-8. <sup>4</sup> Bernard AC et al. *Journal of the American College of Surgeons*. 2009;208:931-937. <sup>5</sup> Surgenor SD et al. for the Northern New England Cardiovascular Disease Study Group. *Anesthesia & Analgesia* 2009;108:1741-1746. <sup>6</sup> A New Look at Blood Transfusion. *Joint Commission Perspectives on Patient Safety*. 2007;1:1-12. <sup>7</sup> Hill SR et al. *Cochrane Database of Systematic Reviews* 2000, Issue 1. <sup>8</sup> Shander A. *Surgery*. 2007;142:S20-S25. <sup>9</sup> Goodnough LT et al. *The American Journal of Medicine*. 1993;94:509-514. <sup>10</sup> Hebert, et al. Transfusion Requirements in Critical Care Investigators. *Canadian Critical Care Trials Group*. *N Engl J Med*. 1999;340:409-17. <sup>11</sup> Corwin HL et al. *Crit Care Med*. 2004;32(1):39-52. <sup>12</sup> Taylor RW et al. *Crit Care Med*. 2006;34(9):2302-8. <sup>13</sup> Patient Blood Management Measures. [www.jointcommission.org](http://www.jointcommission.org). <sup>14</sup> Ehrenfeld JM et al. *ASA*. 2010. LB05.



# UNDETECTED BLEEDING CHALLENGES

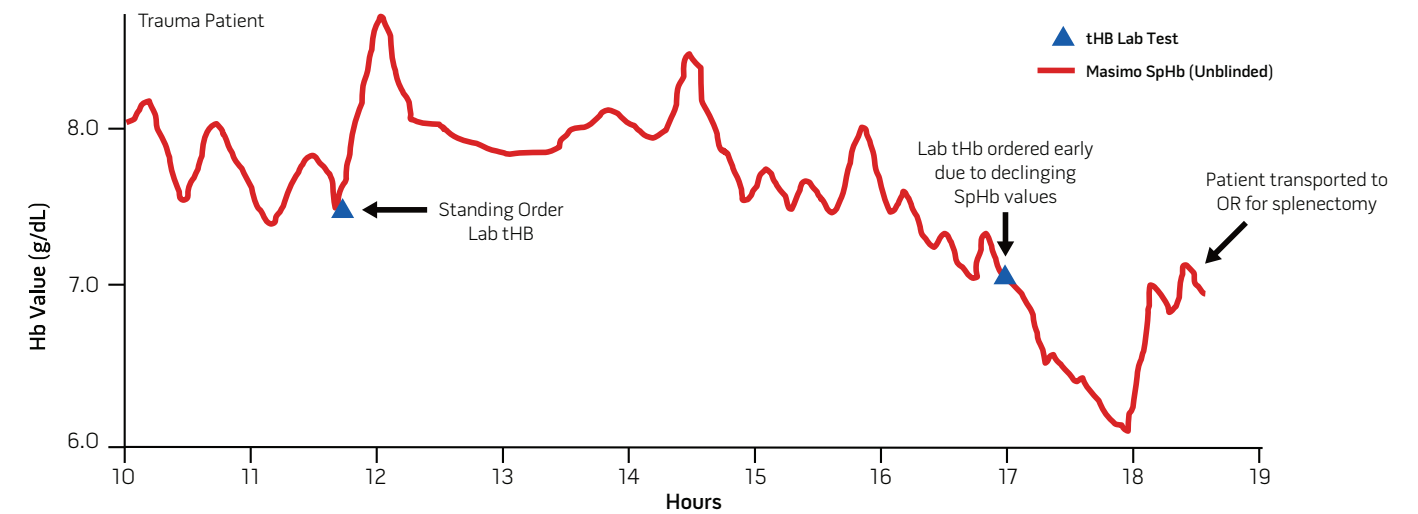
Post-surgical and critical care patients face real dangers from undetected bleeding

- > Significant bleeding occurs in up to 35% of surgical and critical care patients<sup>1</sup>
- > Low hemoglobin identifies almost 90% of patients with bleeding, but traditional laboratory measurements are infrequent and delayed<sup>2</sup>
- > Bleeding is a significant risk factor:
  - > Late detection increases risk<sup>2</sup>
  - > 19% in-hospital maternal deaths from postpartum hemorrhage<sup>3</sup>
- > Bleeding significantly increases the cost of treatment<sup>2</sup>

“In the past, we’ve only received glimpses of our patients’ hemoglobin levels from lab measurements, but now we have complete and real-time hemoglobin visibility. This is vital in the ICU, where post-operative monitoring of internal bleeding is critical to patient recovery.”

RANDY MARCEL, MD  
Medical Director and Chief of Anesthesiology at  
The Heart Hospital Baylor Plano, Plano, TX

# SpHb MONITORING — POTENTIAL FOR EARLIER IDENTIFICATION OF FALLING HEMOGLOBIN VALUES



# SpHb — OPPORTUNITY FOR ENHANCED BLEEDING DETECTION

Continuous SpHb monitoring allows you to track changes in hemoglobin that may help you:

- > **Identify bleeding** earlier, increasing patient safety by allowing for more timely intervention.<sup>4</sup>

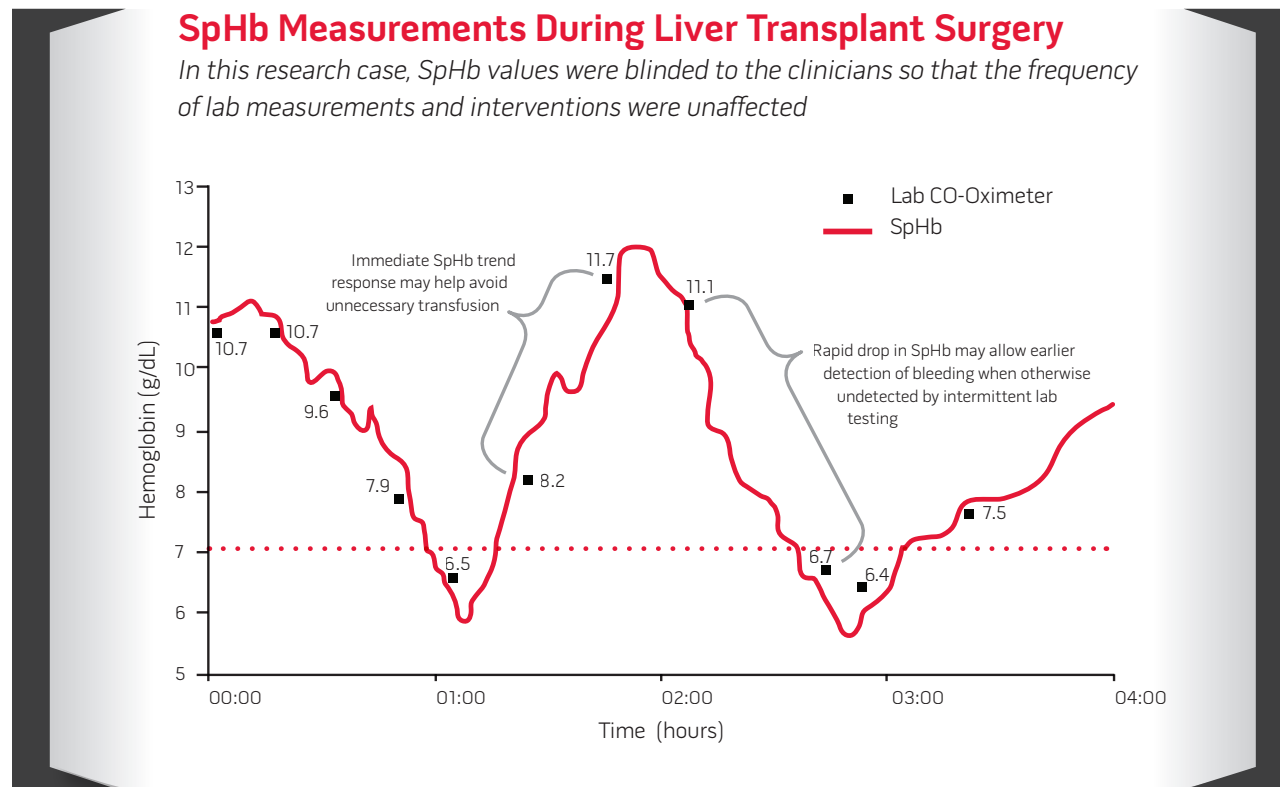
SpHb could contribute to \$67,350 in net annual cost savings in an intensive care department.

CAPGEMINI REPORT, 2009  
Using Noninvasive Pulse CO-Oximetry to Help Improve Patient Safety, Reduce Costs and Increase Hospital Revenues.

<sup>1</sup> Herbert PC. *Critical Care*. 1999; 3(2):57-63.  
<sup>2</sup> Herwaldt LA. *Infect Control Hosp Epidemiol*. 2003; 24(1):44-50.  
<sup>3</sup> Bateman BT et al. *Anesth Analg*. 2010; 1368-1373.  
<sup>4</sup> Butwick AJ et al. *Int J Obstet Anesth*. 2011; 20(3):240-5.



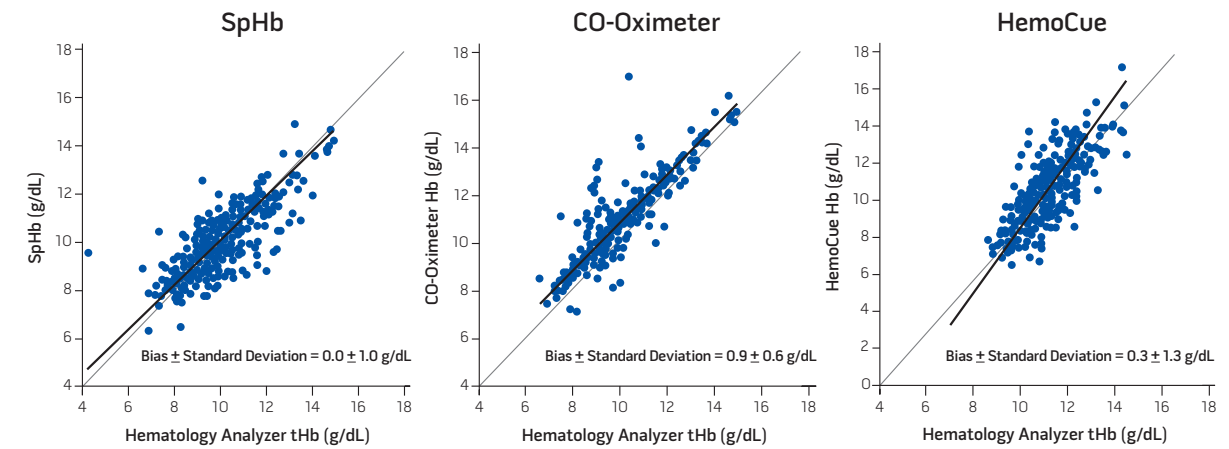
# TREND HEMOGLOBIN WITH CONFIDENCE BETWEEN INVASIVE BLOOD SAMPLES



“Masimo SpHb is an impressive new tool that could potentially help us to more safely guide patients in surgery through to recovery. With it, not only can we spot hemoglobin changes as they occur, but we can see where they are heading. This ability to identify an upward or downward hemoglobin trend on a second-by-second basis as it occurs could be of tremendous value.”

**RONALD MILLER, MD**  
 Chief of Anesthesia, Professor and Chairman of the Dept.  
 of Anesthesia and Perioperative Care at the University of California, San Francisco, CA

# PROVEN ACCURACY COMPARED TO LABORATORY DEVICES<sup>1</sup>



- > In Masimo's FDA submission, SpHb was validated in a range of 8 to 17 g/dL with accuracy of 1.0 g/dL ± at one standard deviation.<sup>2</sup>
- > An independent study in the surgical intensive care unit evaluated 471 hemoglobin measurements from 62 patients. SpHb, a satellite laboratory CO-Oximeter (Siemens RapidPoint 405), and a point-of-care device (HemoCue 301) were compared to reference hemoglobin from the central laboratory hematology analyzer (Sysmex XT2000i).
- > The bias ± precision of each method was as follows:
  - > SpHb 0.0 ± 1.0 g/dL
  - > CO-Oximeter 0.9 ± 0.6 g/dL
  - > Point-of-care device 0.3 ± 1.3 g/dL
- > In the same study, changes in SpHb compared to changes in the reference hemoglobin showed the same correlation as the laboratory CO-Oximeter and better correlation than the point-of-care device.<sup>1</sup>

# PLETH VARIABILITY INDEX (PVI)

PVI is a breakthrough measurement that may help clinicians noninvasively and continuously assess fluid status of patients. Using SpHb in combination with PVI may enable improved fluid and blood management during surgery and in the ICU.<sup>3</sup>

- > Fluid administration is critical to optimizing patient status.<sup>4</sup>
- > Traditional methods to guide fluid administration often fail to predict fluid responsiveness.<sup>5</sup>
- > Newer methods may accurately predict responsiveness but are invasive or costly.<sup>6</sup>
- > PVI has been shown to help clinicians predict fluid responsiveness in mechanically ventilated patients under general anesthesia during surgery and in the ICU.<sup>7,8</sup>
- > PVI has been shown to help clinicians improve fluid management and decrease lactate levels compared to standard care.<sup>9</sup>

<sup>1</sup>Frasca D et al. *Crit Care Med*. 2011 Oct;39(10):2277-82. <sup>2</sup>Masimo FDA 510(k) Submission Data. <sup>3</sup>Ulatowski JA et al. *Proceedings of the 2011 Annual Meeting of the American Society of Anesthesiologists*. A408. <sup>4</sup>Perel A. *Anaesth Analg*. 2008;106(4):1031-33. <sup>5</sup>Michard F et al. *Chest*. 2002;121(6):2000-08. <sup>6</sup>Joshi G et al. *Anaesth Analg*. 2005;101:601-5. <sup>7</sup>Cannesson M et al. *Br J Anaesth*. 2008;101(2):200-6. <sup>8</sup>Loupec T et al. *Crit Care Med*. 2011;39(2). <sup>9</sup>Forget P et al. *Anesth Analg*. 2010;111(4):910-4.





# SpHb FOR THE CONTINUUM OF CARE

From surgery to PACU to the ICU and general floor



## PART OF THE UPGRADABLE RAINBOW SET® TECHNOLOGY PLATFORM



Masimo rainbow SET® is a noninvasive monitoring platform enabling the assessment of multiple blood constituents and physiologic parameters that previously required invasive or complicated procedures, in addition to providing Masimo SET® Measure-through Motion and Low Perfusion pulse oximetry.

- > Acoustic Respiration Rate (RRa™)
- > Carboxyhemoglobin (SpCO®)
- > Methemoglobin (SpMet®)
- > Oxygen Content (SpOC™)
- > Pleth Variability Index (PVI®)
- > Total Hemoglobin (SpHb®)
- > Oxygen Saturation (SpO2)
- > Pulse Rate (PR)
- > Perfusion Index (PI)

The upgradeable rainbow SET® platform lets you choose the rainbow® measurements that are right for you now and be confident that your investment in patient safety won't become obsolete tomorrow.

**Masimo Americas**  
tel 1-877-4-Masimo  
info-america@masimo.com

**Masimo International**  
tel +41-32-720-1111  
info-international@masimo.com

