Baxter

Starling

FLUID MANAGEMENT
MONITORING SYSTEM

100% NON-INVASIVE
FLUID MANAGEMENT

Proper Fluid Management May Improve Clinical Outcomes, Potentially Saving Millions in Operating Costs[1,2]

The **Starling** fluid management monitoring system provides a full hemodynamic profile within seconds.

The effect of fluids can be monitored at any time and treatment modified accordingly, across the continuum of care:
ED > ICU > OR > RRT

In a retrospective, matched, single-center study of nearly 200 patients, researchers from the University of Kansas Health System evaluated stroke volume (SV) guided resuscitation in 100 ICU patients with severe sepsis and septic shock and found[1]:

- ICU Length of Stay — ↓ **-2.89 DAYS**
- Initiation of Acute Dialysis Therapy — ↓ **-13.25%**
- Risk of Mechanical Ventilation — ↓ **-51%**
- Save an estimated $14,498 per treated patient[3] — ↑ **$14K**

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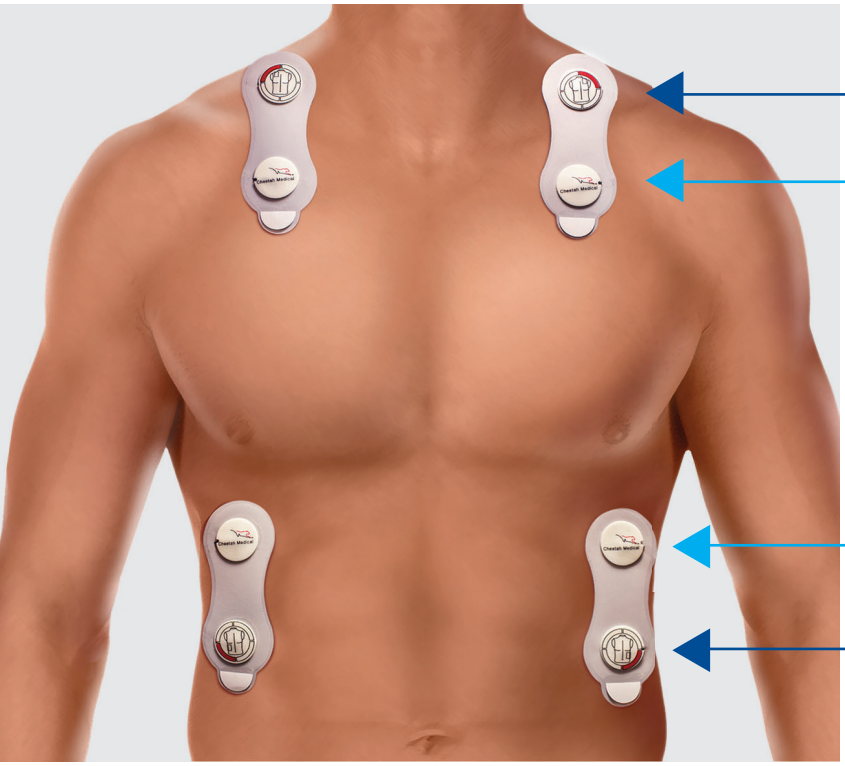
- Over 80% of hospitalized patients receive IV fluids.[4] Yet studies show that giving too little or too much fluid can lead to serious complications and contribute to rising healthcare costs.[5,6]
- Studies also show that only ~50% of hemodynamically unstable patients will respond to IV fluid by increasing cardiac output and perfusion. Assessing whether fluid may help or harm a patient is a critical step in optimizing treatment.[7]
- Using only blood pressure, urine output and heart rate to measure fluid responsiveness may provide limited and inconclusive information.[7]

TAKE THE GUESSWORK OUT OF YOUR FLUID ASSESSMENT WITH STARLING

- Provides a dynamic assessment of fluid responsiveness — accurately, precisely and 100% non-invasively.
- Supports individualized fluid therapy without requiring an invasive arterial or central line, potentially reducing the risk of hospital-acquired infections and other complications.[8]
- Independently validated vs. pulmonary artery catheter.[9]
- Accuracy not affected by vasopressors or shock states.[10,11]
- Works in mechanically ventilated and spontaneously breathing patients.[7,12,13]

How Does **Starling** Technology Work?

Starling monitoring platforms use unique, patented **Bioreactance** technology to take measures continuously and precisely, and they require only four easy-to-place sensor pads. The sensors can be placed anywhere on the chest or back as long as two are positioned above the heart and two below the heart.



Four non-invasive sensor pads are applied to the thorax, creating a "box" around the heart.

A small electric current is applied across the thorax between the outer pair of sensors.

A voltage signal is recorded between the inner pair of sensors.

The flow of blood in the thorax introduces a time delay or phase shift in the signal.

The monitor uses this phase shift as a baseline for stroke volume measurements.

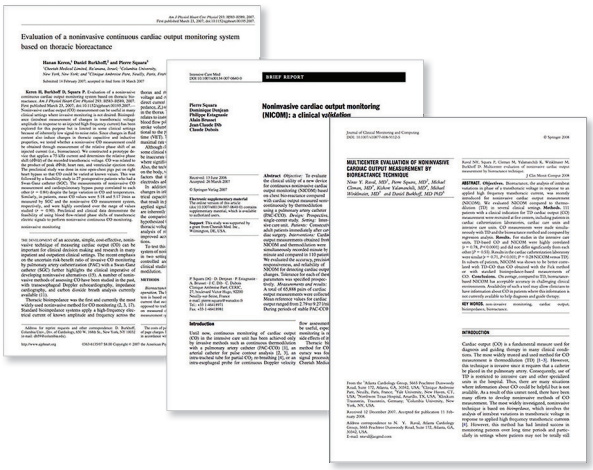
These signal changes have been correlated to known thermodilution cardiac output in 65,000 patient samples, in multiple clinical settings (ICU/OR/Cath Lab).[9,13]

ACCURATE, PRECISE AND EXTENSIVELY VALIDATED TECHNOLOGY

The **Starling** system has a large and growing body of clinical evidence, with technology validation in multiple clinical settings.

VALIDATION STUDIES

- Over 500 patients in published clinical studies
- Multiple clinical settings (ICU/OR/ED/Exercise Lab/Out of Hospital)
- Against all major technologies (Swan Ganz, Pulse Contour, Doppler, Fick)
- Over 100 peer-reviewed publications
- Broad clinical use in hundreds of thousands of patients worldwide since 2009



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1 SIMPLIFIED AND CUSTOMIZED HOME SCREEN:

- Flexibility to choose preferred view and parameters displayed on the screen: Cardiac Index, Cardiac Output, Stroke Volume Index, Stroke Volume, Total Peripheral Resistance and other important parameters

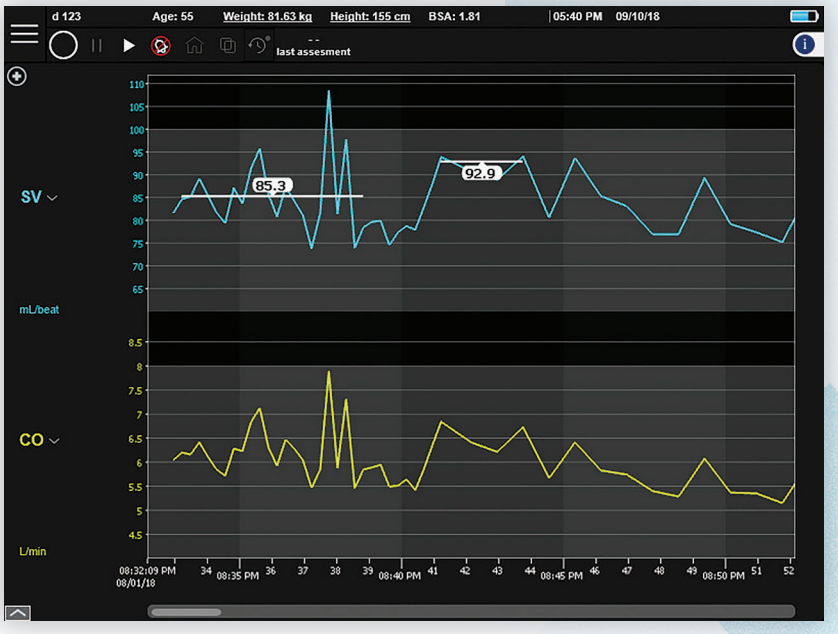
2 ALL INFORMATION IS AVAILABLE ON ONE SCREEN, INCLUDING DYNAMIC ASSESSMENT RESULTS:

- >10% ΔSVI — patient is likely fluid responsive[14]
- <10% ΔSVI (including negative numbers) — patient is likely not fluid responsive
- Sensitivity of 94% and specificity of 100% for predicting fluid responsiveness in critical care situations[15]

Enhanced algorithms to enable shorter dynamic assessment time frames.

Educational tools built into the monitor — easy access to training videos, clinical tools and quick guides.

TREND SCREEN
Displays patient parameter trends and running averages of SV and SVI

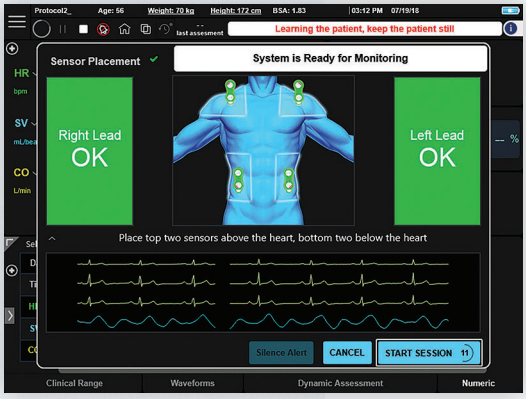


Easy to Use ... Accurate ... Flexible and ... 100% Non-invasive.

THE STARLING SYSTEM OFFERS:

- A portable and lightweight touch screen monitor (H: 8.7", W: 11.4", D: 7.4", 9.5 lbs, 10.4").
- First results in approximately 48 seconds.
- The **Starling** system walks the clinician through an easy, step-by-step protocol for executing a PLR or bolus test.
- User interface provides easy-to-read graphics and numbers with responsive touch control.
- Numeric display for charting provides real-time continuous data with option to select data displayed every minute, 5 minutes, 15 minutes and hour.
- Monitor fits on cart, table or IV pole.
- Seamlessly integrates with hospital EMR systems.
- Battery operation.

CLINICAL RANGE DISPLAY
Shows whether patient's parameters are within the pre-set normal range



SENSOR PLACEMENT
Indicates proper sensor placement

Published Data Highlight Clinical and Economic Benefits

In a retrospective, matched, single-center study of nearly 200 patients, researchers from the University of Kansas Health System assessed whether stroke volume (SV) guided resuscitation in 100 ICU patients improves outcomes in patients with severe sepsis and septic shock. Researchers found that implementing SV guided resuscitation was associated with improved patient outcomes which may also be associated with a reduction in cost of care.[1,3]

Variable	**Starling** Stroke Volume Fluid Therapy (n=100)[1]	Usual Care (Control, n=91)[1]	Δ/p Value[1]	Costs Assumptions*	Cost Avoidance*
ICU LOS (Days)	5.98 ± 0.68	8.87 ± 1.18	2.89 days ↓ *P* = 0.03	$4,004/ICU day[16] $906/floor day[17]	$8,953
Fluid Balance (Liters)	1.77 L ± 0.60	5.36 L ± 1.01	3.59 L ↓ *P* = 0.002		
Pressor Use (Hours)	32.08 ± 5.22	64.86 ± 8.39	32.78 hours ↓ *P* = 0.001		
Mechanical Ventilation (Relative Risk)	29%	57%	RR=0.51 ↓ *P* = 0.001	$1,522/day[18] 5.1 days[17]	$1,940
Acute Dialysis Therapy Initiated	6.25%	19.5%	13.25% ↓ *P* = 0.01	$27,182 x (12.73 cases avoided/ 96 total patients)[17]	$3,605
ESTIMATED SAVINGS PER TREATED PATIENT*					**$14,498**

*Based upon supplemental data.

"We embarked on this study with the hypothesis that actively managing patients' fluids was associated with improved clinical outcomes. The study demonstrated positive patient outcomes from actively monitoring resuscitation by optimizing stroke volume, which may be translated to significant cost savings to the hospitals caring for these very critical patients."

Dr. Heath Latham, University of Kansas Health System

COST ASSUMPTIONS

ICU Length of Stay (LOS): 2.89 days x ($4,004 [Avg ICU Day] – $906 [Avg Floor Day]) = $8,953

Mechanical Ventilation (MV): $1,522 x 5.1 days x .25 = $1,940

Assumes:

1. Incremental cost of MV $1,522/day. 2. Average duration of MV in septic shock 5.1 days. 3. Assumes an absolute 25% reduction of patients receiving mechanical ventilation.

Acute Dialysis Therapy: $27,182 (avg. dialysis-related hospital costs) x (12.73 cases avoided/96 total patients) = $3,605

Starling Across the Continuum of Care

EMERGENCY DEPARTMENT (ED)

Quickly and non-invasively assess whether IV fluids will help or harm your patient, to determine the most optimal treatment path.

- Rapid assessment of fluid status to determine whether a patient is fluid responsive.
- Treat complex clinical situations without the risks and time associated with invasive lines.
- Guide fluid resuscitation in septic and shock patients and help manage sepsis bundle compliance.

RAPID RESPONSE TEAM (RRT)

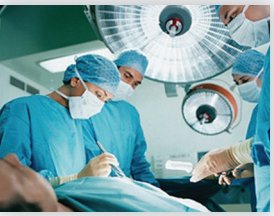
Rapid response for any hypotensive emergency, wherever your patient may be in the hospital.

- Quickly assess for fluid responsiveness and determine next treatment decision.
- Complete portable solution that includes:
  - Monitor carrying with all the essentials for treating a hypotension emergency
  - Passive leg raise (PLR) Lift solution to assess for fluid responsiveness

MEDICAL ICU (MICU)

Starling system's 100% non-invasive hemodynamic profile allows clinicians to:

- Obtain an accurate, continuous hemodynamic picture in about 48 seconds once sensors are placed
- Manage clinical shock states: septic, cardiogenic and hypovolemic
- Assess a patient's response to volume by directly measuring stroke volume (SV) changes after passive leg raise (PLR) or IV bolus administration
- Assess the effectiveness of fluids, vasopressors and inotropes



OPERATING ROOM (OR)

Starling system's 100% non-invasive hemodynamic profile allows anesthesia and surgical teams to:

- Obtain advanced hemodynamic parameters throughout the entire continuum of care: pre-op, operating room, PACU and SICU/Step Down
- Use changes in SV to guide fluid decisions in enhanced recovery after surgery (ERAS) and perioperative surgical home (PSH) protocols
- Trend key hemodynamic parameters through the perioperative period to assess Intravascular volume loss and fluid responsiveness

SURGICAL ICU (SICU)

Patients often emerge from surgery with an indeterminate volume status due to intraoperative fluid shifts. Optimum recovery may be facilitated by establishing, restoring and maintaining adequate perfusion.

Starling technology is especially useful in:

- Assessing post-operative patients where the non-invasive trending of hemodynamic parameters may reveal rapid changes in perfusion
- Providing minute-by-minute status of the patients' individualized volume needs by using dynamic assessments of fluid responsiveness (fluid bolus and passive leg raise)

ABOUT **STARLING**

The **Starling** system is a 100% non-invasive fluid management monitoring system that provides clinicians with a dynamic assessment of fluid responsiveness quickly, accurately and precisely. The **Starling** system can be used across all care settings within the hospital to help determine whether fluid administration will be effective, enabling clinicians to personalize fluid therapy and potentially leading to improved patient outcomes.

Rx Only. For safe and proper use of product mentioned herein, please refer to the Instructions for Use or Operators Manual.

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