Baxter

Starling

FLUID MANAGEMENT
MONITORING SYSTEM

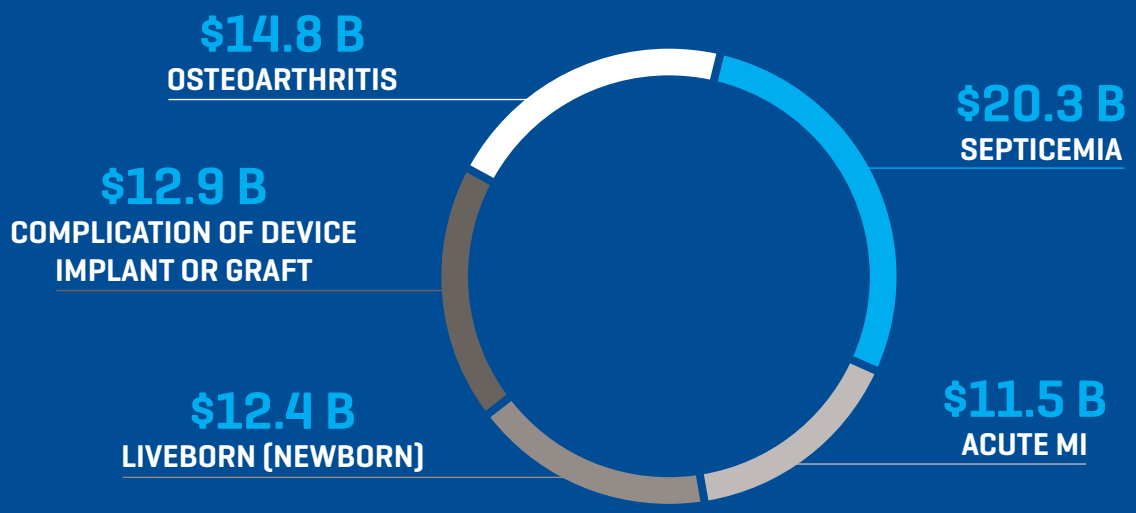
AN INDIVIDUALIZED APPROACH TO FLUID MANAGEMENT MAY IMPACT YOUR CLINICAL AND FINANCIAL OUTCOMES

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

ICU LOS	⬇ **-2.89 DAYS**
Fluid Balance	⬇ **-3.59 L**
Pressor use	⬇ **-32.78 HOURS**
Risk of Mechanical Ventilation	⬇ **-51%**
Initiation of Acute Dialysis Therapy	⬇ **-13.25%**

Sepsis is a key healthcare concern

MOST EXPENSIVE CONDITIONS TREATED IN U.S. HOSPITALS[2]



DID YOU KNOW?
IV FLUIDS CAN CAUSE HARM ...

- Fluid is an independent predictor of mortality.[7,*]
- Only ~50% of hemodynamically unstable patients will respond to IV fluid by increasing cardiac output and perfusion.[8]
- Assessing whether fluid may help or harm a patient is a critical step in optimizing treatment.

*From a retrospective study

- Sepsis is the body's life-threatening response to infection that can lead to tissue damage, organ failure, and death[9]
- Treatment includes IV fluids and medications
- In the U.S., 1.7 M cases of sepsis arise each year, resulting in 270 K deaths[10]
- Sepsis remains the most expensive reason for hospitalization, costing more than $20B annually in the U.S.[2]
- Patients with Severe Sepsis admitted to the ICU have an average length of stay of approx. 7 days[3]
- Average ICU cost of sepsis per patient is between $25,000–$50,000[4]
- Increased sepsis bundle compliance is correlated with decreased sepsis mortality[5]
- Sepsis is a leading cause of hospital readmission[6]
- 20.4% of people hospitalized with sepsis are re-hospitalized within 30 days[6]

The solution:
100% non-invasive fluid management

UTILIZING **STARLING** TECHNOLOGY AS A TOOL MAY HELP YOU IMPROVE SEP-1 COMPLIANCE*

- **The Starling fluid management monitoring system is the only device that will allow your hospital to meet the reassessment of volume status and tissue perfusion of the 6-hour bundle, with a simple and easy to use nurse-driven PLR**
- Works in mechanically ventilated and spontaneously breathing patients[11,12]
- Not affected by vasoactive drugs or arrhythmias
- Moves seamlessly across the continuum of care: **ED > ICU > OR > RRT > Floor**

Simplified User Interface

SIMPLIFIED USER INTERFACE

- Everything you need on one Home screen
- Flexibility to choose preferred view and parameters displayed on the screen

DYNAMIC ASSESSMENT: PLR/FLUID BOLUS

- Quickly get your Dynamic Assessment Results by seeing where the patient resides on the **Starling** Curve
- Option to end Dynamic Assessment as soon as patient's ΔSVI** climbs ⩾10%

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

PASSIVE LEG RAISE (PLR) LIFT TO ASSESS FOR FLUID RESPONSIVENESS

Passive Leg Raise (PLR) technique translocates 250-300 cc of blood from lower extremities into the heart, providing a reversible challenge of the heart's response to increased fluid load.

* CMS data in combination with Baxter internal data on file

** ΔSVI = Change in Stroke Volume Index

USE THE STARLING SYSTEM AND DYNAMIC ASSESSMENTS TO GUIDE YOUR FLUID DECISIONS

Hospital Reluctant to Give Fluid to CHF Patient

TOO LITTLE FLUID[11,13] [HYPOVOLEMIA]

Possible complications:
Tissue Hypoperfusion, Tissue Hypoxia, Organ Failure, Insufficient Perfusion

THE PATIENT

78 yo male from Skilled Nursing Facility arrived at the ED with hypotension, malaise. Work up for possible aspiration pneumonia.

- **PMHx:** CHF, Stage 3 Chronic Kidney Disease, IDDM

FLUIDS ADMINISTERED:

- Patient had received a **500 ml bolus from EMS**
- 09:30am arrival to **ED, 500 ml bolus infused.** BP 91/47 (58), HR 105
- 10:30am: **250 ml ED bolus infused**. BP 87/47(56), HR 107

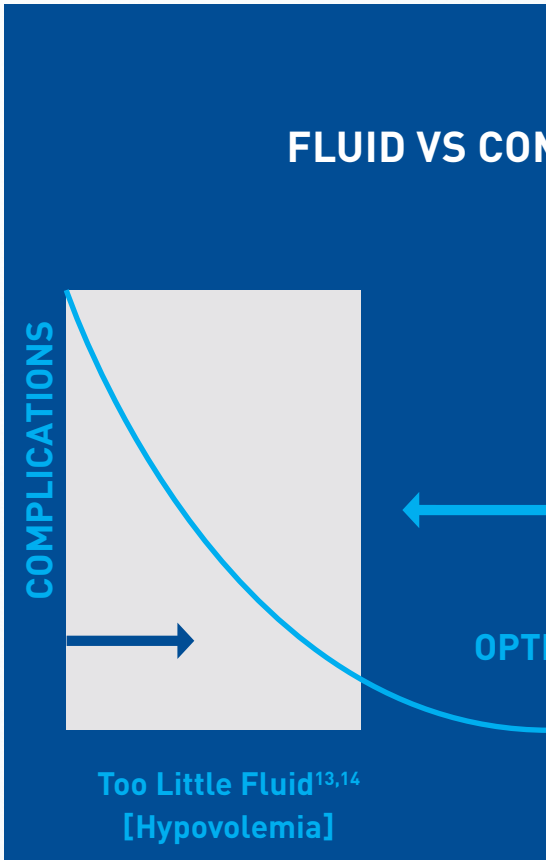
Although the patient was still hypotensive, RN stated no plans for more IVF due to CHF and Kidney Disease.

The ED team decided not to guess whether the patient was fluid responsive, and a PLR was completed to assess if patient is fluid responsive:

- SVI increase of 15.7% indicated patient is still fluid responsive.
- One liter of NS given, patient became normotensive in ED after infusion completed.

Checking for fluid responsiveness gave permission to give more fluids that were needed in this situation, when otherwise IVF may have been held.

Results may vary from patient to patient.



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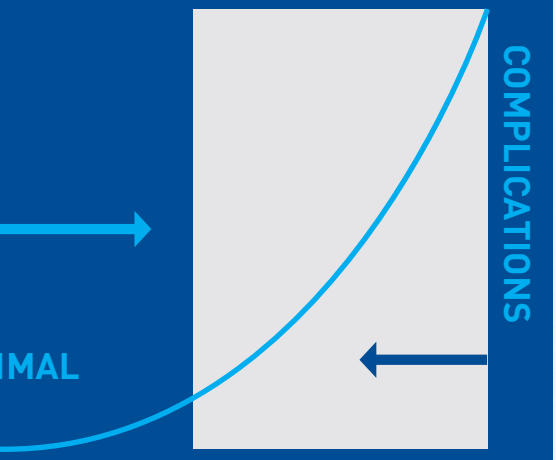
Sepsis Patient is No Longer Fluid-Responsive

TOO MUCH FLUID[15-17] [HYPERVOLEMIA]

Possible complications:
Tissue Edema, Organ Failure, Increased ICU/Ventilator Days, Increased Mortality

MPLICATIONS



Too Much Fluid[15-17] [Hypervolemia]

w that giving oo much d to serious ns and ortality.[11,13-16]

THE PATIENT

70 yo male presented to the ED with malaise and possible sepsis.

FLUIDS ADMINISTERED:

- Patient received **1 L NS from EMS and 2 L NS in ED**. BP 97/61
- Lactic Acid: 5, **Sepsis Protocol initiated.**

STARLING MONITORING INITIATED AT START OF 4TH LITER IVF:

- **After the first 500 ml (of the 4th liter)** a PLR was performed to assess whether the patient was fluid responsive.

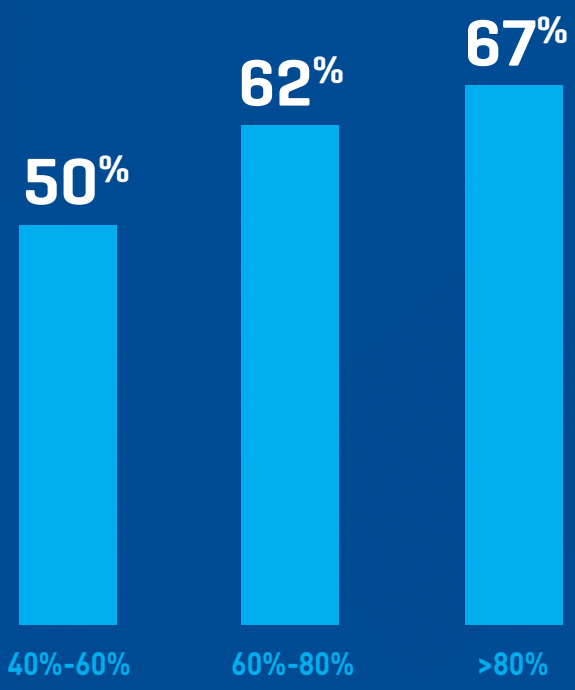
- The patient's ΔSVI increased by 11%, which indicated that the patient was still fluid responsive.
- **After 4th Liter infused**, a second PLR was performed, which indicated that the patient was not fluid responsive (ΔSVI = 5%), and therefore would not likely benefit from further IV fluids at this time.
- Fluids stopped and patient was admitted to hospital with a stable blood pressure 102/76.

CHECKING FOR FLUID RESPONSIVENESS ALLOWED THE CLINICAL TEAM TO TITRATE FLUID ACCORDING TO PATIENT RESPONSE:

- **Give more fluids when the patient benefited from additional fluids**
- **Stop giving additional fluids after 4 L and prevent potential complications associated with fluid overload**

Utilizing Starling technology as a tool may help you improve SEP-1 compliance*

AVG SEP-1 COMPLIANCE RATES OF HOSPITALS UTILIZING **STARLING** TECHNOLOGY



Percent of Sepsis patients treated using **Starling** technology

There is a statistically significant correlation between Starling sensor usage and SEP-1 compliance![18]

*CMS data in combination with Baxter internal data on file

- SEP-1 is a Quality Measure issued by CMS, stipulating a protocol for the treatment of severe sepsis or septic shock patients.
- Your hospital SEP-1 compliance levels are now publicly reported at Medicare.gov Hospital Compare: medicare.gov/hospitalcompare/search.html
- **Starling** is the only device with demonstrated outcome data that will allow your hospital to meet the reassessment of volume status and tissue perfusion of the 6-hour bundle ... with a nurse-performed PLR!

SV-Guided Fluid Resuscitation May Translate To 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.[1,19]

FINANCIAL BUSINESS CASE

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[20] $906/floor day[21]	$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[22] 5.1 days[21]	$1,940
Acute Dialysis Therapy Initiated	6.25%	19.5%	13.25% *P* = 0.01	$27,182 x (lc) (12.73 cases avoided/ 96 total patients)[21]	$3,605
ESTIMATED SAVINGS PER TREATED PATIENT*					**$14,498**

*Based upon supplemental data.

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

"By reducing length of stay, vasopressor use, and the requirement for mechanical ventilation using dynamic assessments provided by the **Starling** system, sepsis patients may benefit by an improved quality of care and reduced healthcare costs."

Dr. Steven Q. Simpson, Acting Director,
Division of Pulmonary Disease and Critical Care Medicine at the University of Kansas Medical Center

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USMP/CHE/20-0012 04/20