The slide features a background image of a city skyline at sunset. The top left corner has an orange banner with the text '2017 AmSECT'. The main title 'quality & outcomes' is in a large, bold, black font, with 'quality' in a lighter weight and '& outcomes' in a bolder weight. Below the title, the date and location 'October 18/21, 2017 | Portland, OR' are written in a smaller font. The top right corner contains the AmSECT logo and the text 'AmSECT experience'. The title of the presentation, 'Blood Management of the Cardiac Patient in the Postoperative Period', is centered in a black serif font. Below the title, the names and credentials of the speakers are listed: 'Al Stammers, MSA, CCP, Eric Tesdahl, PhD', 'Andy Stasko MS, CCP, RRT, Linda Mongero, BS, CCP,', and 'Sam Weinstein, MD, MBA'.

2017 AmSECT

**quality & outcomes**

October 18/21, 2017 | Portland, OR

AmSECT | AmSECT experience

Blood Management of the Cardiac Patient in the Postoperative Period

Al Stammers, MSA, CCP, Eric Tesdahl, PhD  
Andy Stasko MS, CCP, RRT, Linda Mongero, BS, CCP,  
Sam Weinstein, MD, MBA

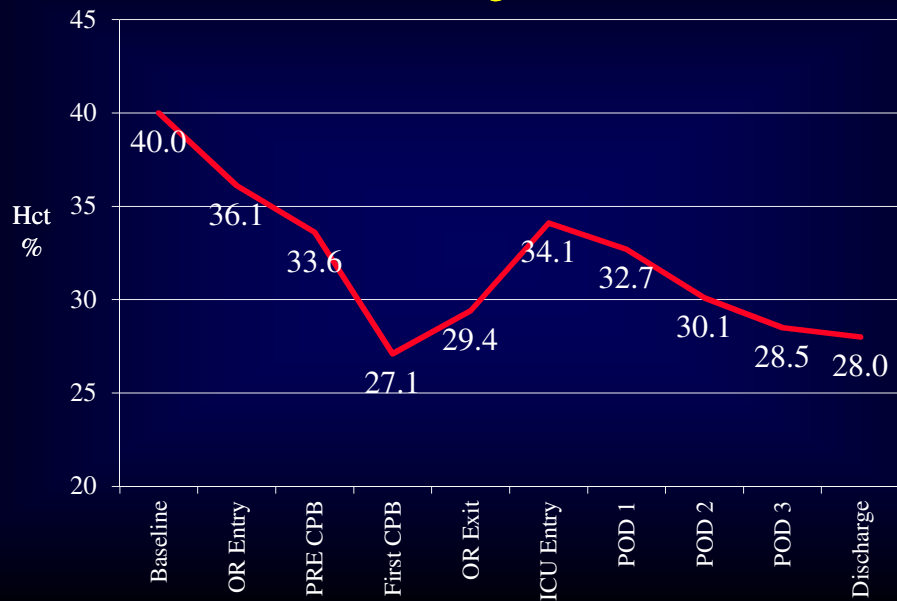
## *Goal*

To examine the effect of cardiac surgery with cardiopulmonary bypass on hemodilution and coagulation through postoperative transfusions.

*Disclosure: None.*

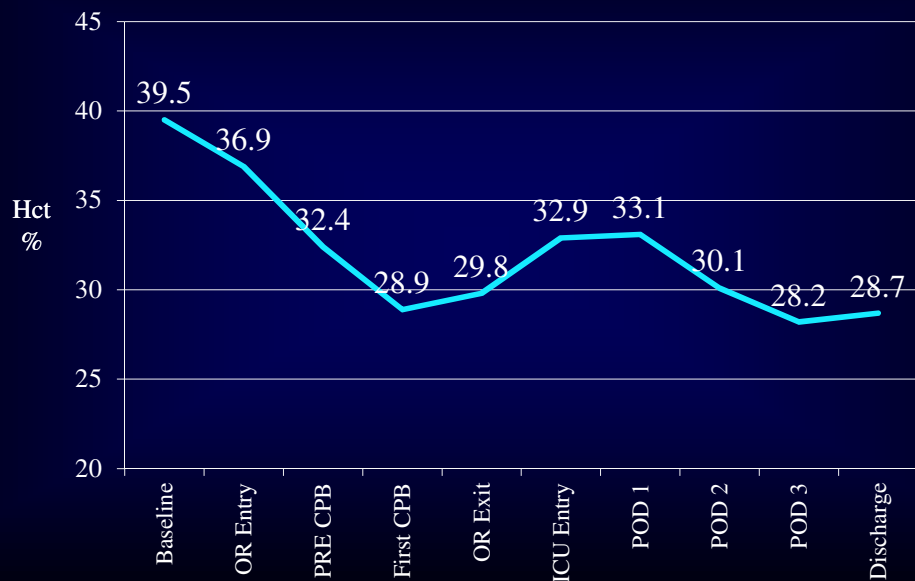
*Pre Change in Autologous Prime Technique*

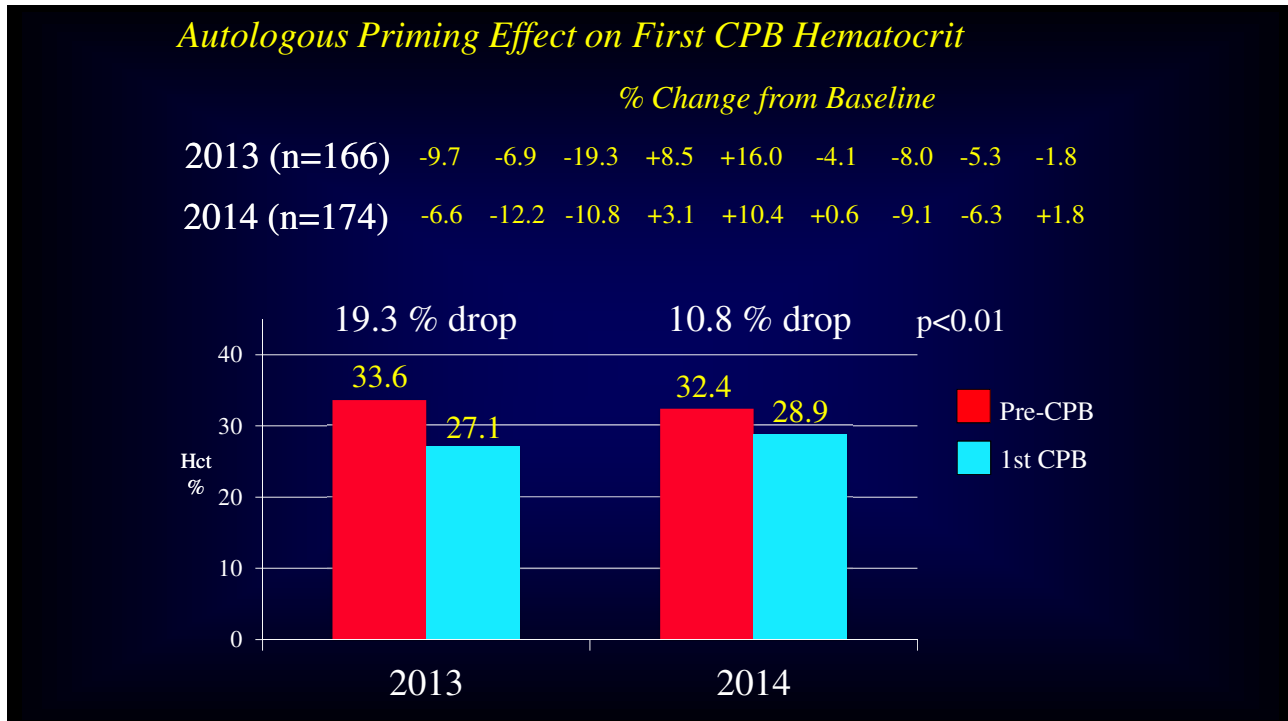
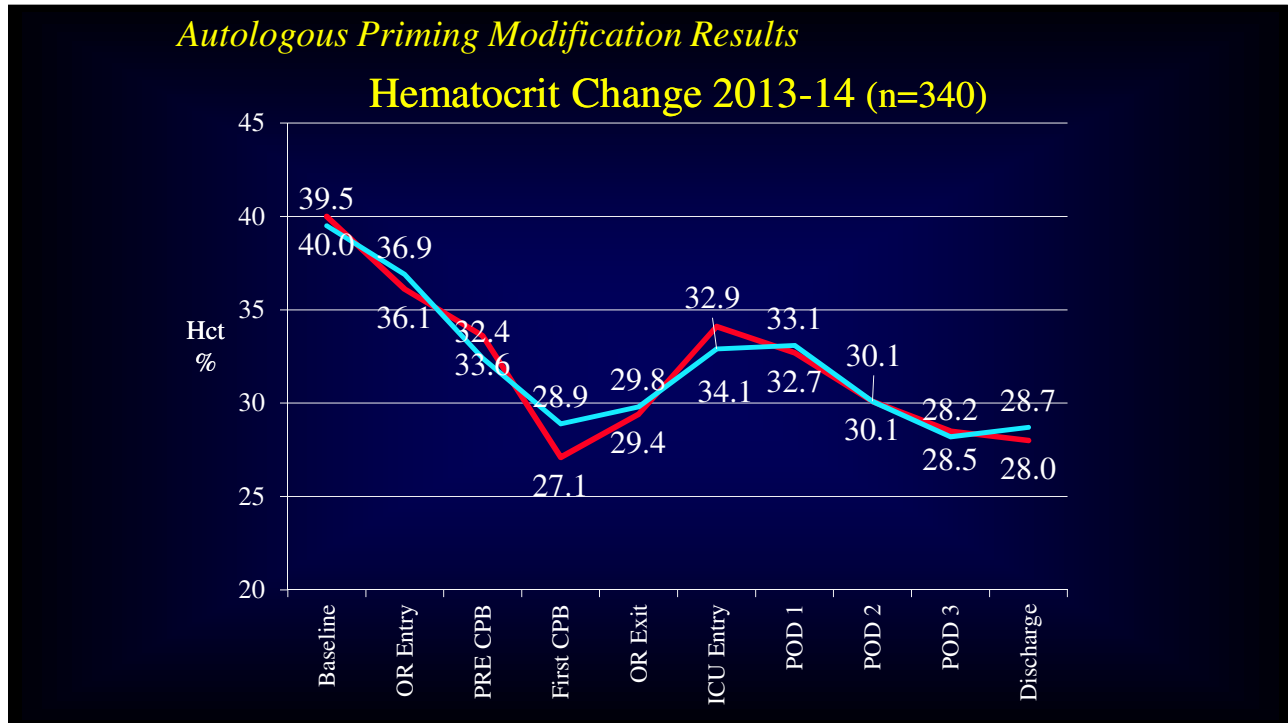
**Hematocrit Change 2013 (n=166)**

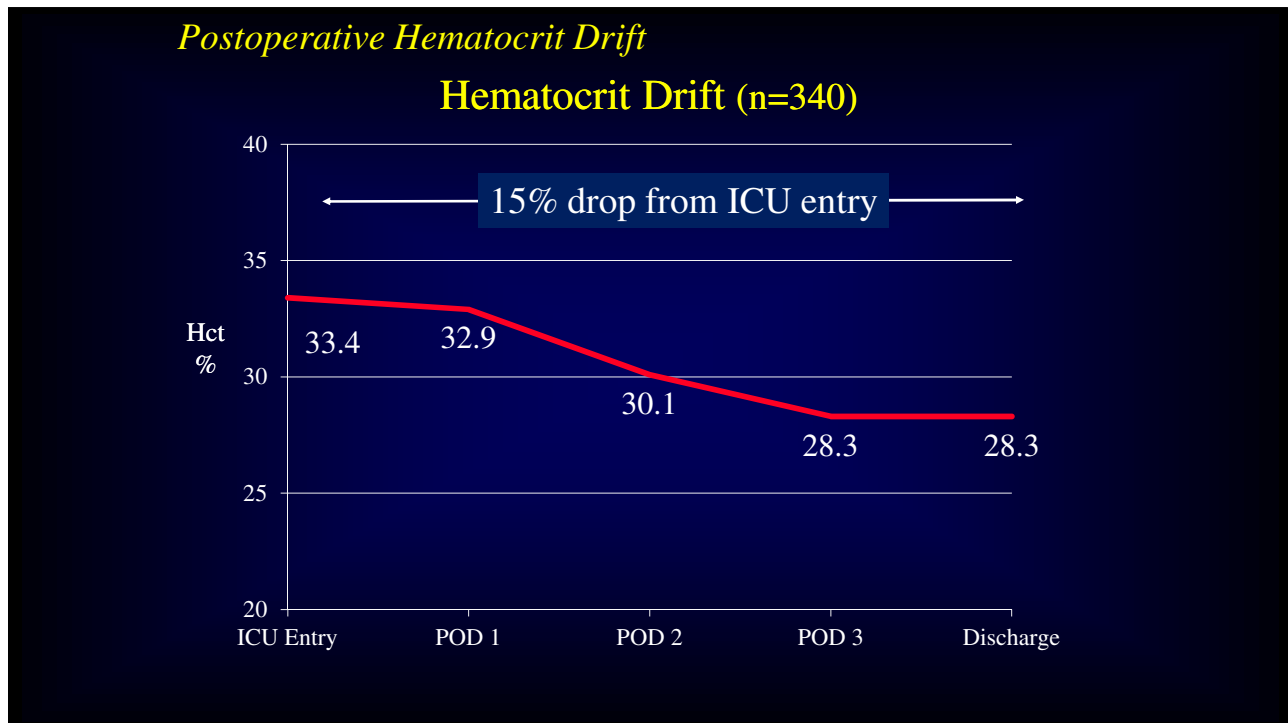
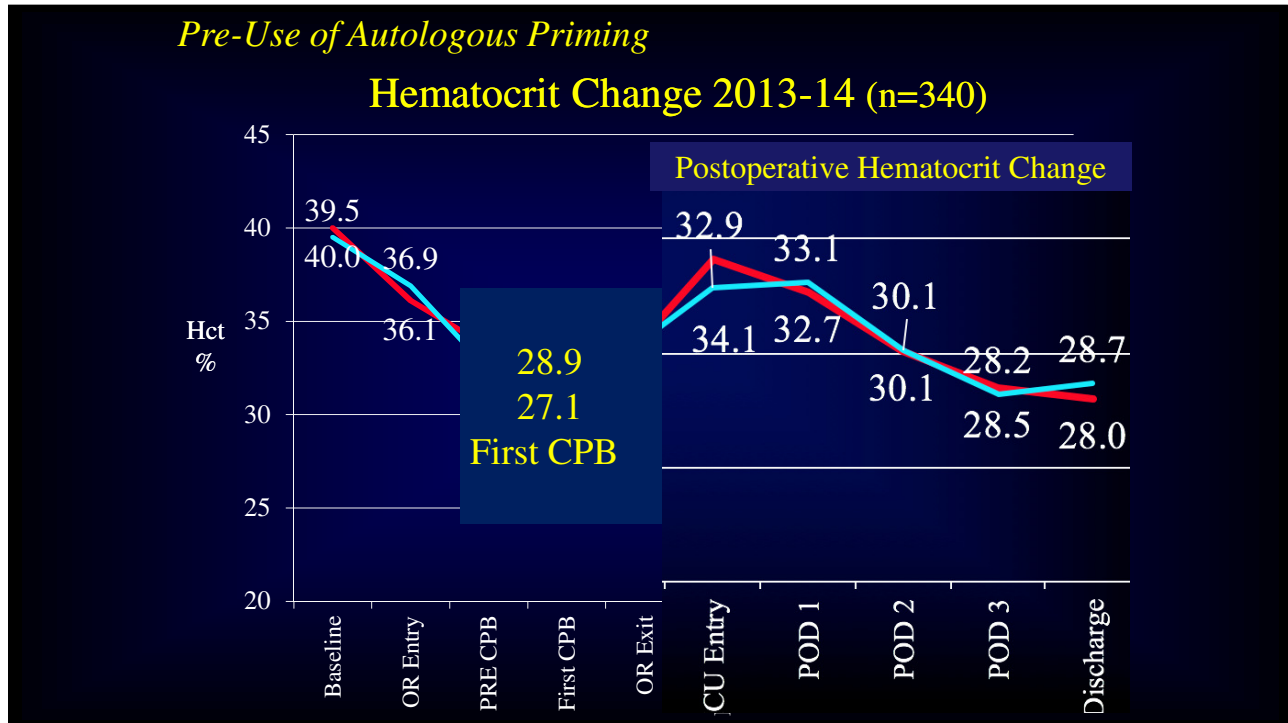


*Change in Autologous Priming Technique*

**Hematocrit Change 2014 (n=174)**







## *Transfusion Rate in Cardiac Surgery*

- ✓ 20% of world's blood supply transfused in CABG patients

Snyder-Ramos et al. *Transfusion*. 2008;48:1284-99.

## *Successful Blood Management in Cardiac Surgery Requirements*

- ✓ Comprehensive and multifactorial
- ✓ Perioperative origin
- ✓ Algorithms affect outcomes
- ✓ Change culture for transfusion administration

## *Transfusion Rate in Cardiac Surgery*

### *Factors Influencing Likelihood of Intraop Transfusion*

<u>Parameter</u>	<u>More Likely to be Transfused</u>
Age	Older
Gender	Female
Size	Smaller height & weight
Preop ICU	ICU prior to surgery
Procedure	Combined
CPB	Longer
XC	Longer
HB Levels (pre and intraop)	Lower

De Santo et al. *Eur J CardioThorac Surg*. 2013;43:359-66.

### *Transfusion Rate in Cardiac Surgery Isolated CABG*

#### **Intraop/Postop Transfusion**

<b>Overall:</b>	<b>42.3%</b>
RBC	
1 Unit	9.4%
2 Units	11.6%
3 Units	5.1%
4+ Units	9.9%
FFP	11.7%
PLT	18.3%
CRYO	5.2%

#### **Postop Transfusion**

<b>Overall:</b>	<b>29.3%</b>
RBC	
1 Unit	9.5%
2 Units	9.2%
3 Units	3.1%
4+ Units	4.8%
FFP	6.2%
PLT	7.3%
CRYO	3.1%

STS Executive Summary, June 2016

### *Percentage of Cardiac Surgery Patients Transfused (Red Blood Cells)*

<u>Overall</u>	<u>1U</u>	<u>2-3U</u>	<u>4-5U</u>	<u>6-8U</u>	<u>&gt;9U</u>
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45.3	12.0	18.3	7.9	3.3	3.5
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Frank. *Anesthesiology*.  
2012;117:99.  
All CS Patients

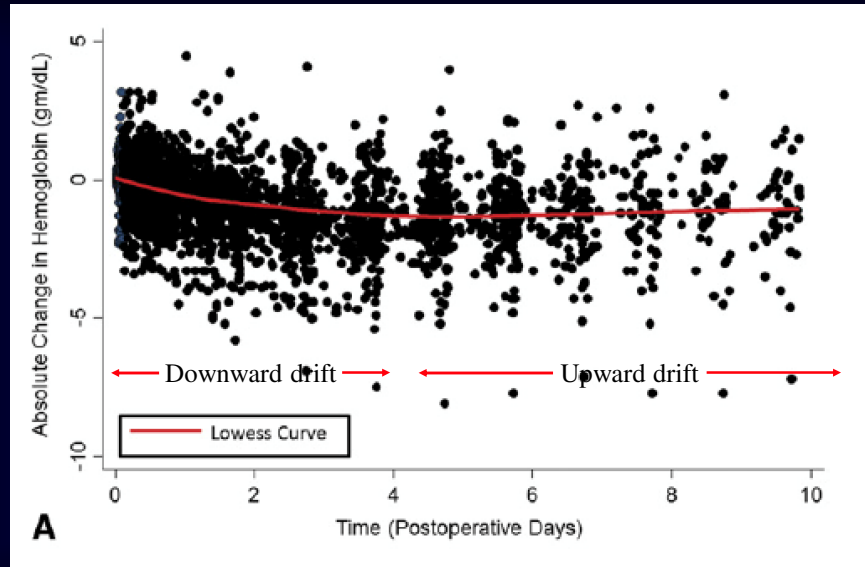
40.0

Cote. *JTCVS*.  
2015;149:237.  
All CS Patients

56.1

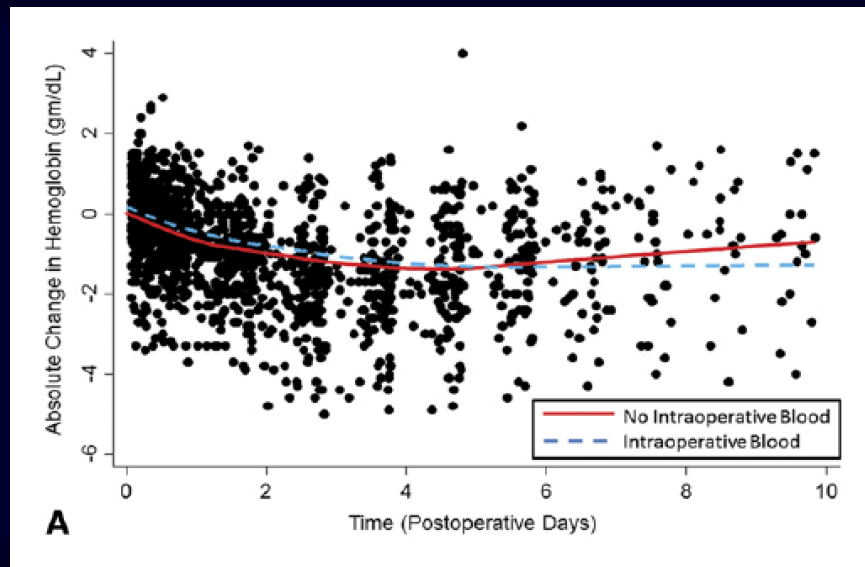
Bennet-Guerrero. *JAMA*.  
2010;304:1568.  
CABG Patients

## Postoperative Hemoglobin Drift



George et al. *Ann Thorac Surg.* 2012;94:703-9.

## Transfusion Rate in Cardiac Surgery



George et al. *Ann Thorac Surg.* 2012;94:703-9.

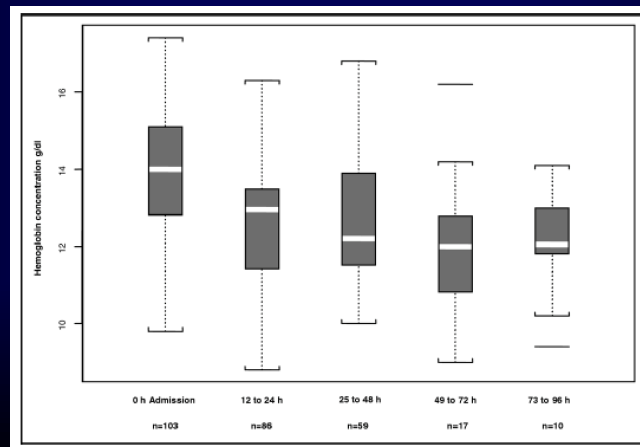
## ICU Hemoglobin Drift

Previsdomini. *Am J Cardiol.* 2007;100:579.

### Non-CS Patients, Non-Bleedings

In first 24 hours HB levels drop by 1.29 G

- Diagnostic sampling
- Hemodynamic maintenance
- Nitroglycerine use
- Stress



## Factors Influencing Postop Transfusion Rates

- ✓ Fluid shifts post cardiac surgery with CPB
- ✓ Quantity of fluid resuscitation volumes
- ✓ Use of heparin, ASA and other coag affecting meds
- ✓ Surgeon ultimate arbiter v. anesthesia and perfusion

Cremer et al. *Ann Thorac Surg.* 1996;61:1714-20.



*Perioperative Transfusion Rate**N=340*

<i>Any</i>	<i>Pre-Intraop</i>		<i>Postop</i>		
<b>Overall:</b>	<b>42.4%</b>	<b>Overall:</b>	<b>25.8%</b>	<b>Overall:</b>	<b>33.3%</b>
RBC	40.4%	RBC	22.8%	RBC	30.9%
FFP	10.3%	FFP	2.9%	FFP	8.1%
PLT	11.0%	PLT	3.7%	PLT	7.4%
CRYO	4.4%	CRYO	1.5%	CRYO	2.9%

- ✓ Majority of transfusions occur in the postoperative period
- ✓ 30% more RBC transfusion in ICU
- ✓ 2 times higher rate of FFP and platelets given in ICU

*Timing of Transfusion**N=340**Red Blood Cell Transfusion*

Intraop Only	21.4% (30)
ICU Only	39.3% (55)
Both	39.3% (55)

<b>RBC</b>	<b>% (n)</b>
Prime Only	6.6% (22)
CPB Only	20.6% (70)
Both Prime & CPB	5.1% (17)
Anesthesia Only	4.4% (15)
Anesthesia & Perfusion	2.2% (7)
ICU Only	17.6% (60)
ICU & Anesthesia	0.7% (2)
ICU & Perfusion	11.0% (37)
ICU & Anesthesia & Perfusion	1.5% (5)

### *Risk Significant Factors for Transfusion*

	Non-Transfused	Transfused	p value
STS RS - Mortality	1.07%±0.89%	1.07%±0.89%	0.001
STS RS - Morbidity	1.07%±0.89%	1.07%±0.89%	0.001
Baseline Hematocrit	41.6%±5.2%	37.3%±5.3%	0.001
1 <sup>st</sup> CPB Hematocrit	31.5%±4.1%	26.5%±4.1%	0.001
Last OR Hematocrit	29.9%±4.1%	26.9%±4.2%	0.001
1 <sup>st</sup> ICU Hematocrit	36.1%±4.0%	33.8%±5.1%	0.001
ICU & Anesthesia			

- ✓ Male - 82.9% v. 64.3% in transfused
- ✓ BSA & BMI similar
- ✓ More combined procedures in transfused group

### *Risk Significant Factors for Transfusion*

	Non-Transfused	Transfused	p value
Total Heparin (IU)	46,151±12,971	52,053±17,919	0.01
Total CPB Vol. (ml) Input	1,660±670	2,536±1,236	0.001
Total CPB Vol. (ml) Output	286±391	621±905	0.01
CPB Time (m)	93.4±39.6	125.8±46.4	0.001
X Clamp Time (m)	67.3±26.9	94.3±43.4	0.001

- ✓ No difference in NPV or AP volume
- ✓ No difference in urine output and CUF volumes
- ✓ More combined procedures in transfused group

*Risk Significant Factors for Transfusion*

	Non-Transfused	Transfused	p value
Total In Vol. (ml)	2,850 $\pm$ 960	4,245 $\pm$ 1651	0.001
Total Out Vol. (ml)	556 $\pm$ 439	903 $\pm$ 925	0.01
Fluid Bal. Vol. (ml)	2,294 $\pm$ 852	3,342 $\pm$ 1600	0.001
Operative Time (h)	2:46 $\pm$ 0:54	3:32 $\pm$ 1:38	0.001

- ✓ Higher ATS processed returned vol. in transfused group

*Risk Significant Factors for Transfusion*

	Non-Transfused	Transfused	p value
CT Vol. 12-Hr (ml)	392.5 $\pm$ 193.7	683.4 $\pm$ 618.0	0.001
CT Vol. 24-Hr (ml)	683.2 $\pm$ 252.0	1,074.2 $\pm$ 766.2	0.001
CT Vol. Total (ml)	1,015.3 $\pm$ 438.8	1,880.1 $\pm$ 1,780	0.001
LOS (d)	4.5 $\pm$ 2.4	6.6 $\pm$ 5.4	0.001

- ✓ Higher ATS processed returned vol. in transfused group

### *Risk Significant Factors for Transfusion*

STS Outcomes	Non-Transfused	Transfused	p value
Pulmonary Dysfun.	9.9%	23.4%	0.001
AFIB	31.0%	23.4%	0.001
Reop. Bleeding	4.2%	8.5%	0.001
Prolonged Vent.	8.5%	23.4%	0.001
Cardiac Arrest	1.4%	6.4%	0.001
AKI	1.4%	4.3%	0.001
30-D Readmission	5.6%	8.5%	0.01
30-D Op. Mortality	6.4%	0.0%	0.001

- ✓ No differences: infection, CVA, Dialysis, MOS failure, GI complications, reoperation valve, DVT or Thrombosis, anticoagulant dysfunction

### *Factors Affecting Postoperative Transfusion*

#### *Conclusions*

- ✓ Major fluid shifts occur in the postoperative period that have major hemorheologic effects, with the majority of transfusions occurring during this period
- ✓ Intraoperative techniques should focus on optimizing hematocrit, and coagulation status, with specific attention applied to nadir levels