

Blood Preservation in the ICU

Martin Zammert M.D.

Department of Anesthesiology, Perioperative and Pain Medicine

Division of Surgical Critical Care

Division of Cardiac Anesthesia

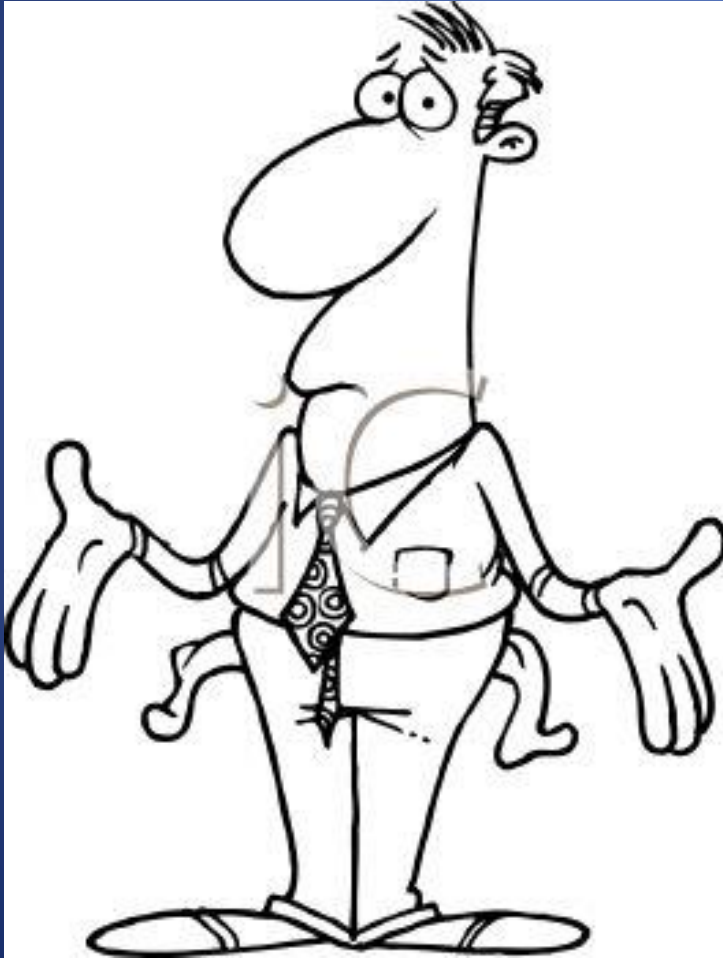
Brigham and Women's Hospital

Harvard Medical School

Boston / USA



Disclosure



NO CONFLICT OF INTEREST

Anemia in the ICU

- Ongoing surgical bleeding
- Coagulopathy
- Gastrointestinal bleeding
- Impaired erythropoiesis
- **Phlebotomy**



Contemporary Bloodletting in Cardiac Surgical Care

Colleen G. Koch, MD, MS, Edmunds Z. Reineks, MD, PhD, Anne S. Tang, MS, Eric D. Hixson, PhD, MBA, Shannon Phillips, MD, Joseph F. Sabik, III, MD, J. Michael Henderson, MD, and Eugene H. Blackstone, MD

Department of Cardiothoracic Anesthesia, Heart and Vascular Institute; Quality and Patient Safety Institute; Robert J. Tomsich Pathology & Laboratory Medicine Institute; Department of Quantitative Health Sciences, Research Institute; Business Intelligence, Medical Operations; Department of Thoracic and Cardiovascular Surgery, Heart & Vascular Institute; and Department of General Surgery, Digestive Disease Institute, Cleveland Clinic, Cleveland, Ohio

Amount of Blood Drawn per Patient per Hospitalization

Factor	No.	Minimum (mL)	Maximum (mL)	Median [25th, 75th percentiles] (mL)
Cumulative for hospitalization	1,921	14	16,020	454 [270, 813]
CVICU	1,766	39	15,457	332 [197, 619]
Floor	1,921	12	292	118 [73, 232]

CVICU = cardiovascular intensive care unit.

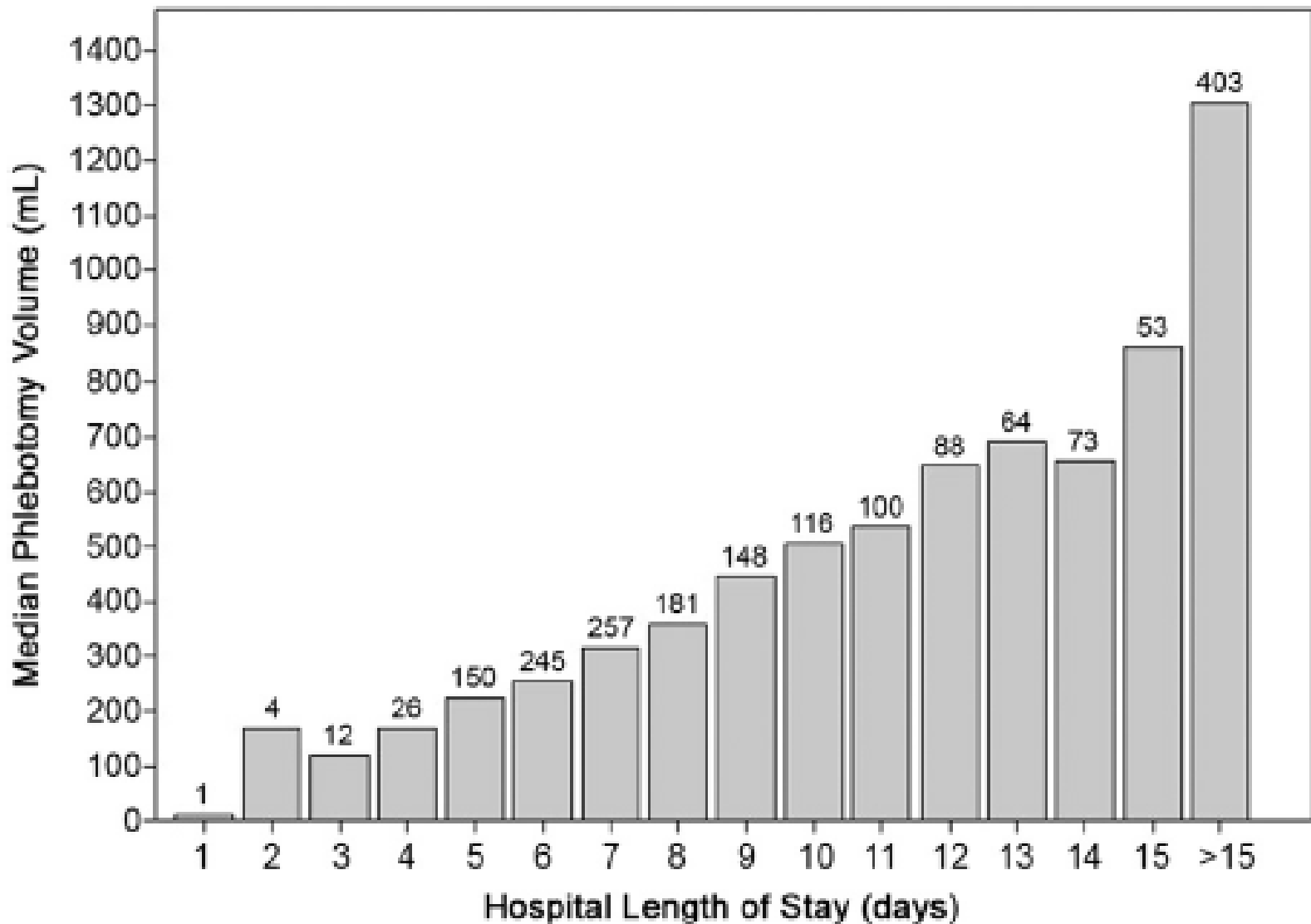
Cumulative Phlebotomy Volume by Operative Procedure

Procedure	No.	Phlebotomy Volume (mL)		Cumulative Volume (mL)
		Median [25th, 75th percentiles]		Median [25th, 75th percentiles]
		CVICU	Floors	
CABG only	235	271 [188, 441]	140 [77, 227]	448 [284, 658]
Valve only	635	216 [162, 402]	99 [64, 196]	338 [237, 619]
Ascending aortic procedures and others ^a	300	312 [197, 565]	104 [69, 167]	428 [286, 760]
Other operations, except valve, CABG, or ascending aortic procedures ^{a,b}	208	328 [143, 969]	152 [86, 306]	506 [225, 1,259]

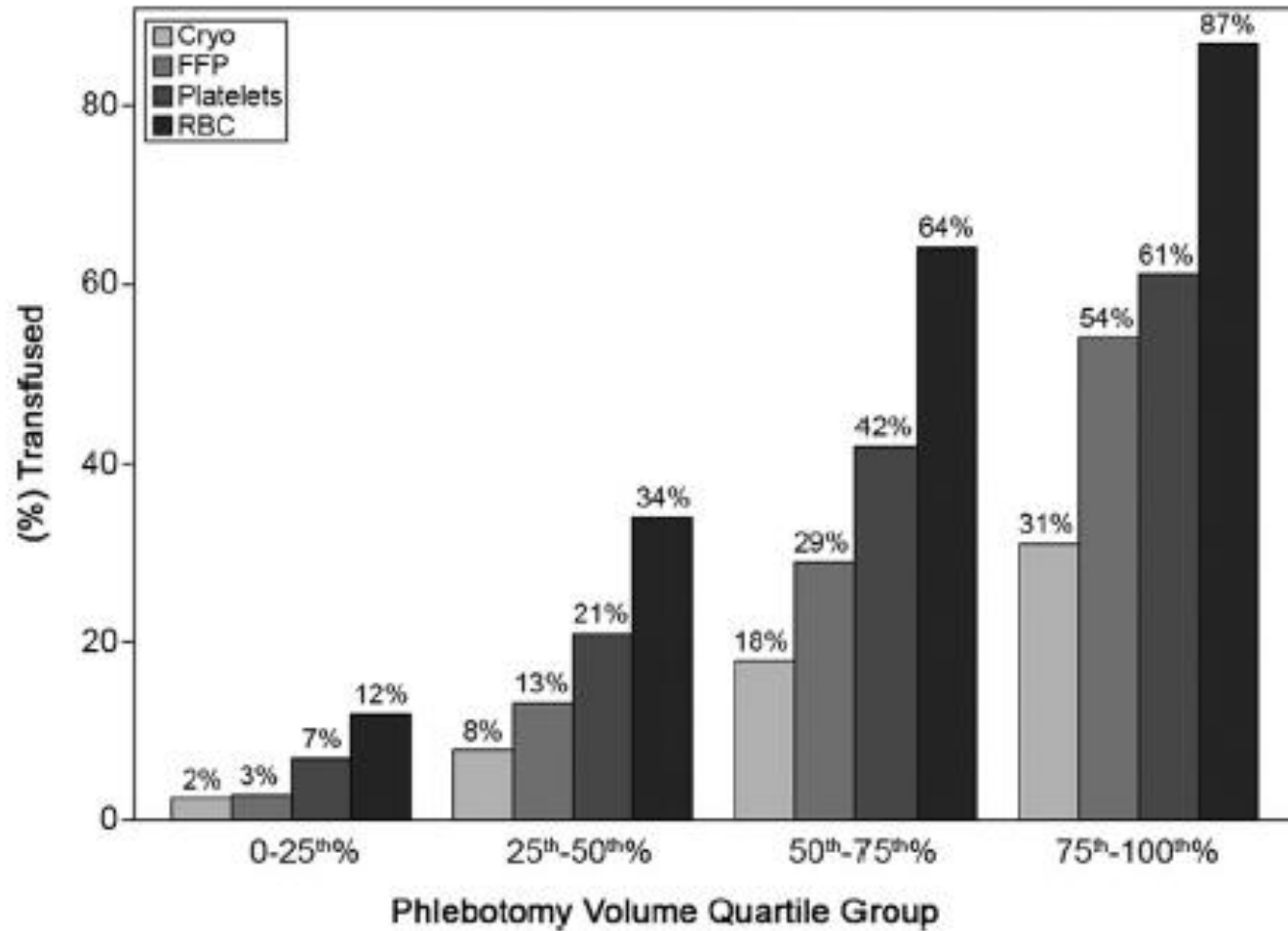
CABG = coronary artery bypass grafting; CVICU = cardiovascular intensive care unit.

a Not mutually exclusive.

b Other operations included any atrial fibrillation procedure, congenital procedures such as atrial septal defect/patent foramen ovale suture closure, removal of an atrial myxoma/cardiac tumor, insertion of an assist device, carotid endarterectomy, heart transplant, descending aorta grafting, pulmonary endarterectomy, septal myectomy, and major left ventricular procedure.



Hospital length of stay and cumulative median phlebotomy volume



Phlebotomy volume by 25th, 50th, 75th, and 100th percentile groups, and percentage of patients transfused with red blood cells (RBC), cryoprecipitate (Cryo), fresh frozen plasma (FFP), and platelets. Transfusion requirements increase in a dose-dependent...

The Silver Challenge



Culture or Necessity?



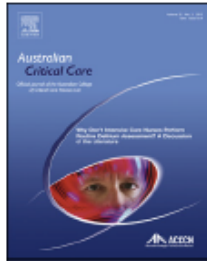


ELSEVIER

Contents lists available at ScienceDirect

Australian Critical Care

journal homepage: www.elsevier.com/locate/aucc



Research paper

‘True Blood’ The Critical Care Story: An audit of blood sampling practice across three adult, paediatric and neonatal intensive care settings

Amanda J. Ullman RN, GC Paediatric ICU, MAppSci^{a,b,*},

Samantha Keogh RN, PhD^{a,b},

Fiona Coyer RN, PG Cert (Adult education), MSc, PhD^{c,b},

Deborah A. Long RN, MNurs (Crit Care), PhD^{a,d},

Karen New RN, PhD^{b,e},

Claire M. Rickard RN, PhD^{a,b,f}

'True Blood' The Critical Care Story: An audit of blood sampling practice across three adult, paediatric and neonatal intensive care settings

Blood sampling across the included intensive care units (n = 940).

	Neonatal ICU (n = 140)	Paediatric ICU (n = 140)	Adult ICU (n = 655)	p values
Blood test: n (%)				
Arterial blood gas	66 (47%)	116 (80%)	543 (82%)	<0.001
Full blood count	21 (15%)	38 (26%)	152 (23%)	0.015
Capillary gas	35 (25%)	0	0	N/A
Urea, electrolytes and liver function test	9 (6%)	36 (25%)	157 (24%)	<0.001
Other	38 (27%)	55 (38%)	128 (20%)	N/A
Reason for blood sampling: n (%)				
Routine	45 (33.1%) ^a	39 (45.4%) ^b	113 (47.5%) ^c	0.024
Medical request	77 (56.6%)	43 (54.4%)	109 (45.8%)	
Previous abnormal result	6 (4.4%)	4 (5.1%)	8 (3.4%)	
Other	8 (5.9%)	0	8 (3.4%)	
Reason for arterial blood gas: n (%)				
Medical staff request	84 (95.4%) ^d	39 (37.5%) ^e	75 (13.4%) ^f	<0.001
Nurse initiated	0	55 (52.9%)	271 (48.5%)	
Routine	3 (3.4%)	1 (1.0%)	192 (35.4%)	
Other	1 (1.1%)	9 (8.6%)	21 (3.7%)	
Number of samples/patient/day:^g	0.7 (0.4)	2.3 (2.9)	5.0 (2.4)	0.045
Volume of samples/patient/day:^g	0.16 (0.4)	5.0 (1.0)	22.3 (16.8)	<0.001
Line clearance method: n (%)				
Return	140 (100%)	99 (68%)	0	<0.001
Discard	0	46 (32%)	655 (100%)	
Volume discarded for line clearance/patient/day:^g	0	3.4 (2.6)	12.6 (8.4)	<0.001
Total blood volume for sampling/patient/day:^g	0.15 (0.4)	9.30 (8.4)	37.7 (23.1)	<0.001

^a7 missing; ^b66 missing; ^c419 missing; ^d55 missing; ^e41 missing; ^f97 missing; ^gmedian (interquartile range).

'True Blood' The Critical Care Story: An audit of blood sampling practice across three adult, paediatric and neonatal intensive care settings

Cost of blood sampling pathology processing across the included intensive care units in Australian (2014) dollars (n=940).

	Neonatal ICU (n=140)	Paediatric ICU (n=145)	Adult ICU (n=655)	p values
Total ABG cost per patient per admission	\$24.48	\$36.72	\$73.44	<0.001
Median (IQR)	(61.20)	(104.04)	(223.38)	
Total Blood Sample costs per patient per admission	\$28.75	\$117.98	\$128.78	<0.001
Median (IQR)	(62.72)	(291.04)	(345.18)	
ABG costs per patient per day	\$5.25	\$19.96	\$51.51	<0.001
Median (IQR)	(9.18)	(46.46)	(25.85)	
Blood Sample costs per patient per day	\$8.13	\$41.55	\$101.11	<0.001
Median (IQR)	(14.95)	(56.74)	(54.71)	

Blood Preservation in the ICU

- Minimize routine blood draws
- Minimize or return line clearing volume
- Minimize blood draw volume (small volume phlebotomy tubes)

