



Transfusionsgradient/trigger för IVA-patienter

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Definition av IVA-patient?



Definition av transfusion?

Many, but not all, outcome studies support exclusion of female plasma from the blood supply

Expert Rev. Hematol. 3(5), 551–558 (2010)

Mark Stafford-Smith^{†1},
Evelyn Lockhart¹,
Nicholas Bandarenko¹
and Ian Welsby¹

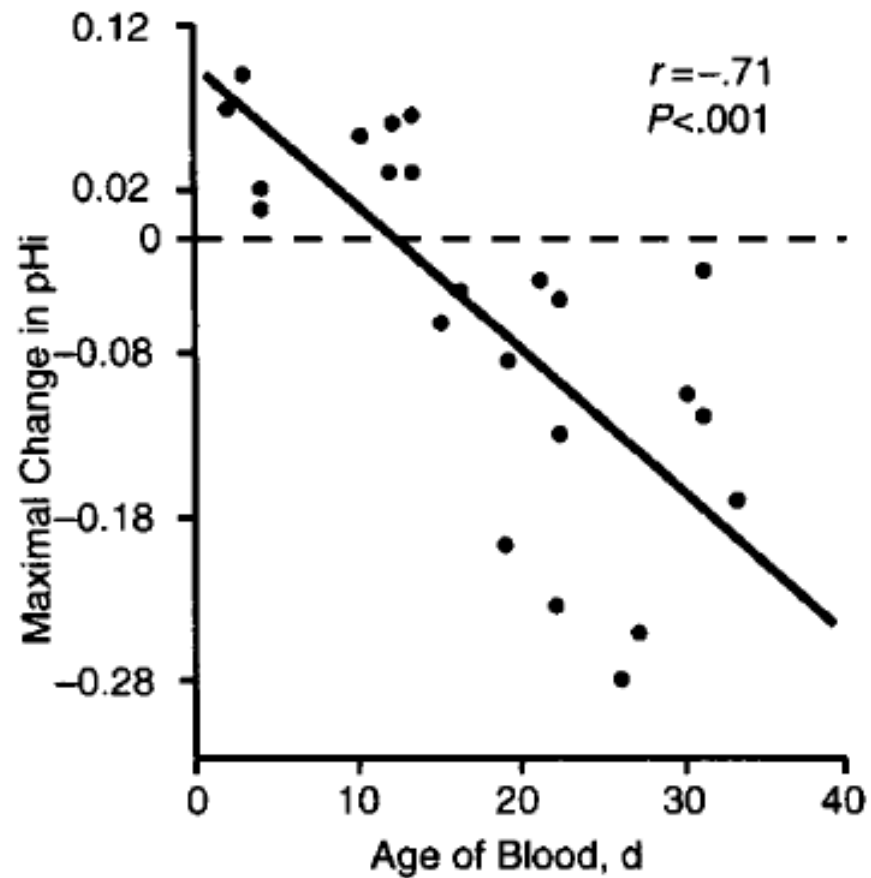
[†]*Duke University Medical Center,
Box 3094 DUMC, Durham,
NC 27710, USA*

Effect of Stored-Blood Transfusion on Oxygen Delivery in Patients With Sepsis

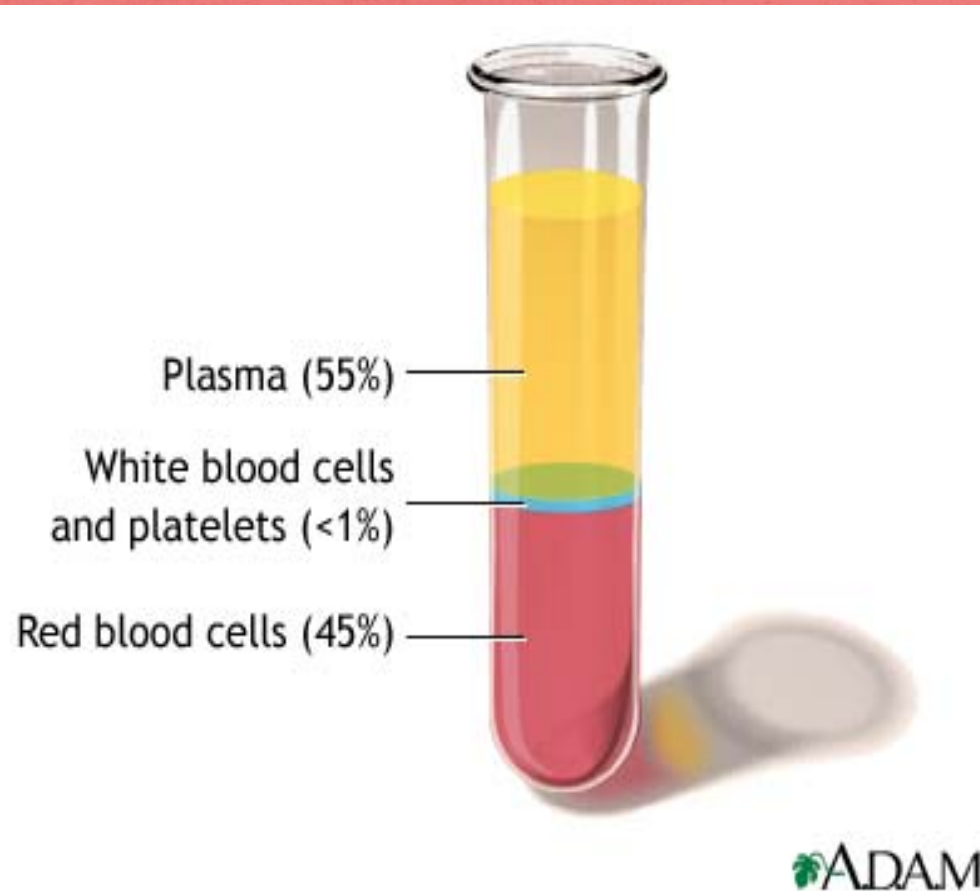
Paul E. Marik, MMed, William J. Sibbald, MD, FRCPC

JAMA, June 16, 1993—Vol 269, No. 23

Gastric intramucosal pH







Blodprodukter

- TRALI (Transfusion- Related Acute Lung Injury)
- Plasma från kvinnor
- HLA-antikroppar
- Neutrofila granulocyter
- Allergi and anaphylaxi
- Överföring av infektioner
- Andra transfusionsreaktioner
- Immunomodulering

Nackdelar



Friska försökspersoner

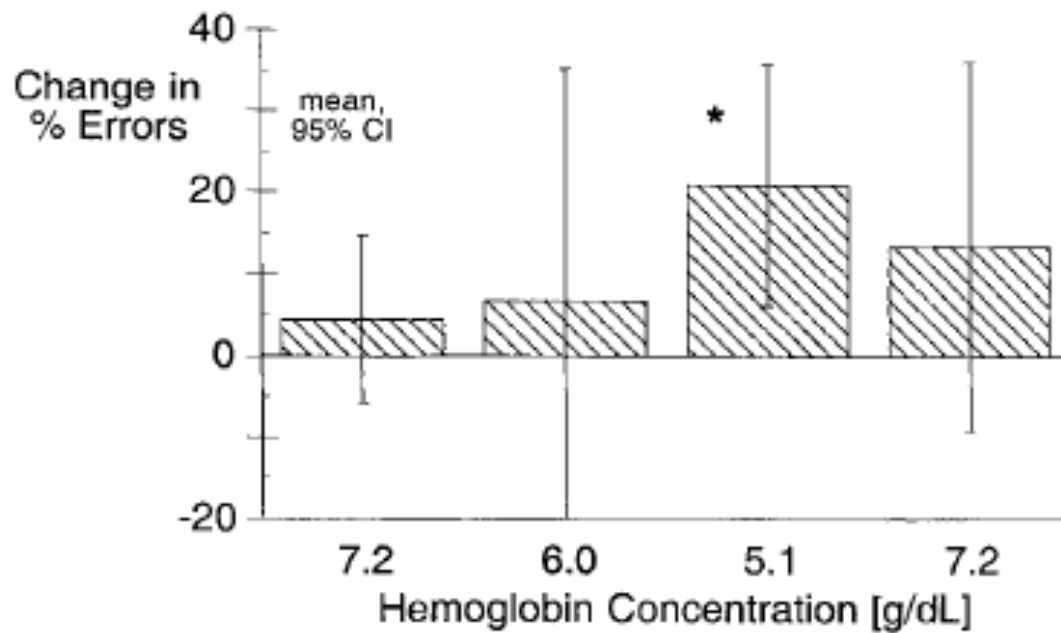
Inducerad anemi

Acute Severe Isovolemic Anemia Impairs Cognitive Function and Memory in Humans

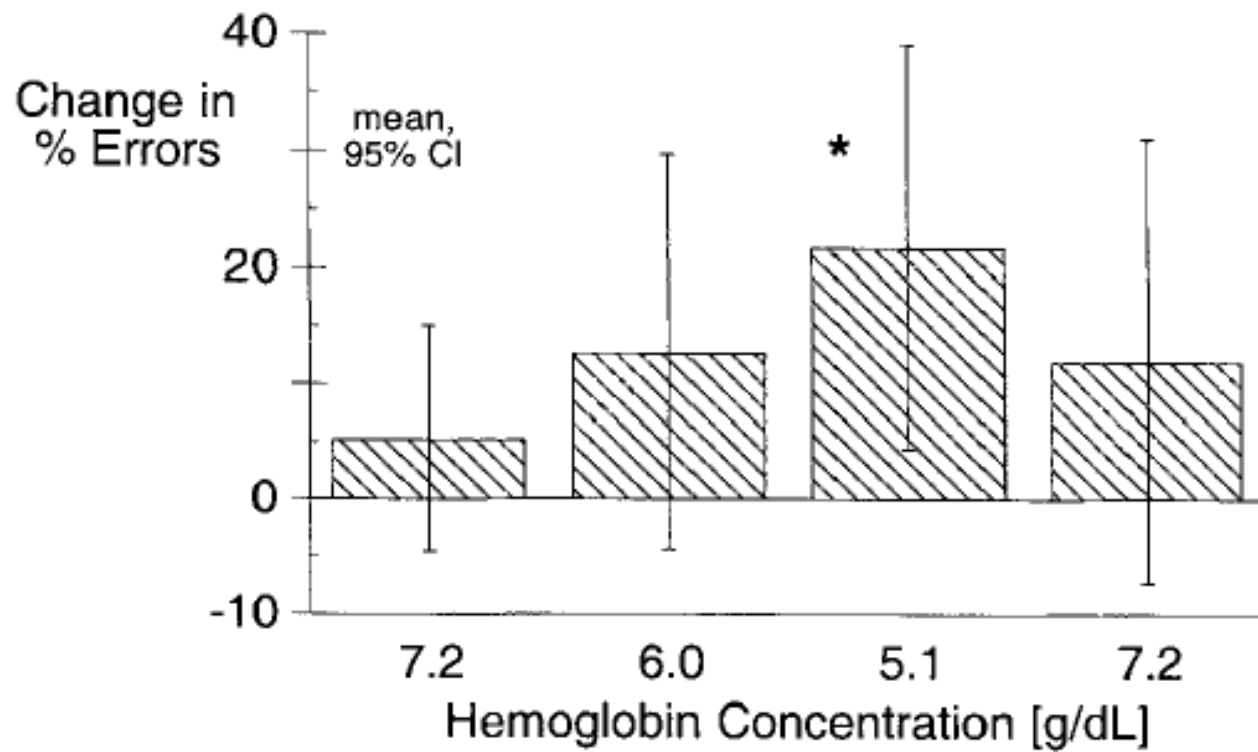
Richard B. Weiskopf, M.D., Joel H. Kramer, Psy.D.,† Maureen Viele, M.D.,‡ Mireille Neumann, M.D.,§
John R. Feiner, M.D.,|| Jessica J. Watson, M.A.,# Harriet W. Hopf, M.D.,** Pearl Toy, M.D.††*

Anesthesiology
2000; 92:1646-52

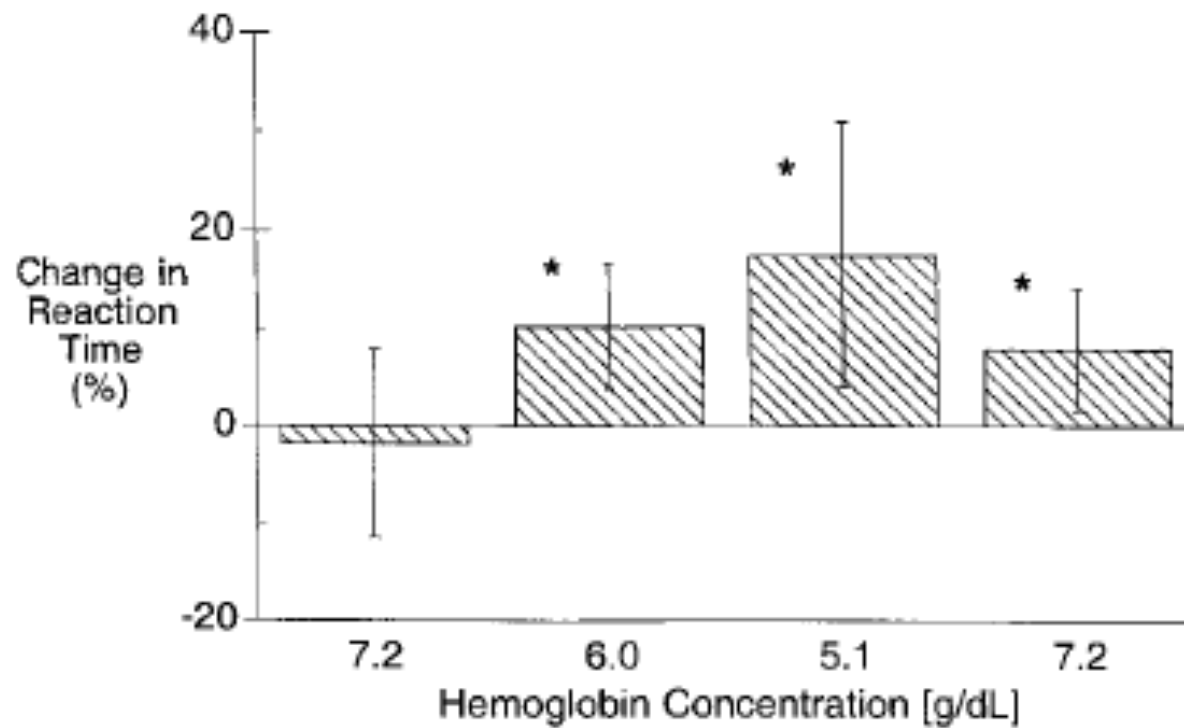
Immediate memory



Delayed memory



Reaction time



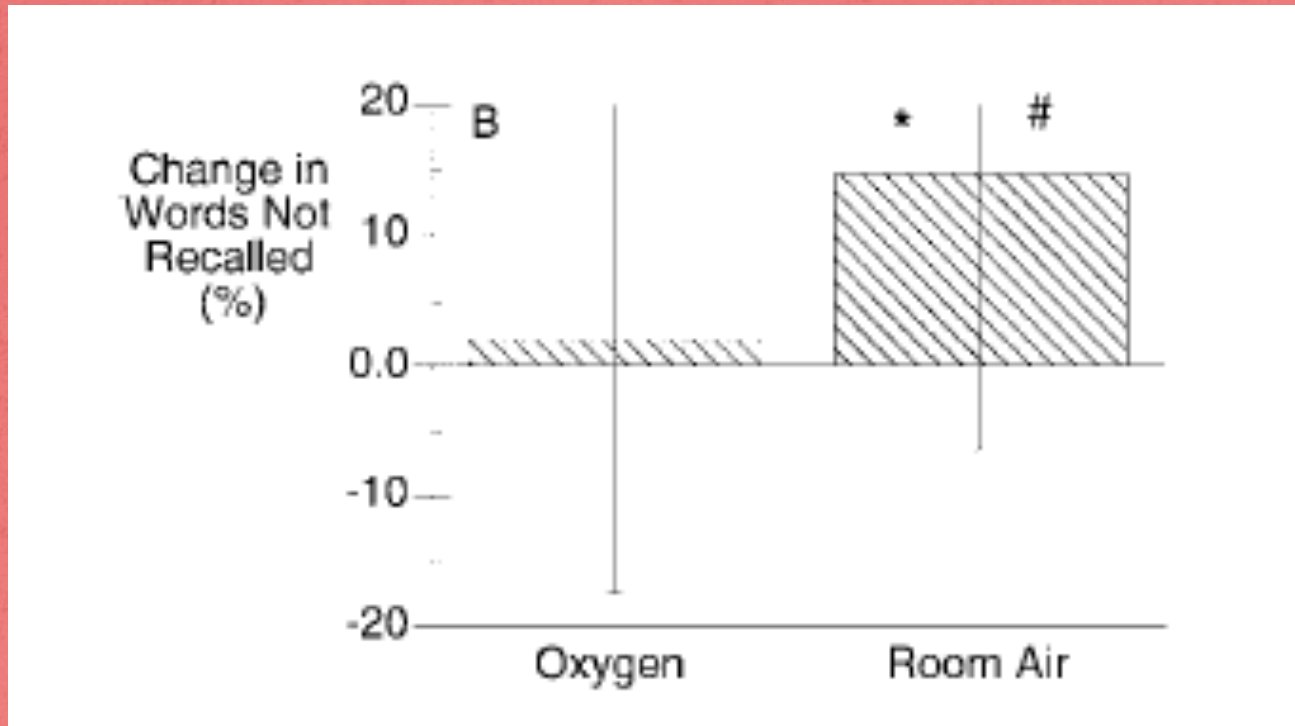
Oxygen Reverses Deficits of Cognitive Function and Memory and Increased Heart Rate Induced by Acute Severe Isovolemic Anemia

Richard B. Weiskopf, M.D., John Feiner, M.D.,† Harriet W. Hopf, M.D.,‡ Maurene K. Viele, M.D.,§
Jessica J. Watson, M.A.,|| Joel H. Kramer, Psy.D.,# Rachel Ho, B.S.,** Pearl Toy, M.D.††*

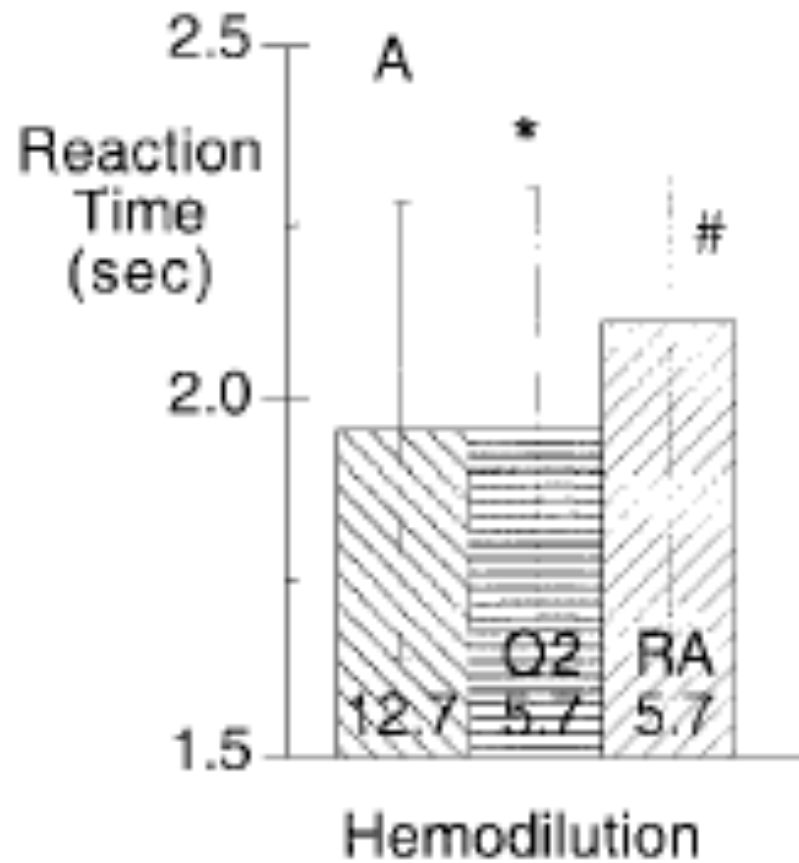
Anesthesiology 2002; 96:871-7

Delayed memory

Hb 57 g/L



Reaction time



RA= Room Air

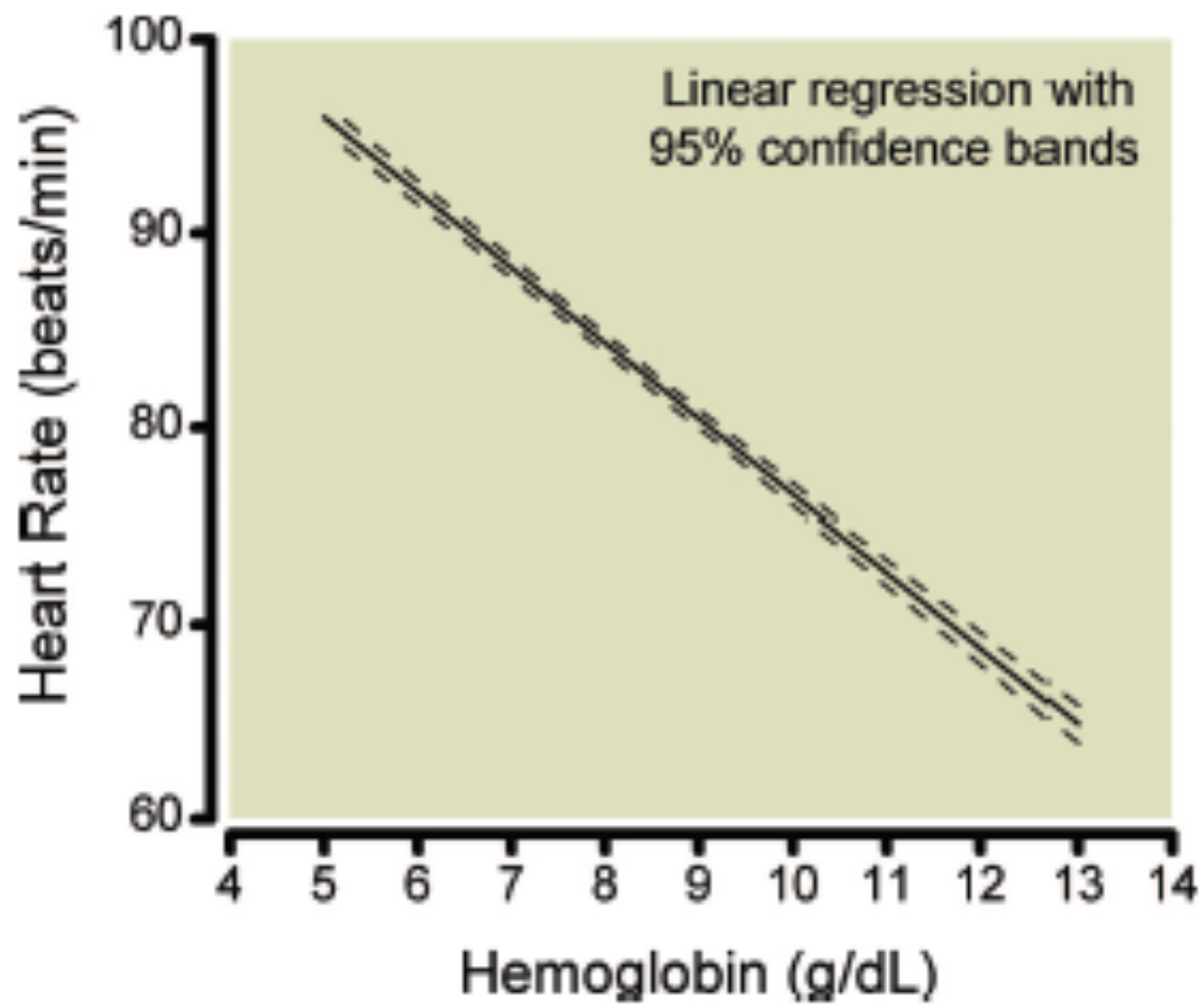
High Oxygen Partial Pressure Decreases Anemia-induced Heart Rate Increase Equivalent to Transfusion

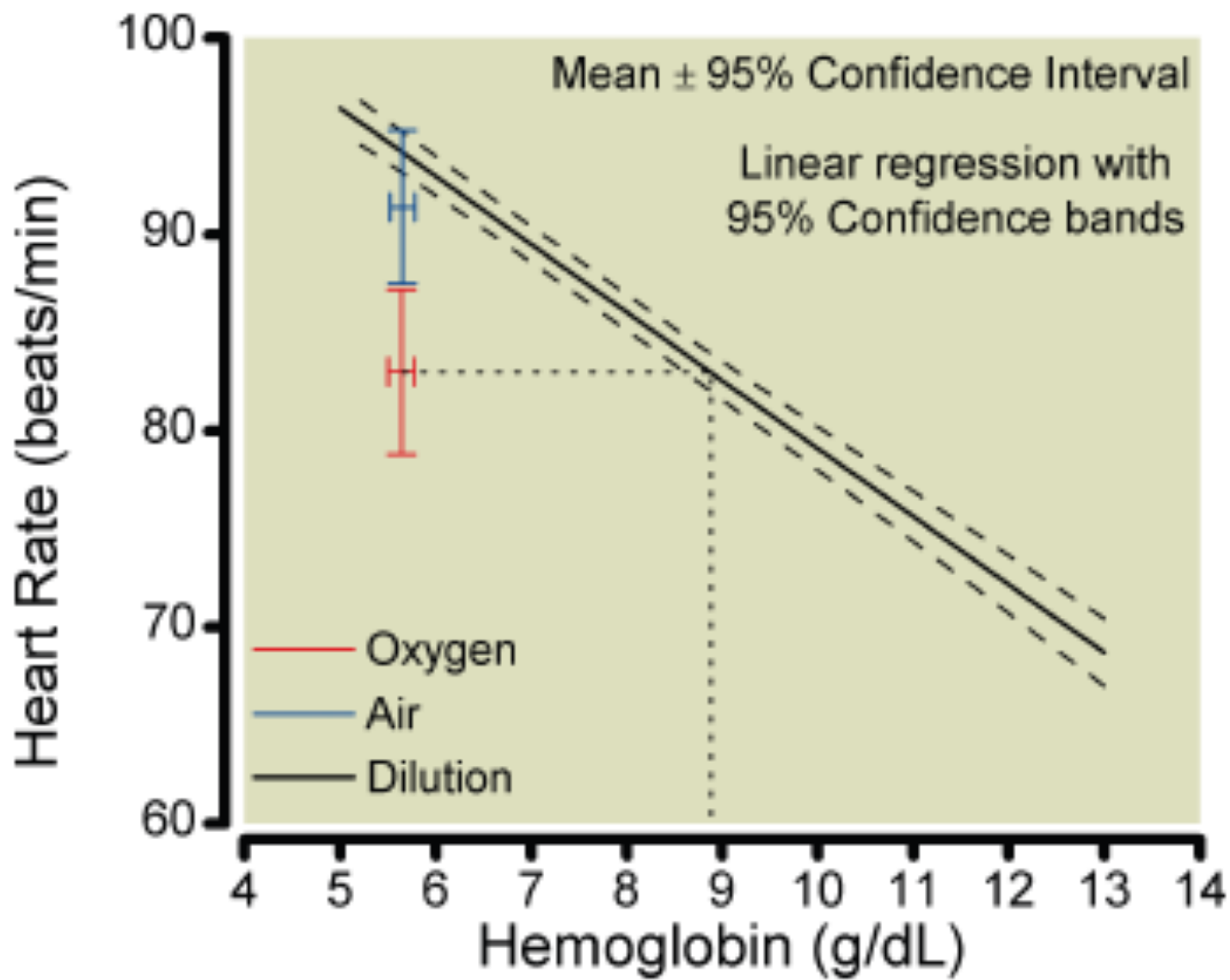
John R. Feiner, M.D.,* Heather E. Finlay-Morreale, M.D.,† Pearl Toy, M.D.,‡
Jeremy A. Lieberman, M.D.,* Maurene K. Viele, M.D.,§ Harriet W. Hopf, M.D.,||
Richard B. Weiskopf, M.D.#

Anesthesiology 2011; 115:492-8

Table 1. Summary of Studies

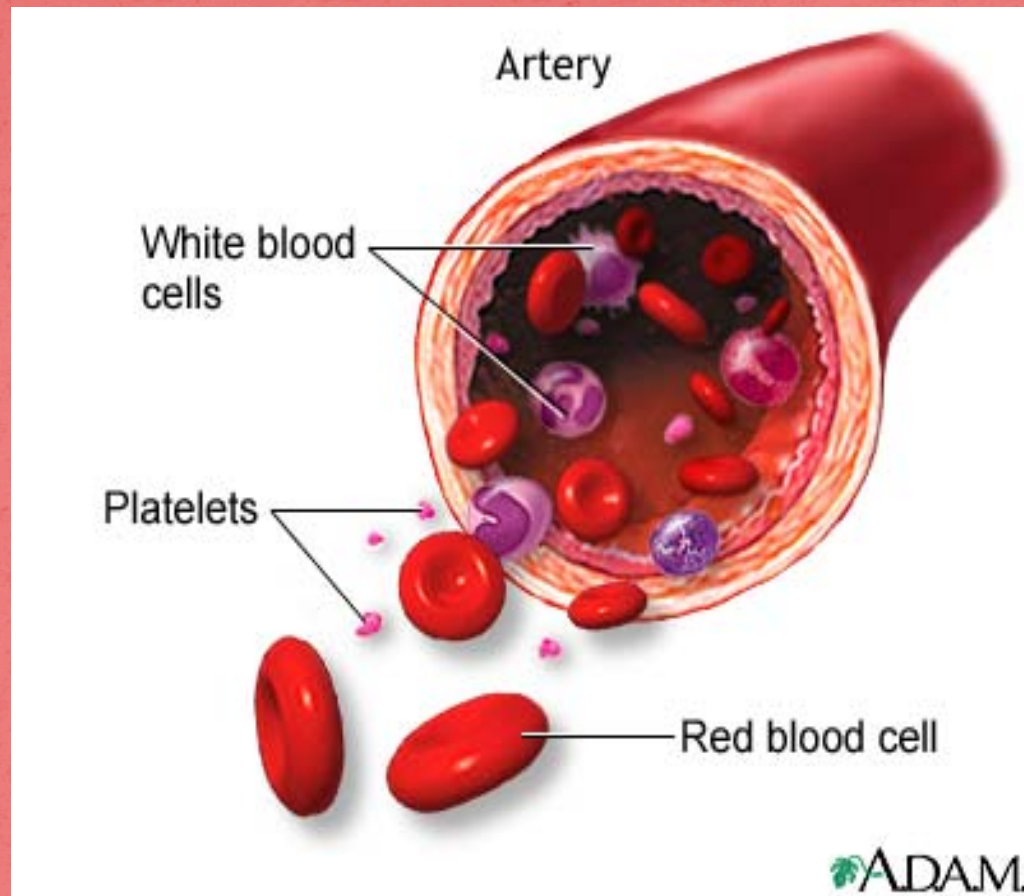
Study	No. of Subjects	Sex (F/M)
Weiskopf <i>et al.</i> ⁶	32	16/16
Hopf <i>et al.</i> ³⁴	14	10/4
Weiskopf <i>et al.</i> ³⁵	11	5/17
Weiskopf <i>et al.</i> ¹²	30	20/10
Weiskopf <i>et al.</i> ³⁶	8	5/3
Weiskopf <i>et al.</i> ¹³	14	10/4
Weiskopf <i>et al.</i> ¹¹	9	6/3
Totals	129	72/57





- Ökning med 3,9 slag i hjärtfrekvens per minut per gram Hb-sänkning
- Hjärtfrekvensen vid Hb 56 g/L och 100% syrgas var ekvivalent med Hb 89 g/L och rumsluft





Blood Platelets Are Concentrated near the Wall and Red Blood Cells, in the Center in Flowing Blood

Piet A.M.M. Aarts, Sjaak A.T. van den Broek, Gerrit W. Prins,
Gerard D.C. Kuiken, Jan J. Sixma, and Robert M. Heethaar

(Arteriosclerosis 8:819–824, November/December 1988)

Platelet Adherence

Hematocrit	Experimental
0	10
0.2	30
0.4	50
0.6	60

Impact of red blood cell transfusion on platelet activation and aggregation in healthy volunteers: results of the **TRANSFUSION** study[†]

Johanne Silvain, Ana Pena, Guillaume Cayla, David Brieger, Anne Bellemain-Appaix, Thomas Chastre, Jean-Baptiste Vignalou, Farzin Beygui, Olivier Barthelemy, Jean-Philippe Collet, and Gilles Montalescot*



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European Heart Journal (2010) **31**, 2816–2821

	Baseline	After erythrocyt-transfusion
Hb (g/L)	126	142
TPK ($\times 10^9/L$)	187	128

Light transmittance aggregometry (n = 25)	Baseline		In vitro transfusion		P-value
	Mean	SD	Mean	SD	
MPA (%) ADP 5 μM	62.6	21.7	69.8	21.6	0.03*
RPA (%) ADP 5 μM	57.7	24.9	65.7	24.1	0.03*
MPA (%) AA 1.25 mM	73.4	24.1	77.1	28.3	0.15
RPA (%) AA 1.25 mM	72.6	23.1	77.2	27.5	0.15
MPA (%) Collagen 2 $\mu g/mL$	60.5	27.3	69.9	23.8	0.03*
RPA (%) Collagen 2 $\mu g/mL$	59.4	27.6	69.7	24.2	0.03*
MPA (%) Epinephrine 20 μM	57.2	25.2	57.2	24.5	0.94
RPA (%) Epinephrine 20 μM	57	25.3	57	24.7	0.90

MPA: Maximal platelet aggregation

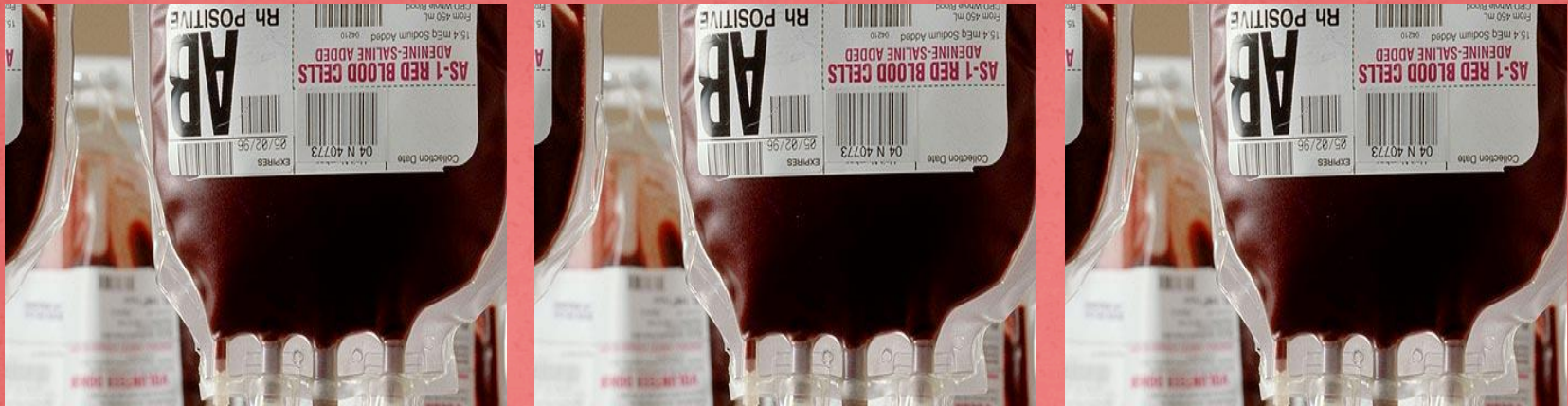
RPA: Residual platelet aggregation



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Transfusion thresholds and other
strategies for guiding allogeneic red
blood cell transfusion



19 studier med totalt 6264 patienter

3 studier innefattar IVA-patienter

Carson JL, Carless PA och Hebert PC

Transfusion Requirements in Critical Care

A Pilot Study

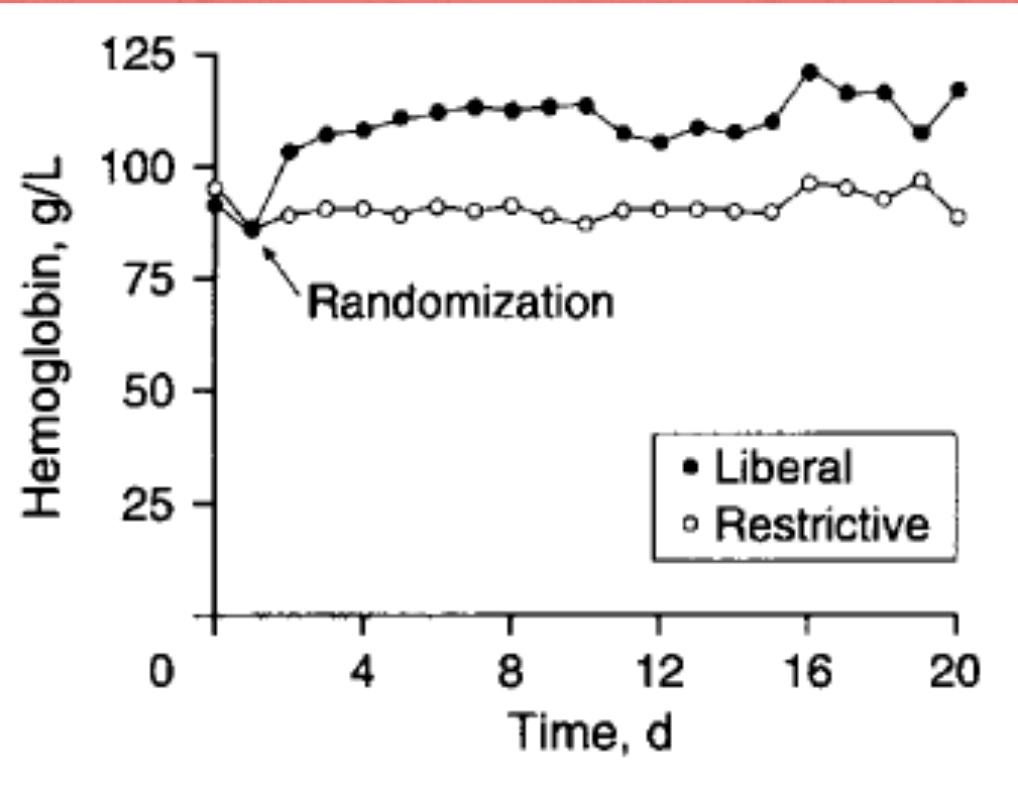
Paul C. Hébert, MD, MHSc, FRCPC; George Wells, PhD; John Marshall, MD, FRCSC; Claudio Martin, MD, MSc, FRCPC; Martin Tweeddale, MD, PhD, FRCPC; Giuseppe Pagliarello, MD, FRCSC; Morris Blajchman, MD, FRCPC;
for the Canadian Critical Care Trials Group

(*JAMA*. 1995;273:1439-1444)

- Randomiserad studie (pilot)
- 69 normovolema IVA patienter
- Transfusionstrigger : Hb 70 g/L versus 100 g/L
- Mål för Hb 70-90 g/L versus 100-120 g/L



Blödande patienter och hjärtkirurgi patienter exkluderades



Hb 70 g/L Hb 100 g/L

Variable	Treatment Strategy		<i>P</i>
	Restrictive (n=33)	Liberal (n=36)	
Mortality rates			
30-day	8 (24%)	9 (25%)	>.99
120-day†	13 (54%)	11 (50%)	>.99
ICU	5 (15%)	7 (19%)	.76
Organ failure and dysfunction			
Organ dysfunction score, mean±SD	9.3±3.6	10.0±3.8	.44
MSOF (≥3 organ failures)	9 (27%)	6 (17%)	.38
Median (interquartile range) length of stay, d			
ICU	6 (3-12)	9 (5-12)	.53
Hospital	38 (25-62)	31 (13-64)	.66

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A MULTICENTER, RANDOMIZED, CONTROLLED CLINICAL TRIAL OF TRANSFUSION REQUIREMENTS IN CRITICAL CARE

PAUL C. HÉBERT, M.D., GEORGE WELLS, PH.D., MORRIS A. BLAJCHMAN, M.D., JOHN MARSHALL, M.D.,
CLAUDIO MARTIN, M.D., GIUSEPPE PAGLIARELLO, M.D., MARTIN TWEEDDALE, M.D., PH.D., IRWIN SCHWEITZER, M.SC.,
ELIZABETH YETISIR, M.SC., AND THE TRANSFUSION REQUIREMENTS IN CRITICAL CARE INVESTIGATORS
FOR THE CANADIAN CRITICAL CARE TRIALS GROUP*

418 pat

- Hb < 70 g/L; transfusion
- Mål för Hb 70-90 g/L

420 pat

- Hb < 100 g/L; transfusion
- Mål för Hb 100-120 g/L



Blödande patienter och hjärtkirurgi patienter exkluderades

Hb 70 g/L Hb 100 g/L

OUTCOME MEASURE	RESTRICTIVE- TRANSFUSION STRATEGY (N=418)	LIBERAL- TRANSFUSION STRATEGY (N=420)	ABSOLUTE DIFFERENCE BETWEEN GROUPS	95% CONFIDENCE INTERVAL	P VALUE
				percent	
Death — no. (%)					
30-day	78 (18.7)	98 (23.3)	4.7	−0.84 to 10.2	0.11
60-day†	95 (22.7)	111 (26.5)	3.7	−2.1 to 9.5	0.23
ICU	56 (13.4)	68 (16.2)	2.3	−2.0 to 7.6	0.29
Hospital	93 (22.2)	118 (28.1)	5.8	−0.3 to 11.7	0.05

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JOURNAL *of* MEDICINE

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APRIL 19, 2007

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Transfusion Strategies for Patients
in Pediatric Intensive Care Units

Jacques Lacroix, M.D., Paul C. Hébert, M.D., James S. Hutchison, M.D., Heather A. Hume, M.D., Marisa Tucci, M.D., Thierry Ducruet, M.Sc., France Gauvin, M.D., Jean-Paul Collet, M.D., Ph.D., Baruch J. Toledano, M.D., Pierre Robillard, M.D., Ari Joffe, M.D., Dominique Biarent, M.D., Kathleen Meert, M.D., and Mark J. Peters, M.D., for the TRIPICU Investigators,* the Canadian Critical Care Trials Group, and the Pediatric Acute Lung Injury and Sepsis Investigators Network

320 patienter
Hb 70 g/L

- Kirurgi 39%
- Sepsis 21%
- Multiorgansvikt 33%
- 54% fick inga erythrocyt-transfusioner
- 12 % försämring med multiorgansvikt
- 4% avled

317 patienter
Hb 95 g/L

- Kirurgi 40%
- Sepsis 21%
- Multiorgansvikt 33%
- 2% fick inga erythrocyt-transfusioner
- 12% försämring med multiorgansvikt
- 4% avled

Blödande patienter , hjärtsjuka patienter och patienter med vikt under 3 kg exkluderades

Hb 70 g/L Hb 95 g/L

Variable	Restrictive-Strategy Group	Liberal-Strategy Group	Absolute Risk Reduction, Odds Ratio, or Difference in Means (95% CI)	P Value
Clinical outcomes — no./total no. (%) [†]				
Death				
In ICU	11/320 (3)	8/317 (3)	-0.9 (-3.6 to 1.7)	0.50
From any cause during 28-day study	14/320 (4)	14/317 (4)	0 (-3.2 to 3.2)	0.98
Nosocomial infections	65/320 (20)	79/317 (25)	4.6 (-1.9 to 11.1)	0.16
At least 1 adverse event	97/320 (30)	90/317 (28)	-1.92 (-9.0 to 5.2)	0.59
Reactions to red-cell transfusion	3/320 (1)	6/317 (2)	1.0 (-0.9 to 2.8)	0.34
Duration of care — days				
Mechanical ventilation	6.2±5.9	6.0±5.4	-0.14 (-1.1 to 0.8)	0.76
ICU stay after randomization	9.5±7.9	9.9±7.4	0.46 (-0.7 to 1.7)	0.39

Sammanfattning för alla 19 studierna



- Heterogenicitet i studierna
- Restriktiv transfusionsstrategi minskar sjukhusmortalitet men inte 30 dagars mortalitet
- Blodtransfusion behövs troligen inte förrän Hb sjunker till 70-80 g/L
- Det finns inga studier på patienter med akuta hjärtsjukdomar



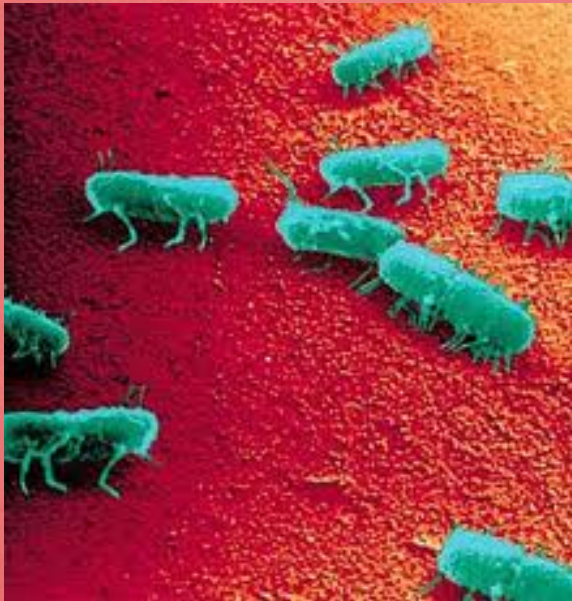
Transfusion-requirements in Septic Shock Trial (TRISS)

Scandinavian Critical Care Trials Group

Transfusion trigger 70 g/L versus 90 g/L

Primary Outcome

- All cause 90 day mortality



B. salmonella

Secondary Outcome

- Persistent organ failure
- Complications of transfusions
- Ischaemic events
- Length of stay in ICU
- Days in need of life support among survivors
- Length of stay in hospital
- Mortality within the whole observation period



Tack!

Oxygen Reverses Deficits of Cognitive Function and Memory and Increased Heart Rate Induced by Acute Severe Isovolemic Anemia

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Table 2. Arterial Blood Gas and pH Values

Variable	Hb = 12.7	Hb = 5.7 (Oxygen)	Hb = 5.7 (RA)
PaO ₂ (mmHg)	104 ± 16	406 ± 47	108 ± 12
Paco ₂ (mmHg)	39.2 ± 3.8	36.5 ± 4.2	38.6 ± 4.8
pHa (units)	7.40 ± 0.03	7.46 ± 0.03	7.45 ± 0.03
Base-excess (mEq/l)	0.4 ± 1.6	3.1 ± 1.8	3.2 ± 1.6

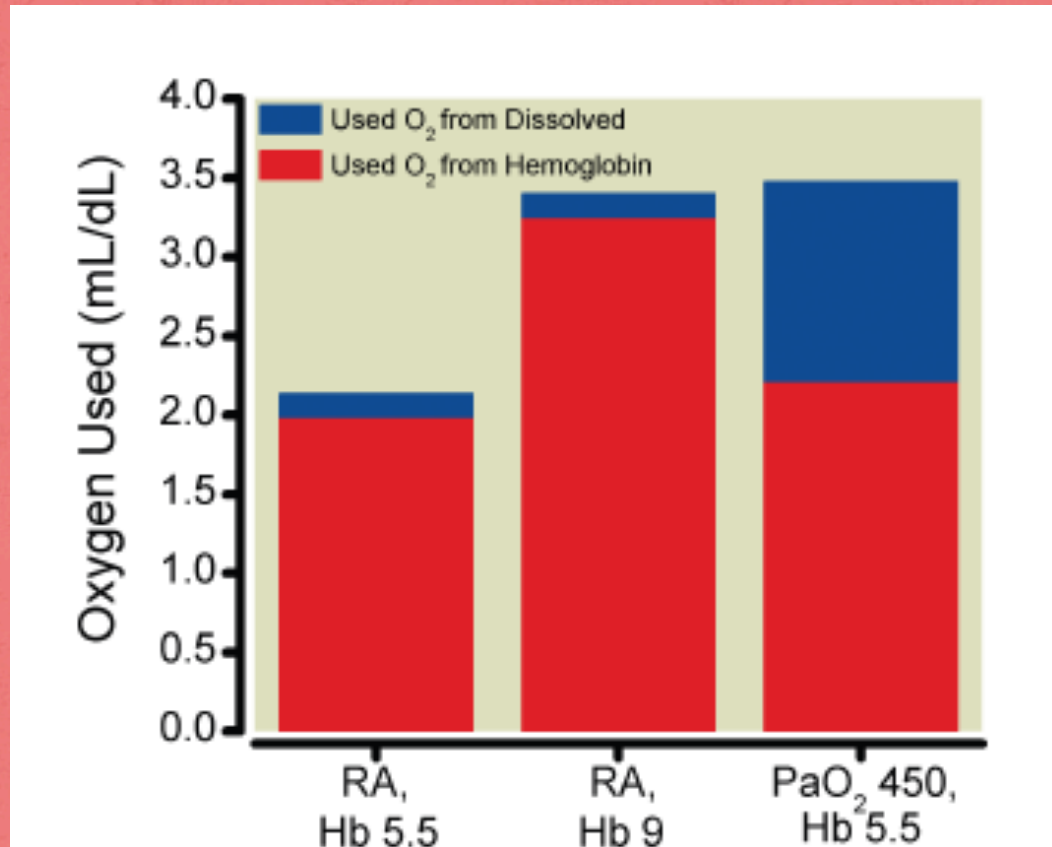
PaO ₂ (kPa)	13,8	54	14.4
PaCO ₂ (kPa)	5,2	4,8	5,13

PaO₂/PaCO₂:
 1 mmHg = 0.133 kPa

RA= Room Air

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PaO₂ 59.8 kPa

RA= Room Air

1 mmHg = 0.133 kPa

Inclusion criteria

- Patient in the ICU
- Septic shock
- Haemoglobin of 9.0 g/dl or less
- Consent obtainable from patient or proxy or national law allows delayed consent

www.clinicaltrials.gov

Exclusion criteria

- Wish against transfusion
- Previous serious reaction with blood product
- Acute coronary syndrome
- Life-threatening bleeding
- RBC transfusion during current ICU admission
- Withdrawal from active therapy or brain death
- Lack of informed consent

Planned inclusion of 1000
patients
during 2011-2014

TRISS study



Tack
!