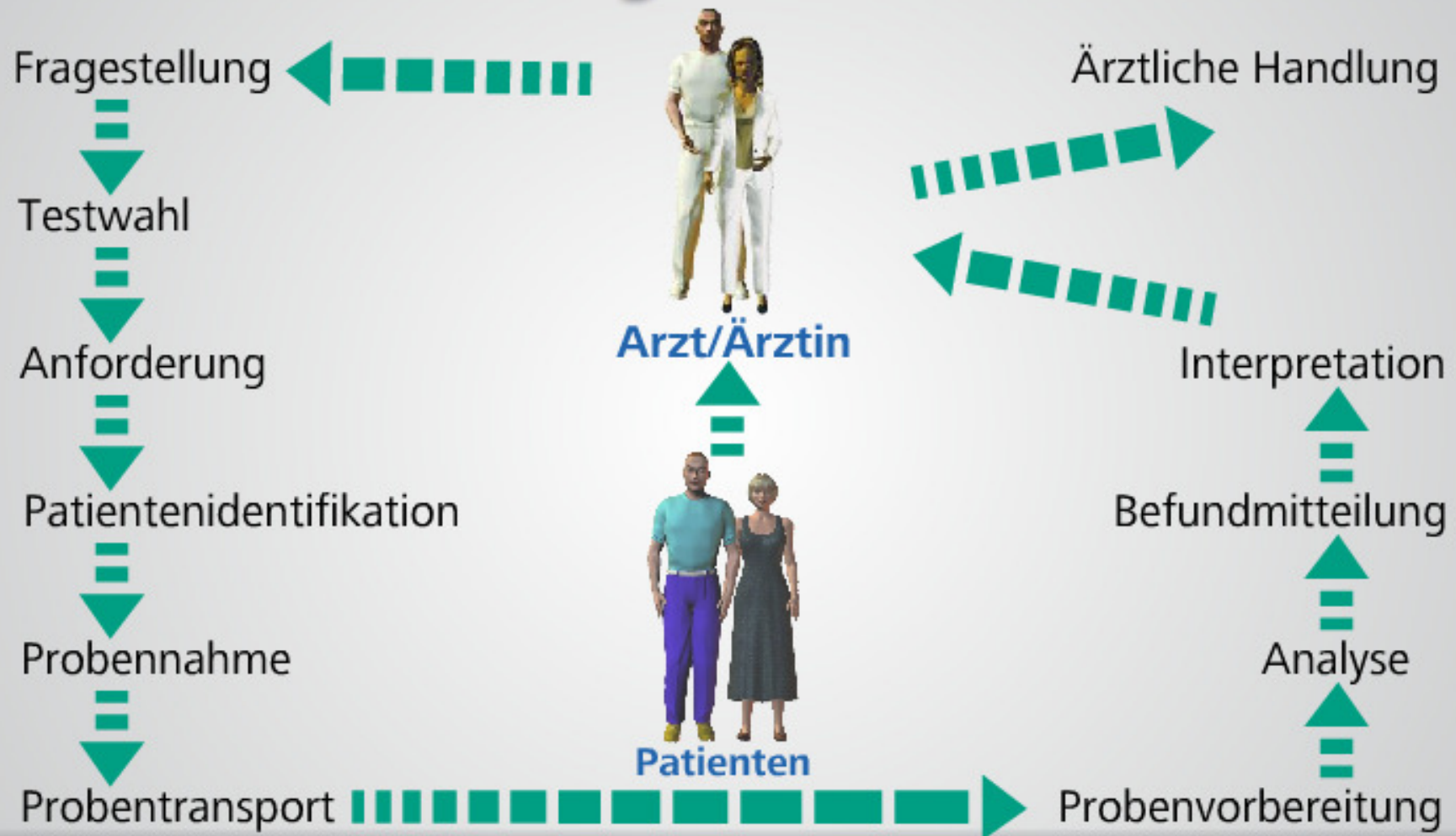




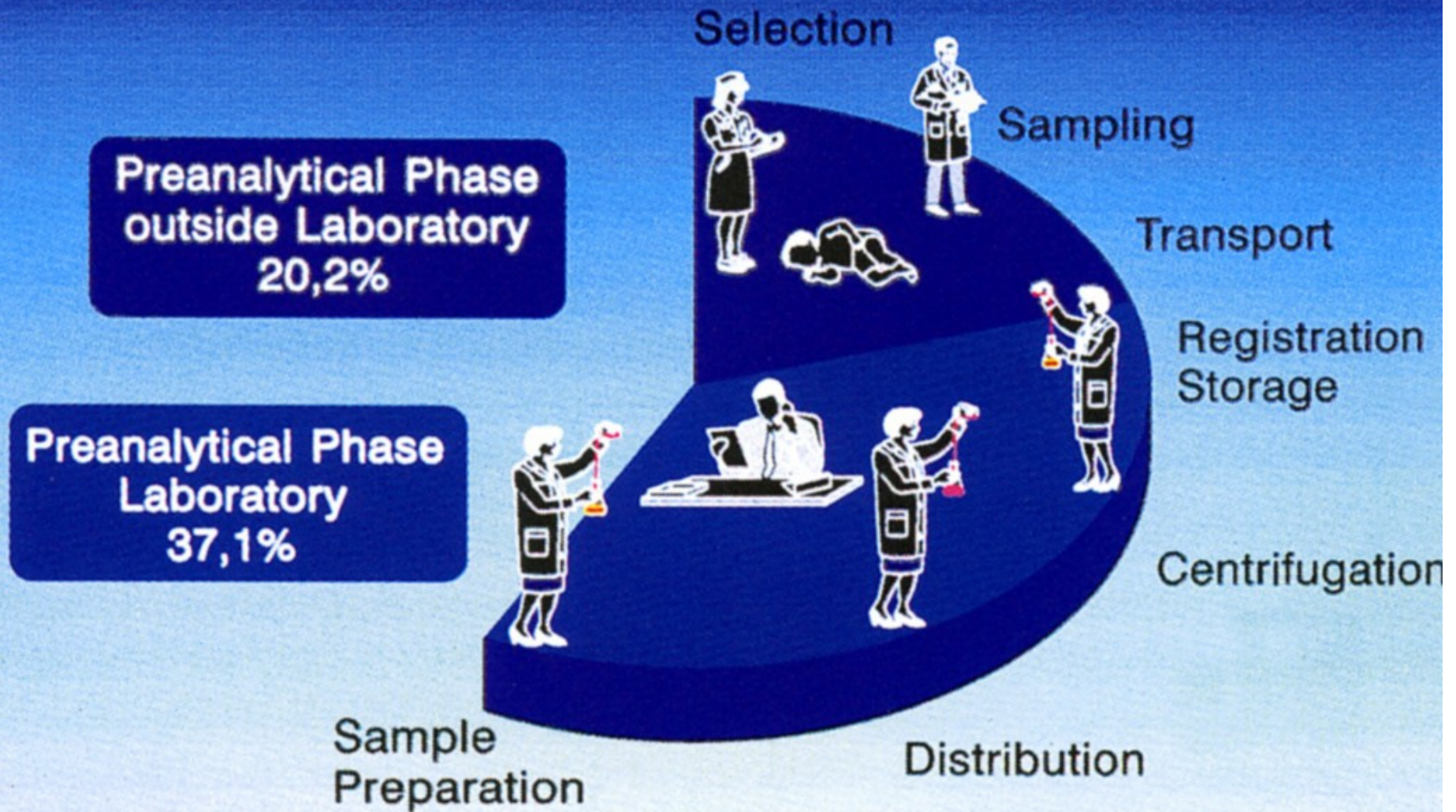
H. Wisser, Stuttgart

SYMPOSIUM PRÄANALYTIK
Linz, 19.09.2009

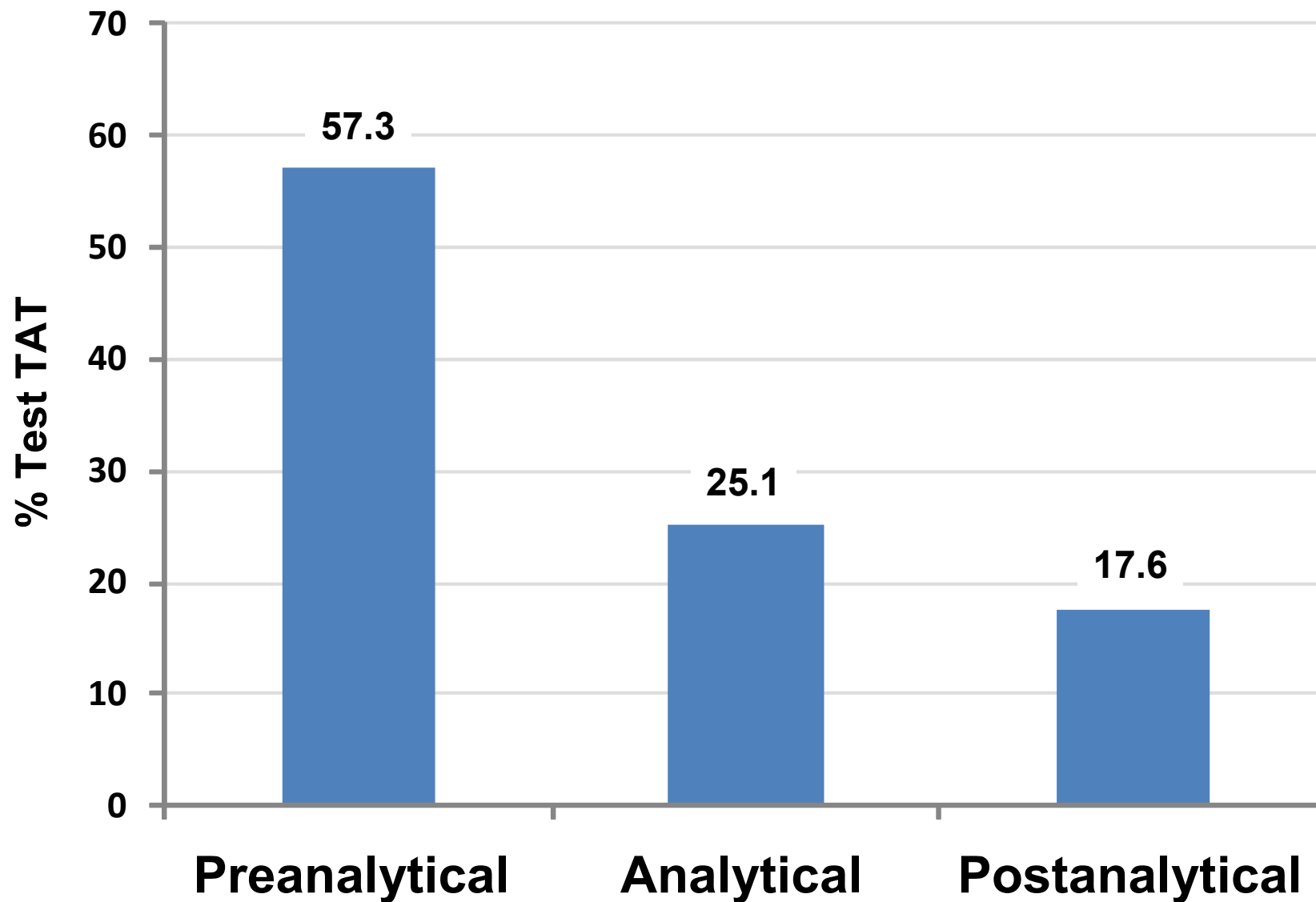
Der labordiagnostische Prozess



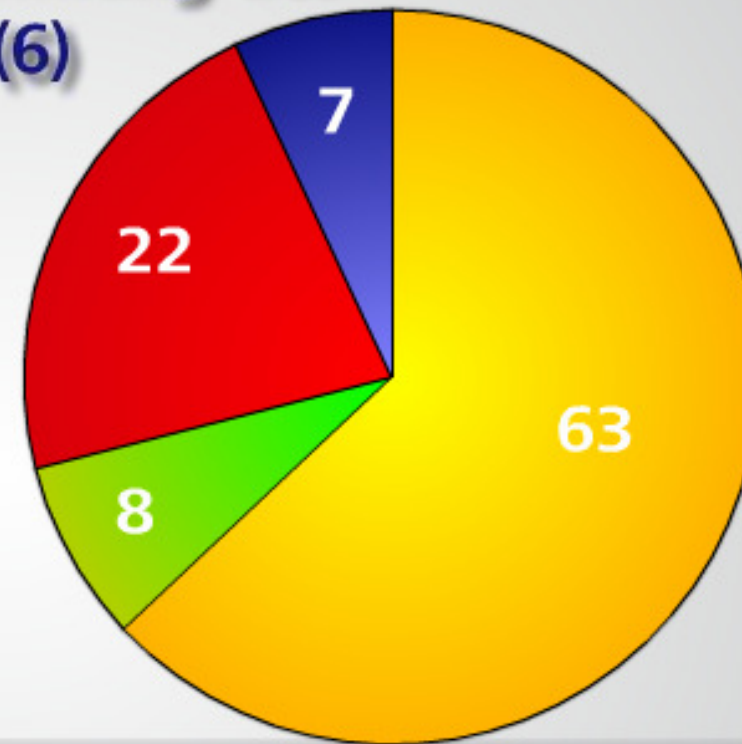
Preanalytical Phase - Persons involved



The Preanalytical Phase in the Diagnostic Process



Gesamtkosten einer Bestimmung des mechanisierten Blutbildes (6)



Randbedingung der Untersuchung:
Abnahme und Transport der Proben
durch das Laborpersonal

- Präanalytik außerhalb des Labors: Testanforderung und Transport (63%)
- Präanalytik im Labor (8%)
- Analytik und Service (22%)
- Postanalytische Validierung und Befundübermittlung (7%)

Errors Distribution according to the Process Phase

Literature	1	2	3	4	5	6
Laboratory sector	Clin. Chem	Whole Lab	Primary Care	Stat Lab	Whole Lab	Transfusion Medicine
Preamanalytical phase	31.6 %	53 %	56.6 %	68.2 %	75 %	41 %
Analytical phase	31.6 %	23 %	13.3 %	13.3 %	16 %	4 %
Postanalytical phase	30.8 %	24 %	30 %	18.5 %	9 %	45 %
Multiple phases	6 %					

Bonini et al Clin Chem 2002; 48: 691-8

1: Ann Clin Biochem 1994; 31: 78-84

3: JAMA 1996; 275: 635-9

5: Clin Chem 1998; 44: 2195 -7

2: Klin Chem Metab 1995; 3: 131-40

4: Clin Chem 1997; 43: 1348-51

6: Arch Pathol Lab Med 1995; 119: 999-1006

Types of Analytical Errors

	Inpatients	Outpatients
Number of tests	2 583 850	2 032 133
Number of errors	15 503 (0.6 %)	792 (0.04 %)

Missing results [%]

Hemolyzed sample	54.8	32.3
Insufficient sample	21.0	12.8
Incorrect sample	11.8	36.5
Clotted sample	5.1	10.1
Incorrect identification	1.9	0.3
Others	5.5	8.1

Bonini et al., Clin Chem 2002;48:691-8

Laboratory Mistakes and Patients' outcome

	No.	[%]
Total errors	189	
No effect	140	74.0
Inappropriate transfusion	4	2.2
Inappropriate modification of heparin infusion	4	2.2
Inappropriate infusion of electrolyte solution	2	1.0
Inappropriate modification of digoxin therapy	2	1.0
Further inappropriate investigations	37	19.6

„..... that the most frequent preanalytical errors are represented by an inappropriate choice of laboratory tests or panel of tests and that most postanalytical errors derive from inappropriate interpretation and utilization of laboratory results.”

Bonini P et al., Errors in laboratory medicine. Clin Chem 2002; 48: 691-8

Ursachen von überholten und überflüssigen Laboranforderungen

Anordnung *ohne* Arbeitshypothese als Folge von:

- nicht erhobener Anamnese
- fehlender Untersuchung
- blindem Vertrauen in ungezielte Screening-Untersuchungen

Anordnung *mit falscher* Arbeitshypothese als Folge von:

- mangelnden labormedizinischen oder biochemischen Kenntnissen
- unkritischer Übernahme unsicherer wissenschaftlicher Aussagen

Anordnung *mit nicht medizinischer* Arbeitshypothese zum Zwecke der:

- Vervollständigung des Befundes
- juristischen Absicherung
- Befriedigung der Instanzenhierarchie
- wirtschaftlichen Überlegungen

Influence and Interference factors

Influence factors

Change the concentration of the analyte to be measured in the system studied

Interference factors

Components of the matrix of the sample to be analyzed interfere with the analytical procedure

Influence factors

1. Unavoidable, non changeable *in vivo* influence factors

age, gender, race

2. Variable changeable *in vivo* influence factors

diet, starvation, exercise, immobilization, posture,
tourniquet, stimulants, addictive drugs

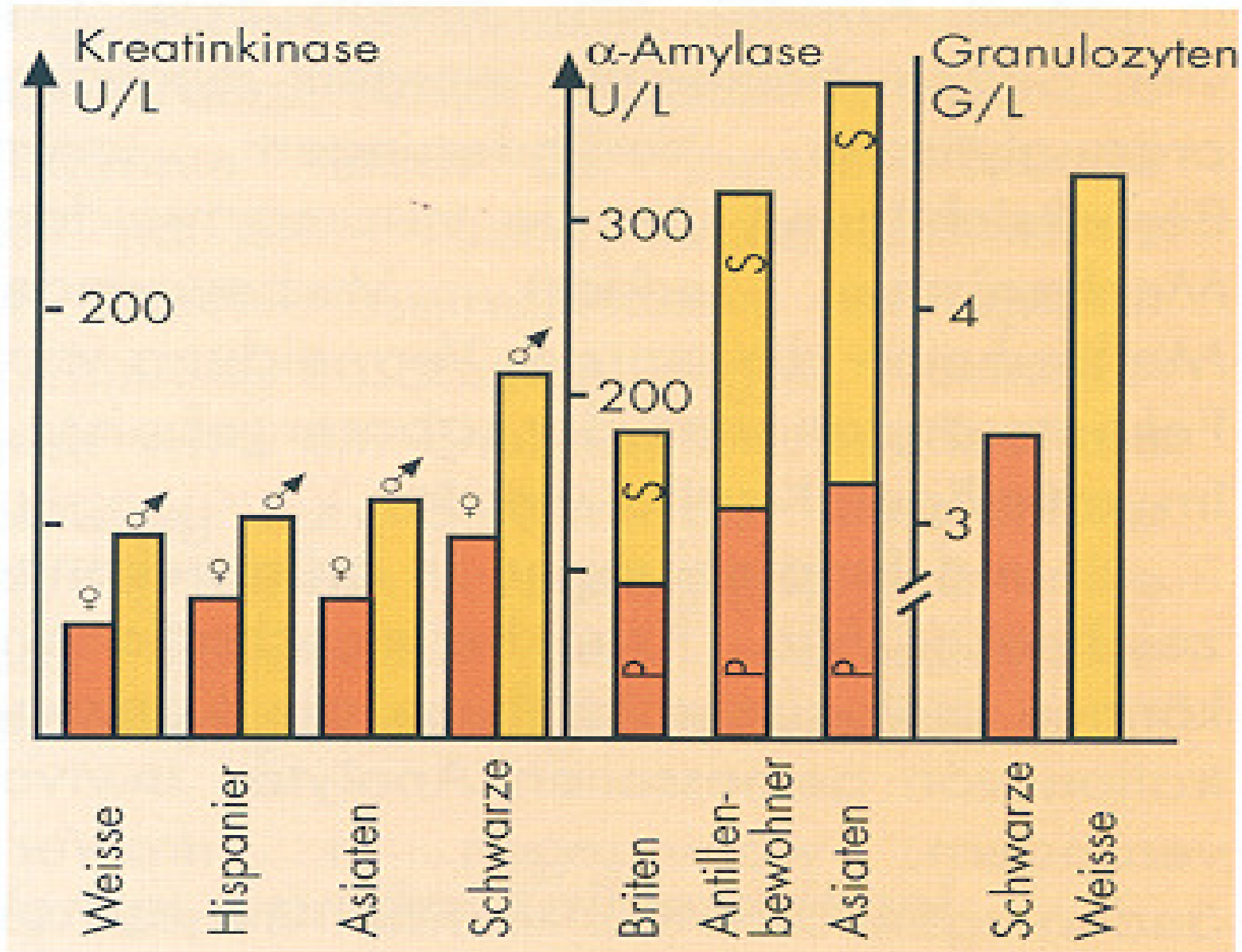
3. Physiological *in vivo* influence factors

circadian rhythms, pregnancy

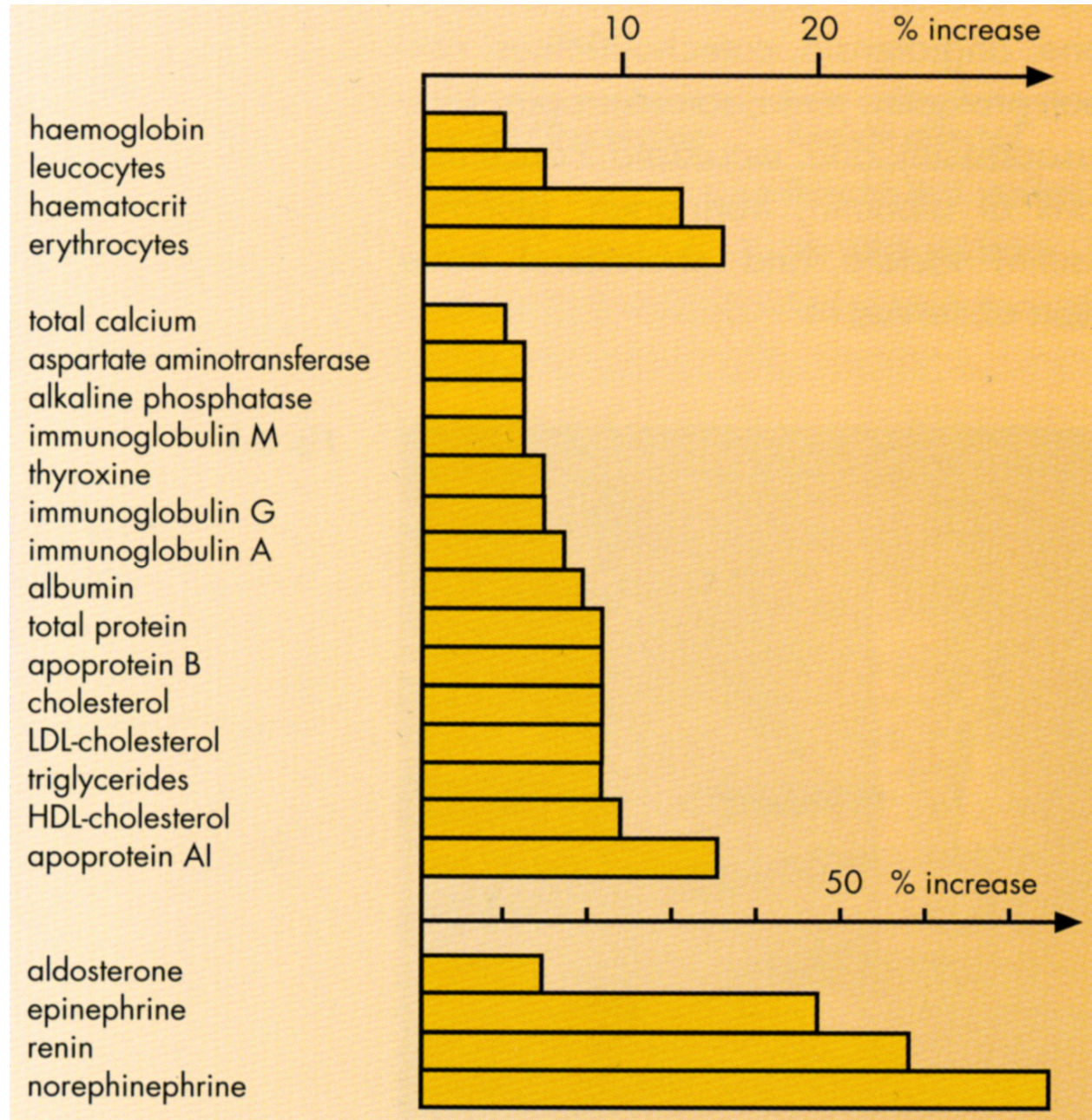
4. In vitro influence factors

metabolic changes, instability during storage,
centrifugation, sublimation, evaporation

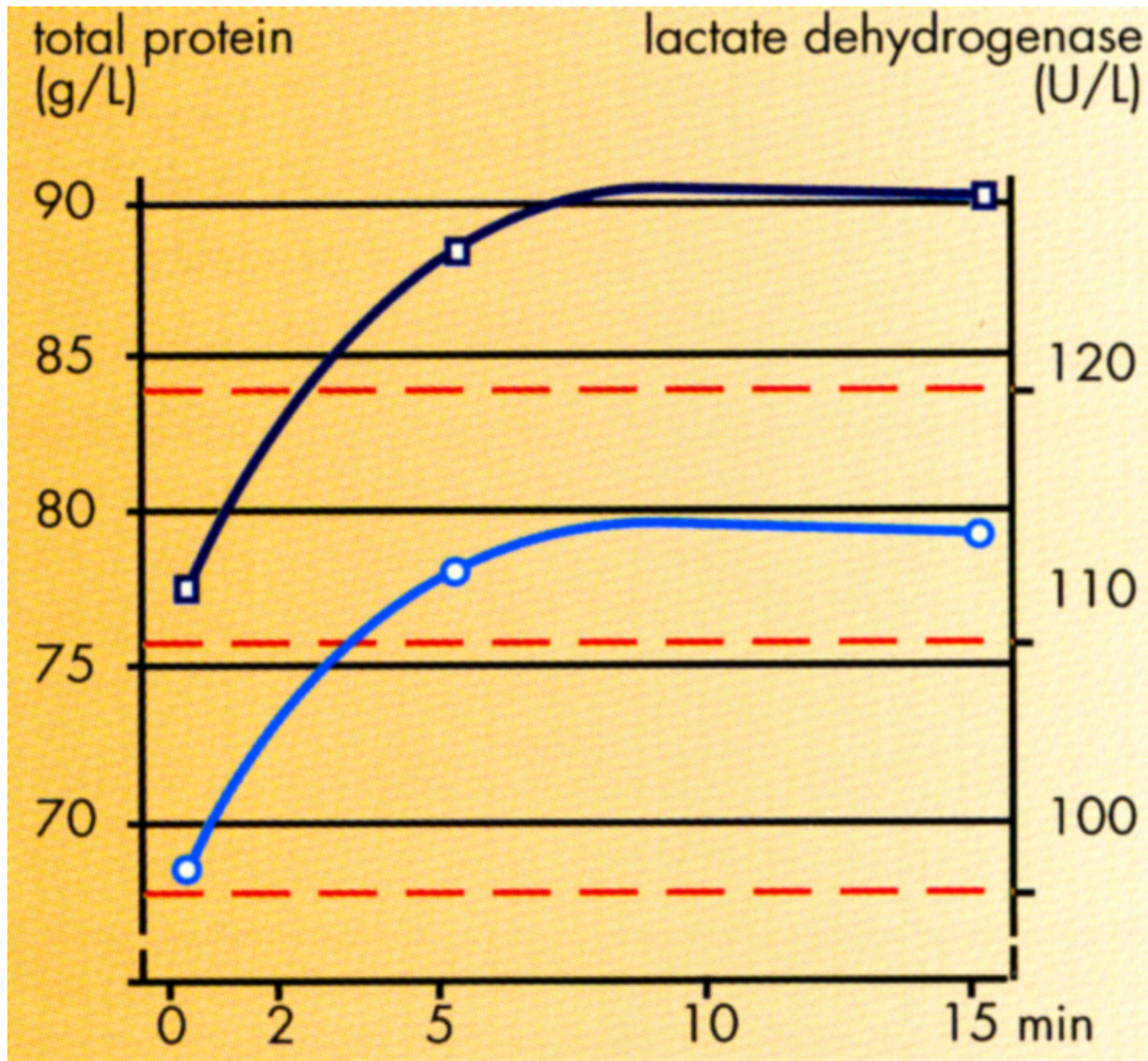
Hautfarbe



Change from Supine to an Upright Position

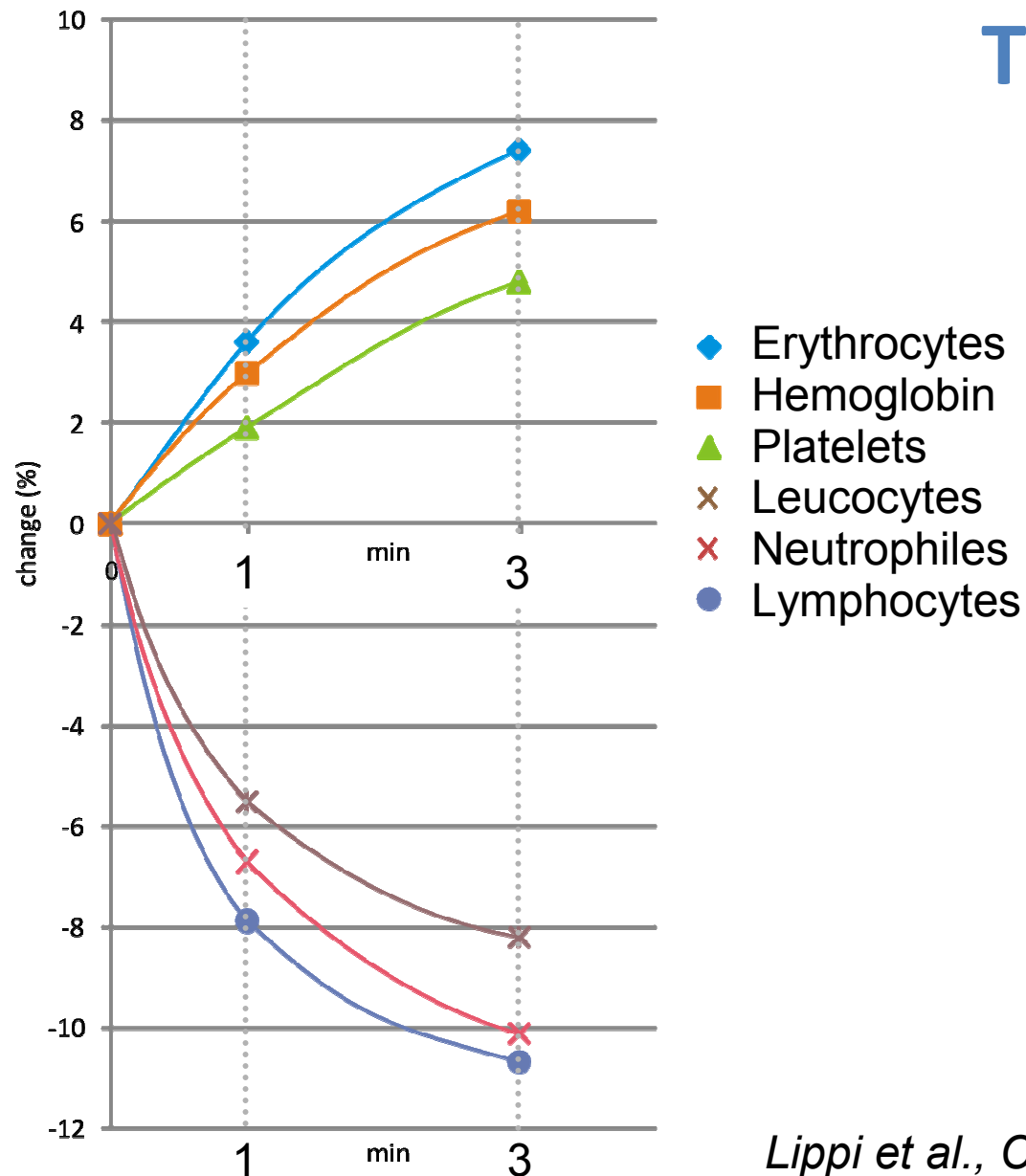


Tourniquet



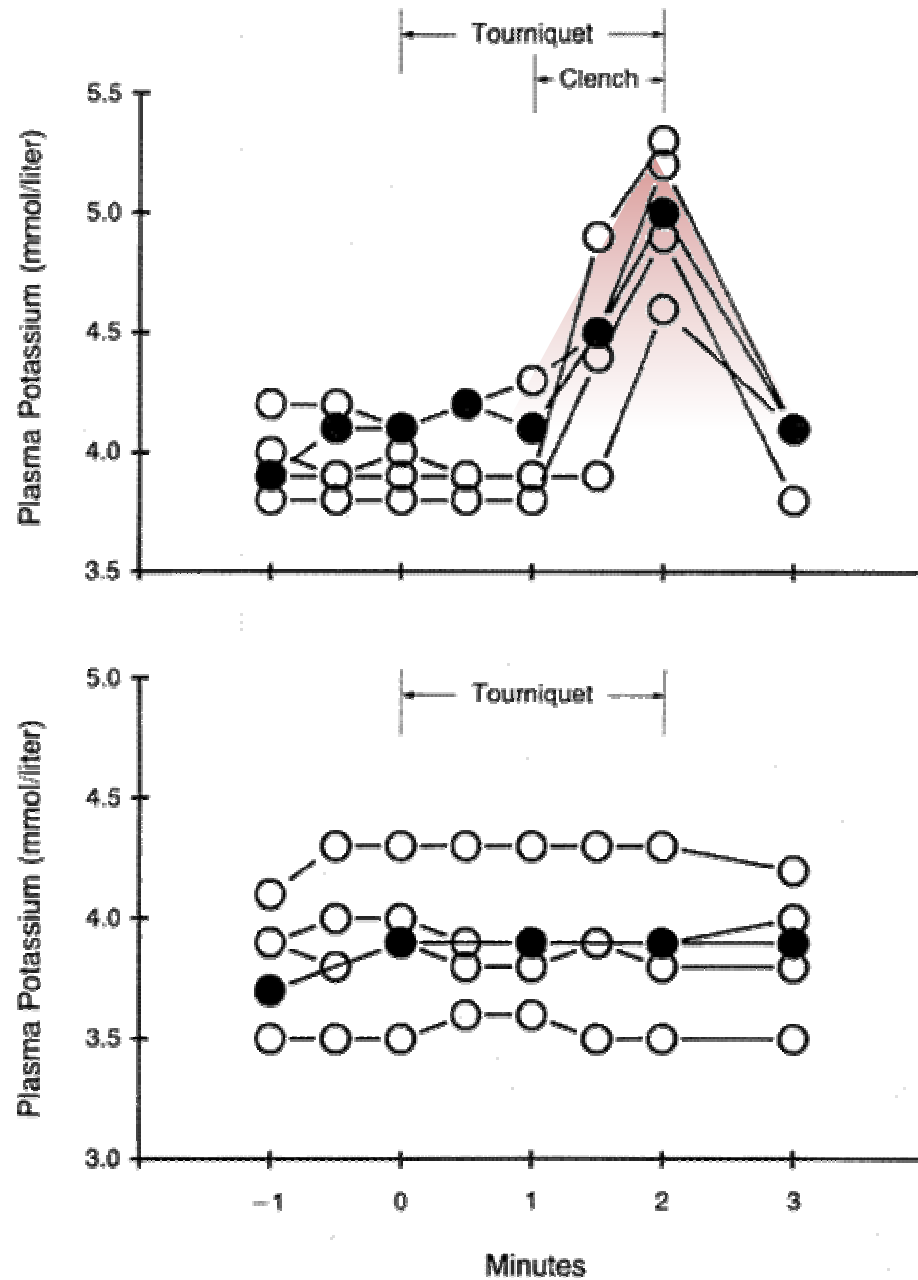
Change in total protein concentration ○ and lactate dehydrogenase activity □ in serum during a 15 min. tourniquet application time

Tourniquet



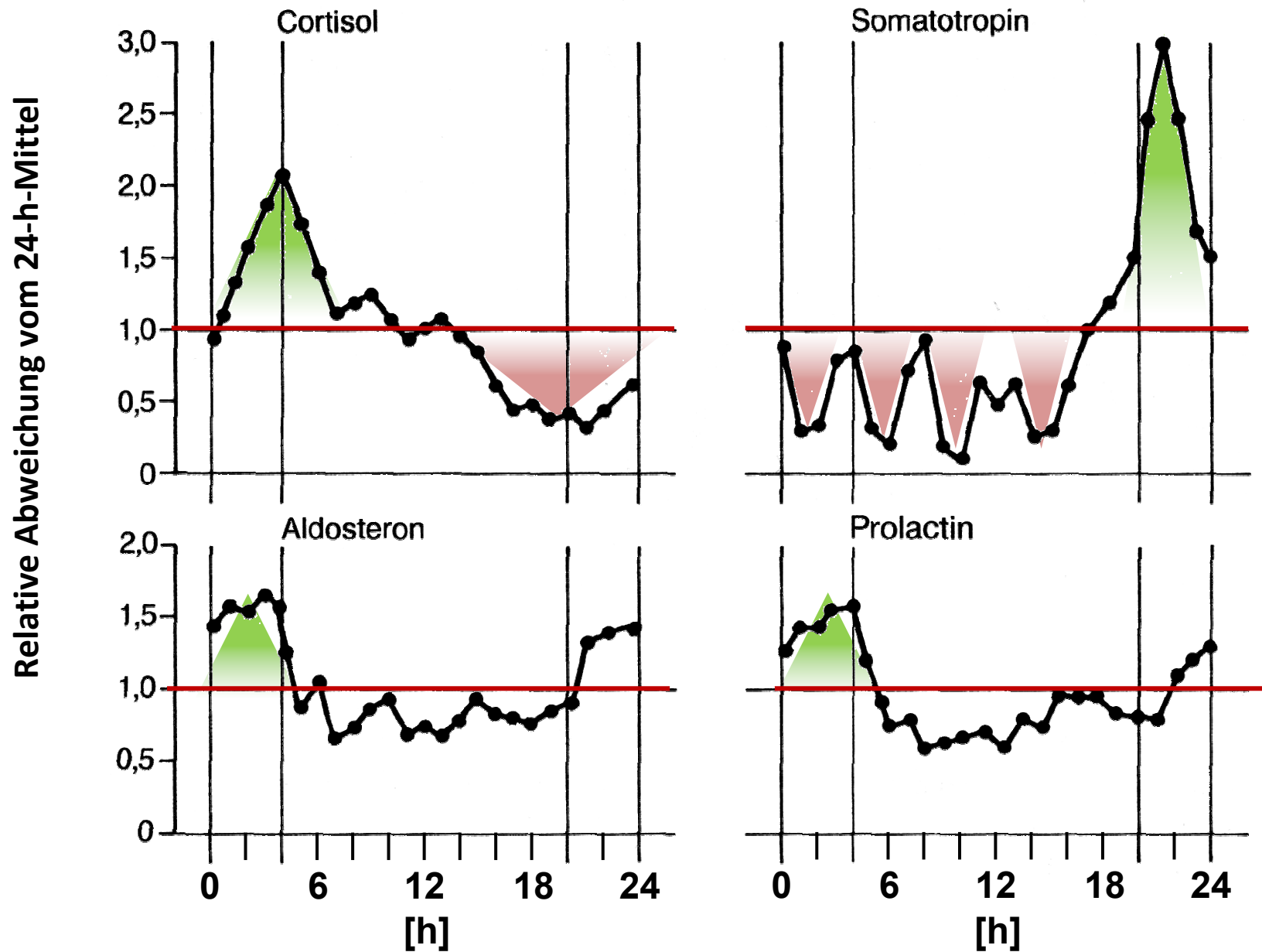
Lippi et al., Clin Lab Haematol 2006;28:332-7

Fist Clenching



New Engl. J Med
1990;322:1290-2

Circadiane Rythmen



Statistical quantities of blood loss and sampling frequency / departments

Department statistical quantities	Hospital stay [days]	Total blood loss [ml]	Blood loss/day [ml]	No. of samp lings	No. of clinical chemistry tests
Visceral surgery					
Median	7	23	4	6	11
95 th percentile	29	150	11	44	66
Max. value	71	1920	44	600	641
Gynecology/obstetrics					
Median	6	16	3	4	5
95 th percentile	19	56	10	16	20
Max. value	59	190	21	56	104
Cardiovascular surgery					
Median	16	201	13	66	84
95 th percentile	39	615	28	178	219
Max. value	90	1307	46	405	470
Gastroenterology					
Median	8	23	4	6	16
95 th percentile	27	107	10	32	56
Max. value	48	991	26	278	256
Nephrology					
Median	9	29	4	8	21
95 th percentile	27	150	12	41	70
Max. value	222	913	18	277	335
Oncology					
Median	6	15	3	4	15
95 th percentile	22	104	10	27	50
Max. value	67	428	67	124	173
Cardiology					
Median	4	10	5	4	12
95 th percentile	19	73	9	20	40
Max. value	65	920	48	275	344

Median Blood Loss of the same Patients during ICU and Ward Stay

Dept.	Care unit	No. Pat. [n]	Hospital-ization [days]	Total blood loss [ml]	Blood loss/d [ml]	Distribution [%]					No. of samplings
						Hematol.	Hemost.	Acid-base status		Other	
								Clin. Chem.			
Cardio-vasc. surgery	ICU	170	4	144	40	21	10	34	34	0	51
	Ward		12	56	5	22	19	38	0	19	15
Visceral surgery/ gynecology	ICU	42	3	63	26	25	14	39	19	0	20
	Ward		12	51	4	25	13	44	0	18	14
Internal medicine	ICU	65	2	29	13	19	19	50	0	0	8
	Ward		11	37	4	18	16	51	0	0	10

Clin Chem 2003;49:1651-5

Process Control Criteria

- TAT
- Diagnostic blood loss
- Error frequency
- Percentage of pathological test results

Definition of TAT

- **Test TAT**

The time between phlebotomy and result reporting

- **Intralaboratory TAT**

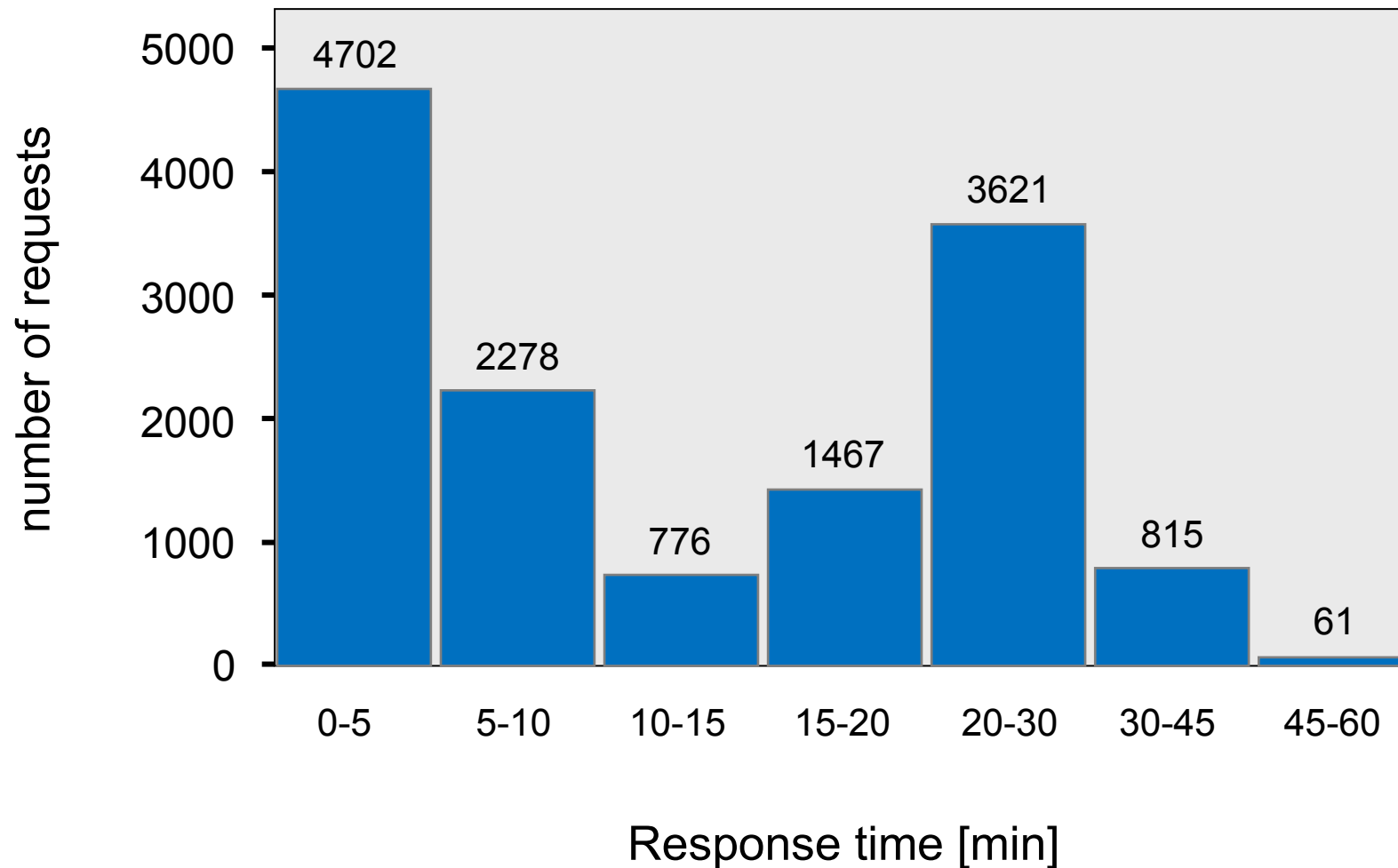
The time between specimen receipt in the laboratory and reporting

- **Preamalytical TAT**

The time between sampling and specimen receipt

Intralaboratory TAT

Response time (hematology, hemostaseology, acid-base-status, Ektachem 700)
stat requests (28 days)



Emergency test -

TAT expectations of clinicians and laboratorians

% = percent of participants

participants	hemoglobin	potassium	glucose	pO ₂
surgeons	92% ≤ 30min.	85% ≤ 30min.	88% ≤ 30min.	50% ≤ 10min.
internists	76% ≤ 30min.	70% ≤ 30min.	74% ≤ 30min.	46% ≤ 10min.
ED-physicians	84% ≤ 30min.	72% ≤ 30min.	79% ≤ 30min.	62% ≤ 10min.
laboratorians	28% ≤ 30min.	20% ≤ 30min.	19% ≤ 30min.	22% ≤ 10min.
	92% ≤ 60min.	88% ≤ 60min.	92% ≤ 60min.	55% ≤ 20min.
all clinicians	82% ≤ 30min.	73% ≤ 30min.	77% ≤ 30min.	58% ≤ 10min.

Quality

Patient outcome

Structure

Process

