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Instrumente Structurale
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OIRPOSDRU REGIUNEA CENTRU

UNIVERSITATEA DE MEDICINĂ ŞI
FARMACIE "CAROL DAVILA"
BUCUREŞTI

AD-COR Program inovativ de formare in domeniul cardiologiei pediatrice
POSDRU/179/3.2/S/152012

Data: **19-11-2015**

MODUL TEORETIC

Human Factors in Intensive Care

Imputernicit: Prof. Dr. Tammam Youssef

Activitate prestata de I.R.C.C.S. POLICLINICO SAN DONATO – MILANO, ITALIA in baza contractului nr. 18/22144/29.07.2015

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Acest material a fost documentat/ validat/ prezentat la sesiunile de formare în cadrul proiectului *„AD-COR Program inovativ de formare în domeniul cardiologiei pediatrice”* - POSDRU/179/3.2/S/152012, proiect cofinanțat din Fondul Social Operațional Sectorial Dezvoltarea Resurselor Umane 2007-2013.

Beneficiar: Universitatea de Medicină și Farmacie „Carol Davila” București

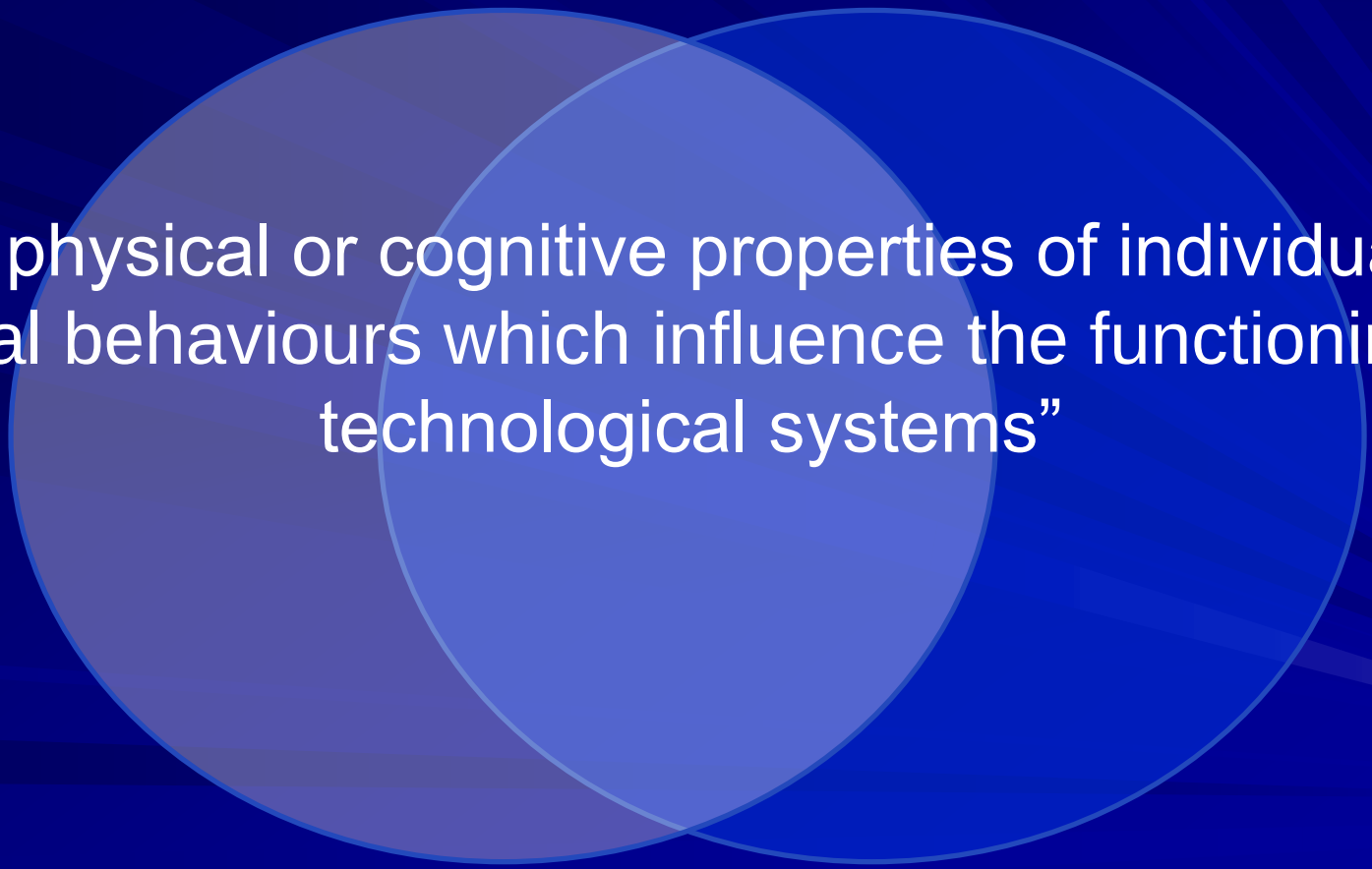
Human Factors in Intensive Care

Overview

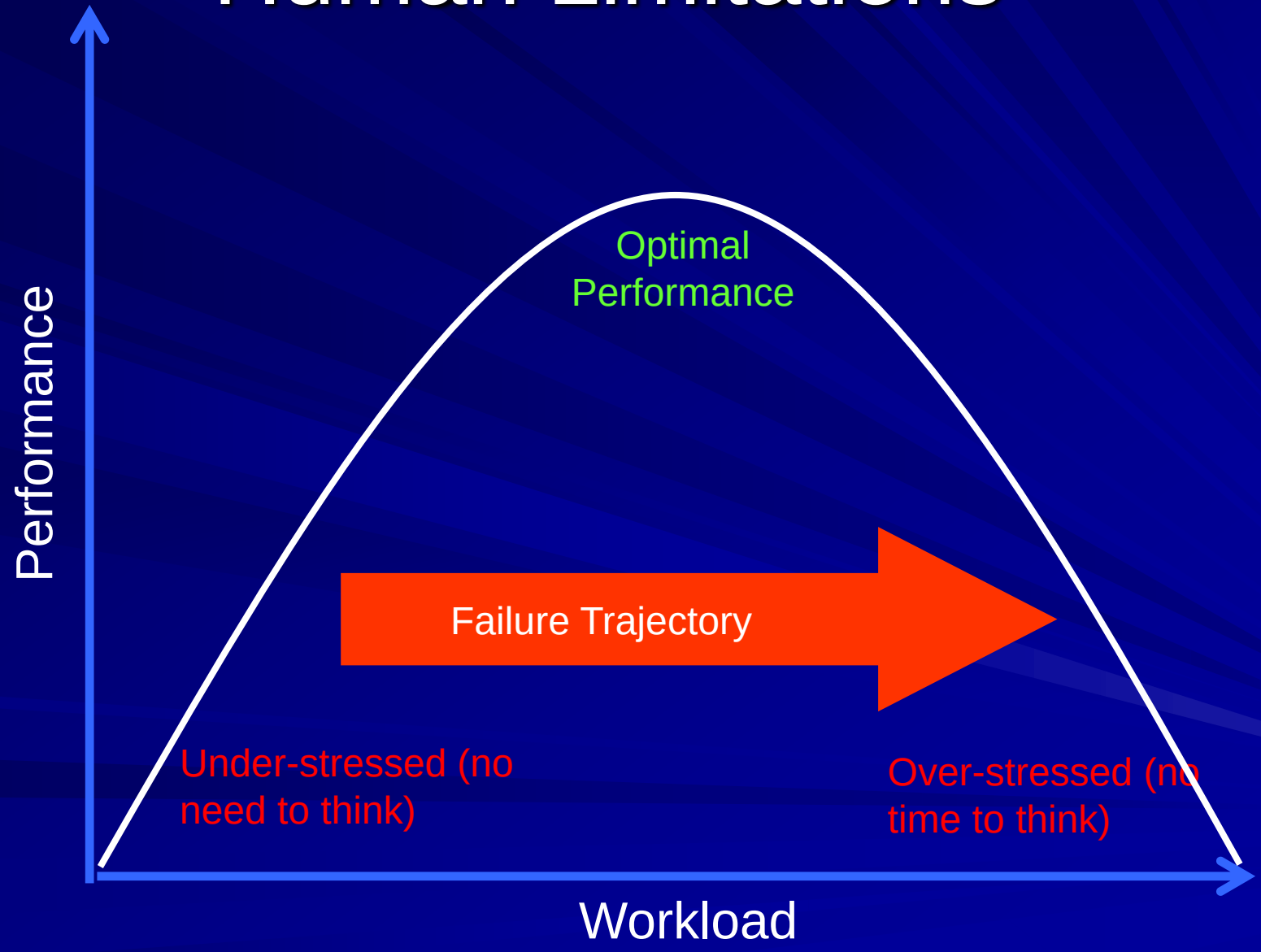
- What is human factors?
- Understanding safety & error in healthcare
- Systemic problems and the influence of teamwork in pediatric cardiac surgery
- Improving handovers from surgery to ICU by learning from motor racing and aviation

What is Human Factors?

"The physical or cognitive properties of individuals or social behaviours which influence the functioning of technological systems"



Human Limitations



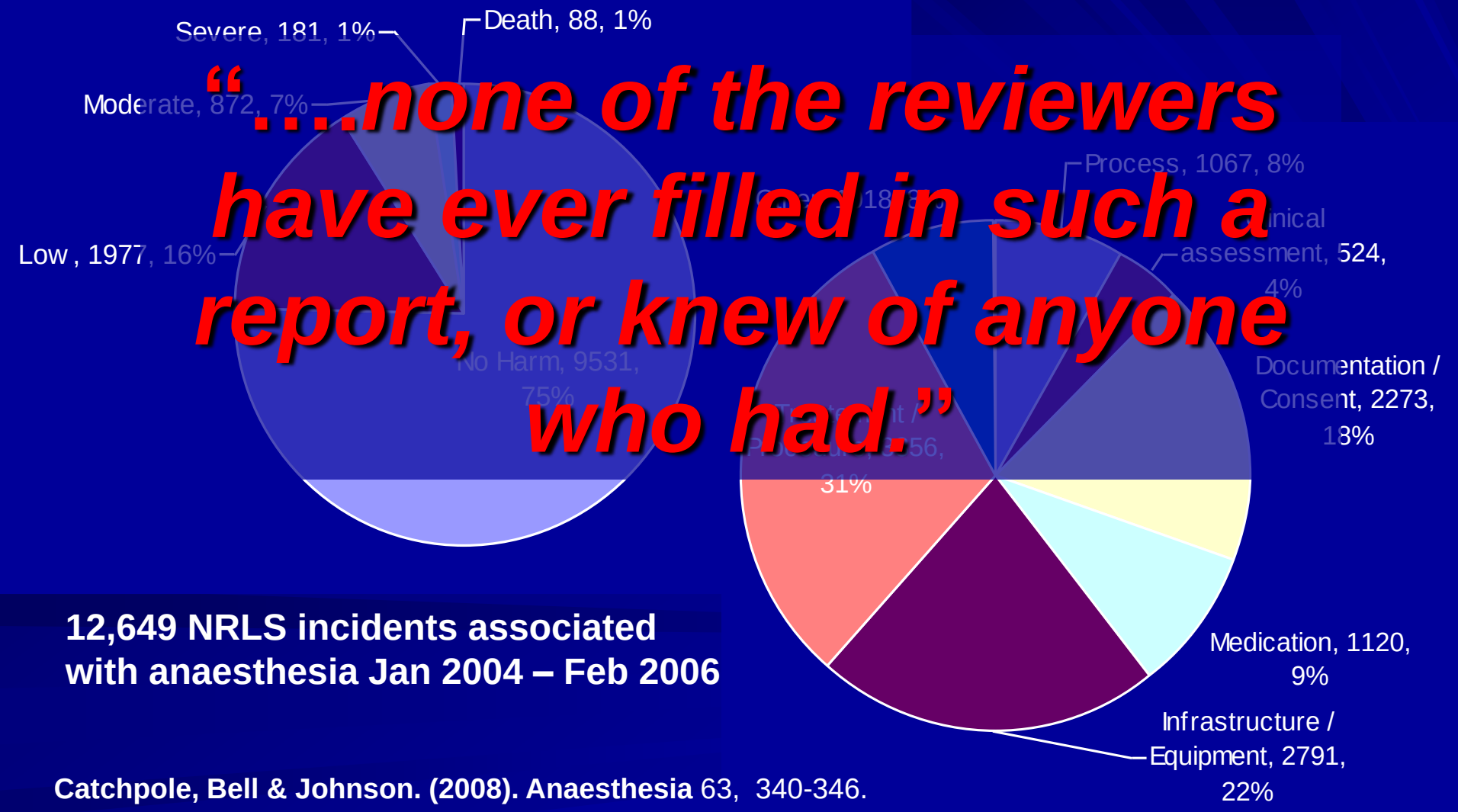
Humans in Complex Systems

- Humans:
  - are a fundamental component of ANY system
  - are uniquely able to function in uncertainty, and make trade-offs
  - *create* safety in complex systems

- Complex systems:
  - are inherently unsafe
  - always function at the limits of capacity
  - require safety to be traded for other aspects of system performance.

"*Human Error is the inevitable by-product of the pursuit of success in an imperfect, unstable, resource constrained world.*" (Dekker, 2003)

Safety in National Systems



"…none of the reviewers have ever filled in such a report, or knew of anyone who had."

12,649 NRLS incidents associated with anaesthesia Jan 2004 – Feb 2006

Catchpole, Bell & Johnson. (2008). Anaesthesia 63, 340-346.

Safety at the “Coal Face”

- Initiation of bypass without sufficient heparin is catastrophic

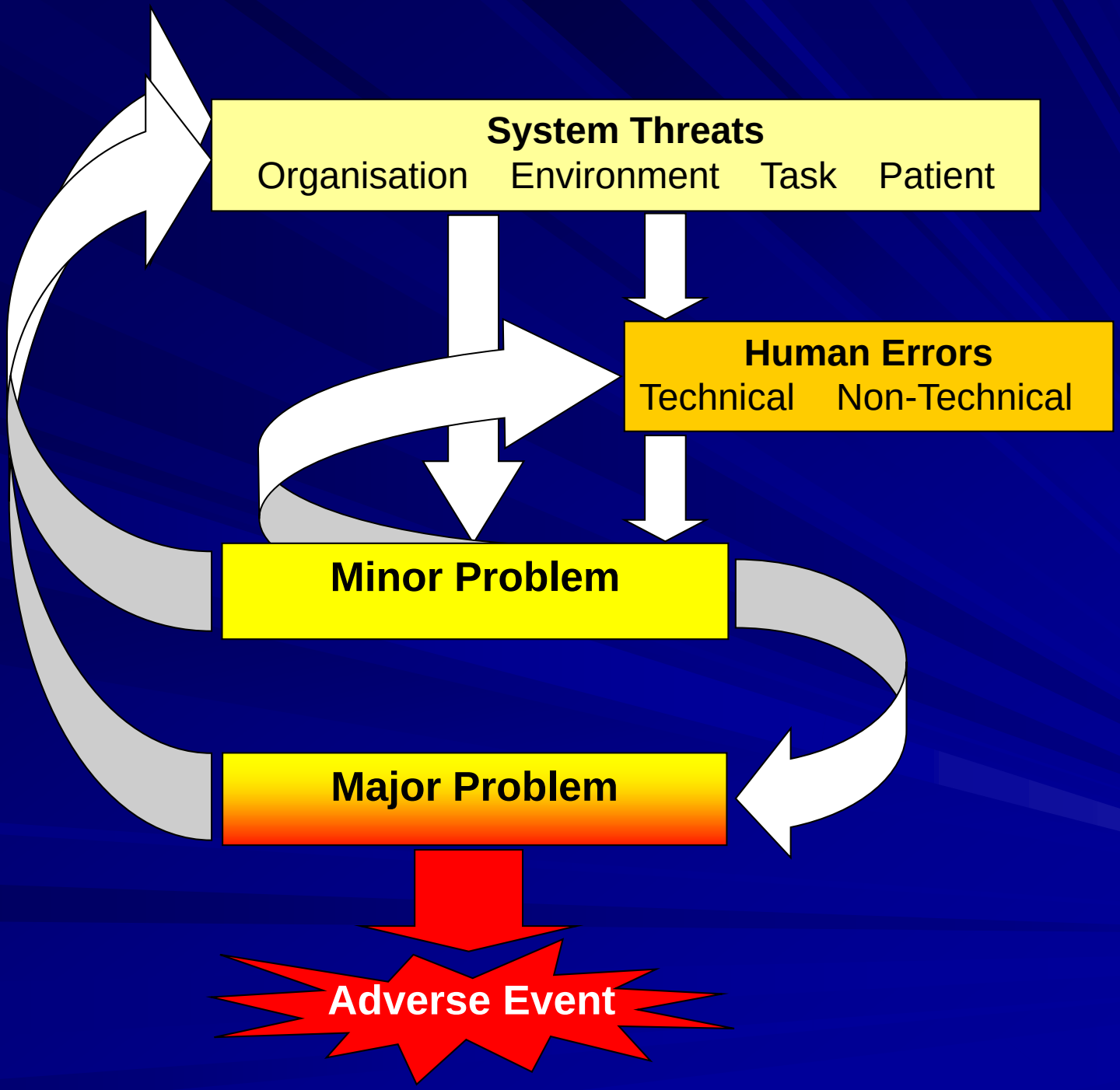
- Hospital A
  - Surgeon: Heparin please
  - Anaesthetist: Okay, heparin
  - Anaesthetist: Heparin going in
  - Surgeon: Are we ready to go on bypass?
  - Anaesthetist: Yes, ready
  - Perfusionist: Yes, I’m ready

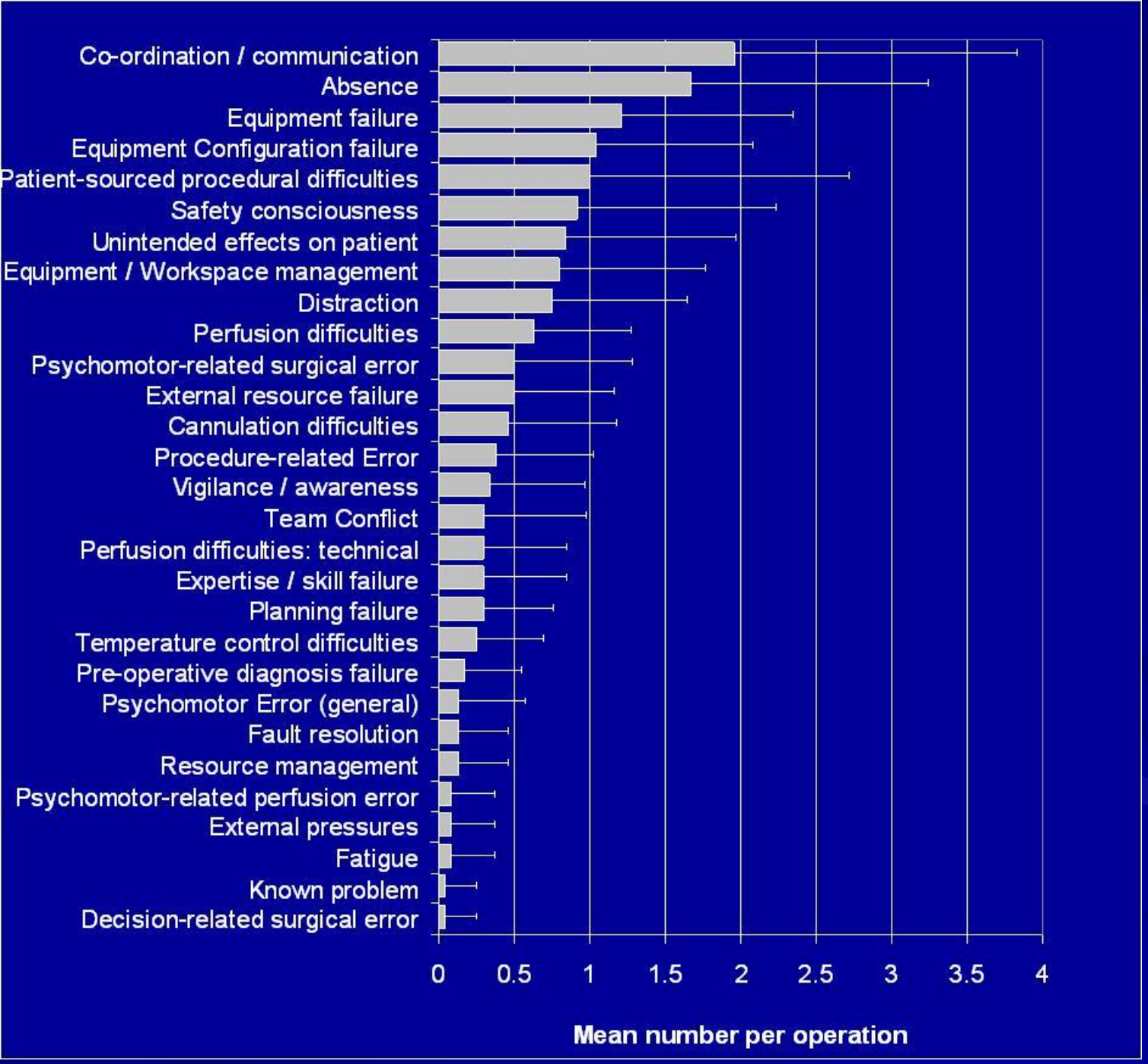
No recent heparin incidents

- Hospital B:
  - Surgeon: Okay?
  - Anaesthetist: Yes
  - Surgeon: Alright then

“It’s fine if you know how **we** do it **here**.”

“About 6 months ago when we had a bit of an incident with someone new, but they weren’t here long.”


System Threats
Organisation Environment Task Patient
Human Errors
Technical Non-Technical
Minor Problem
Major Problem
Adverse Event

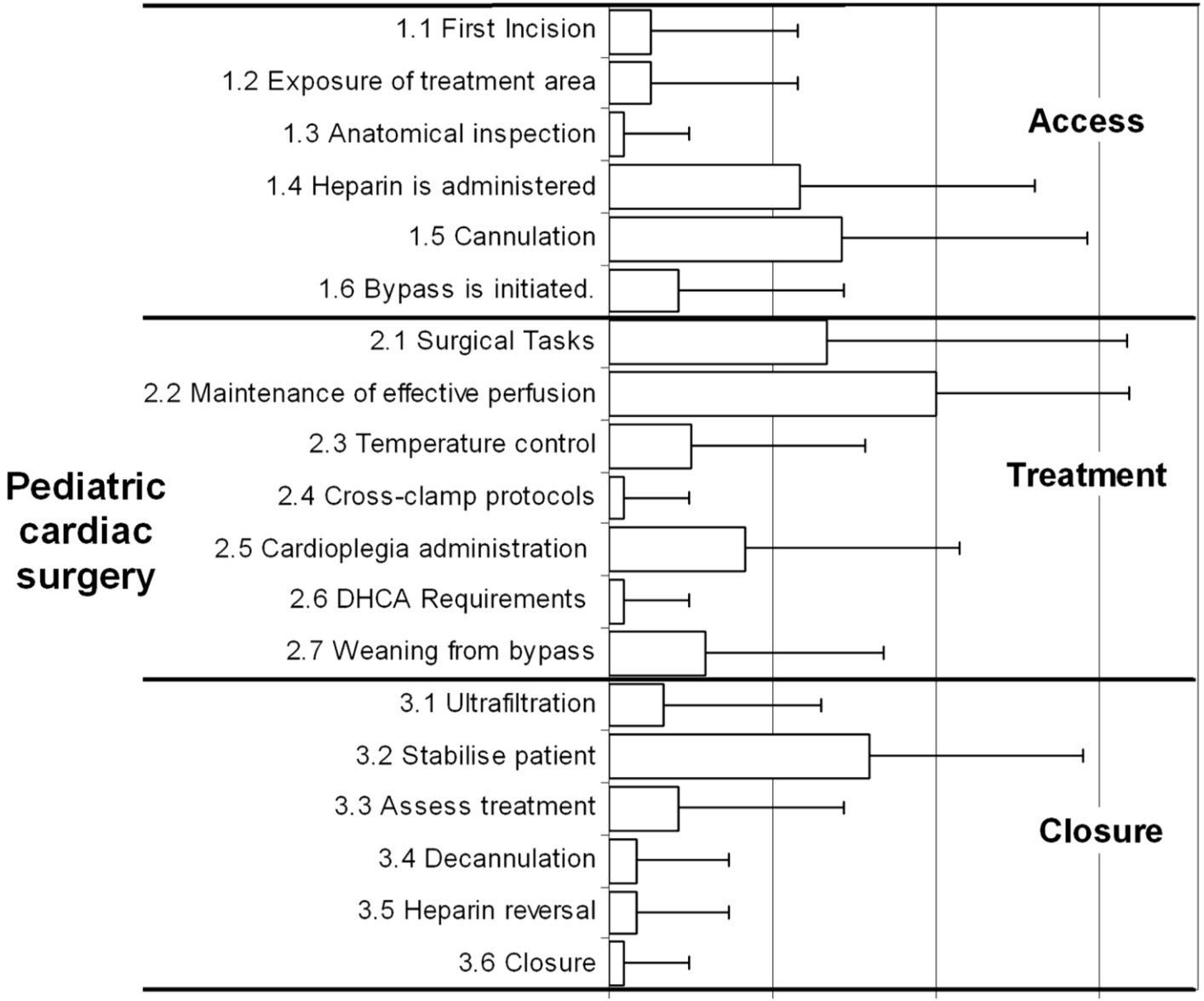


Minor Failure Types

24 Operations
366 minor failures
29 different types

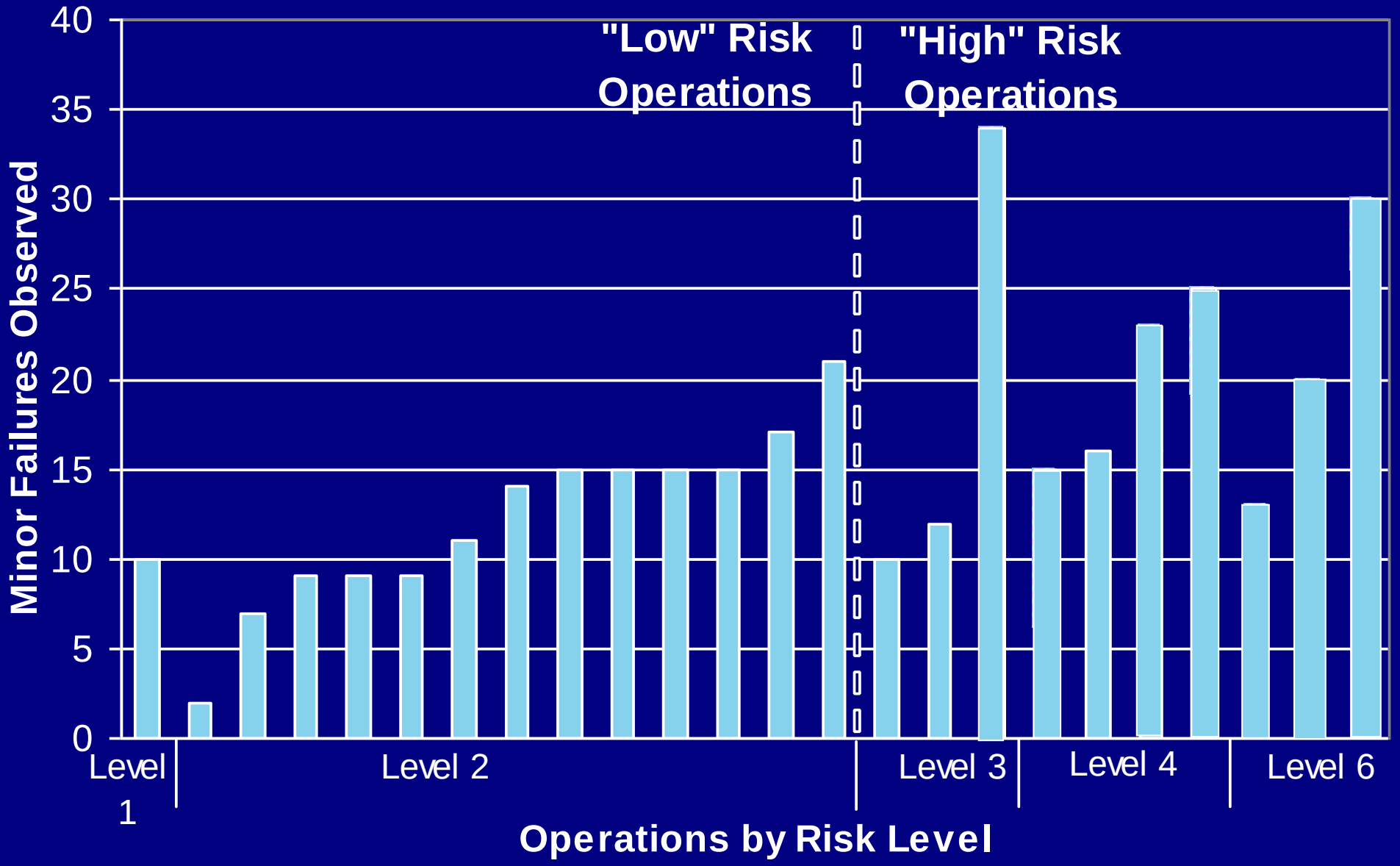
PAEDIATRIC CARDIAC SURGERY

Catchpole et al. (2006). Identification of systems failures in successful paediatric cardiac surgery. *Ergonomics* 49(5-6).



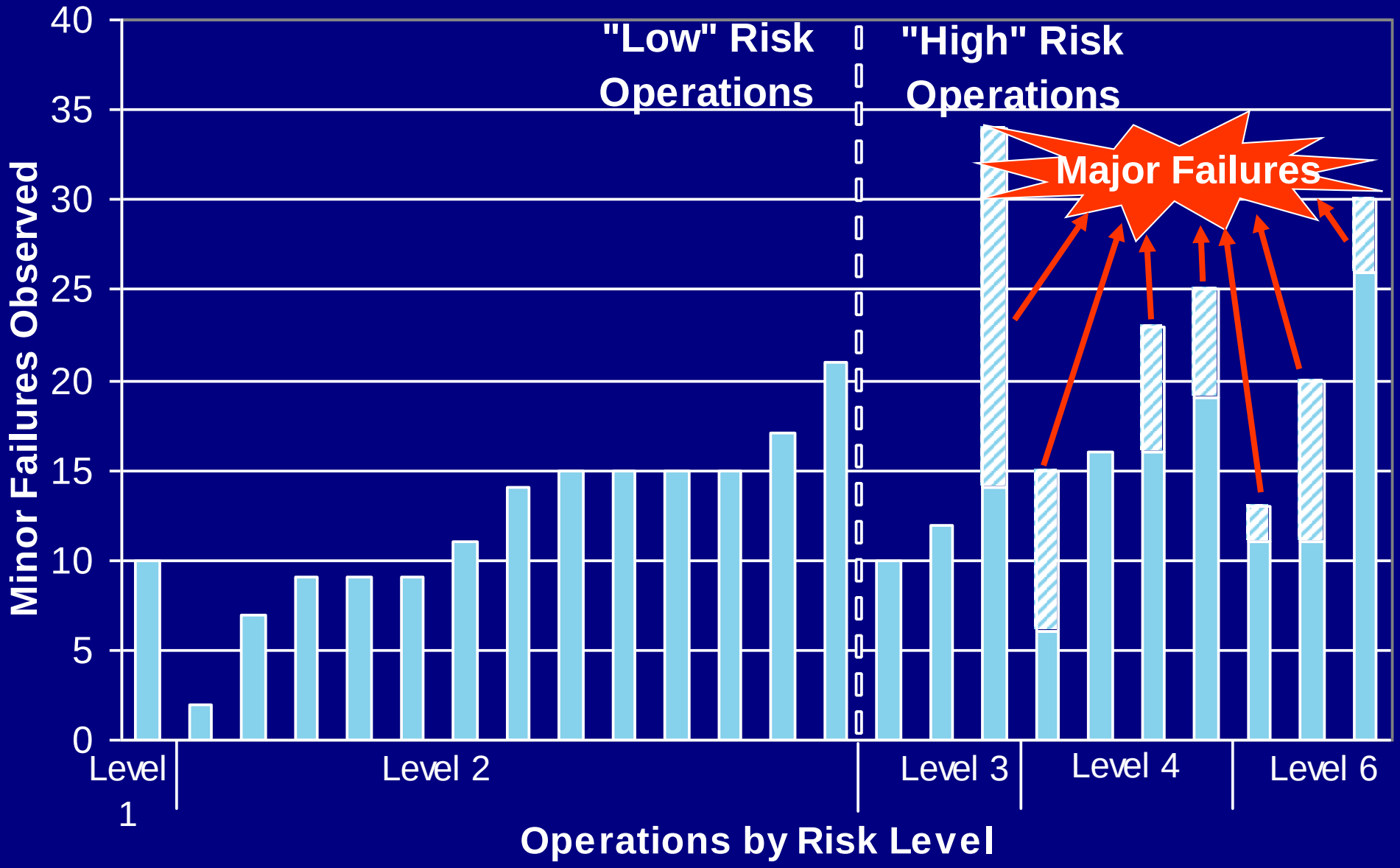
Catchpole, K, Giddings, A, Wilkinson, M, Hirst, G, Dale, T, De Leval, M. (2007) Improving patient safety by identifying latent failures in successful operations. *Surgery* 142(1), pp.102-110.

Minor Failures Per Operation (Paediatric Cardiac Surgery)



Significant difference between failures in “low” and “high” [u = 29.5, p<0.05]

Minor Failures Per Operation (Paediatric Cardiac Surgery)



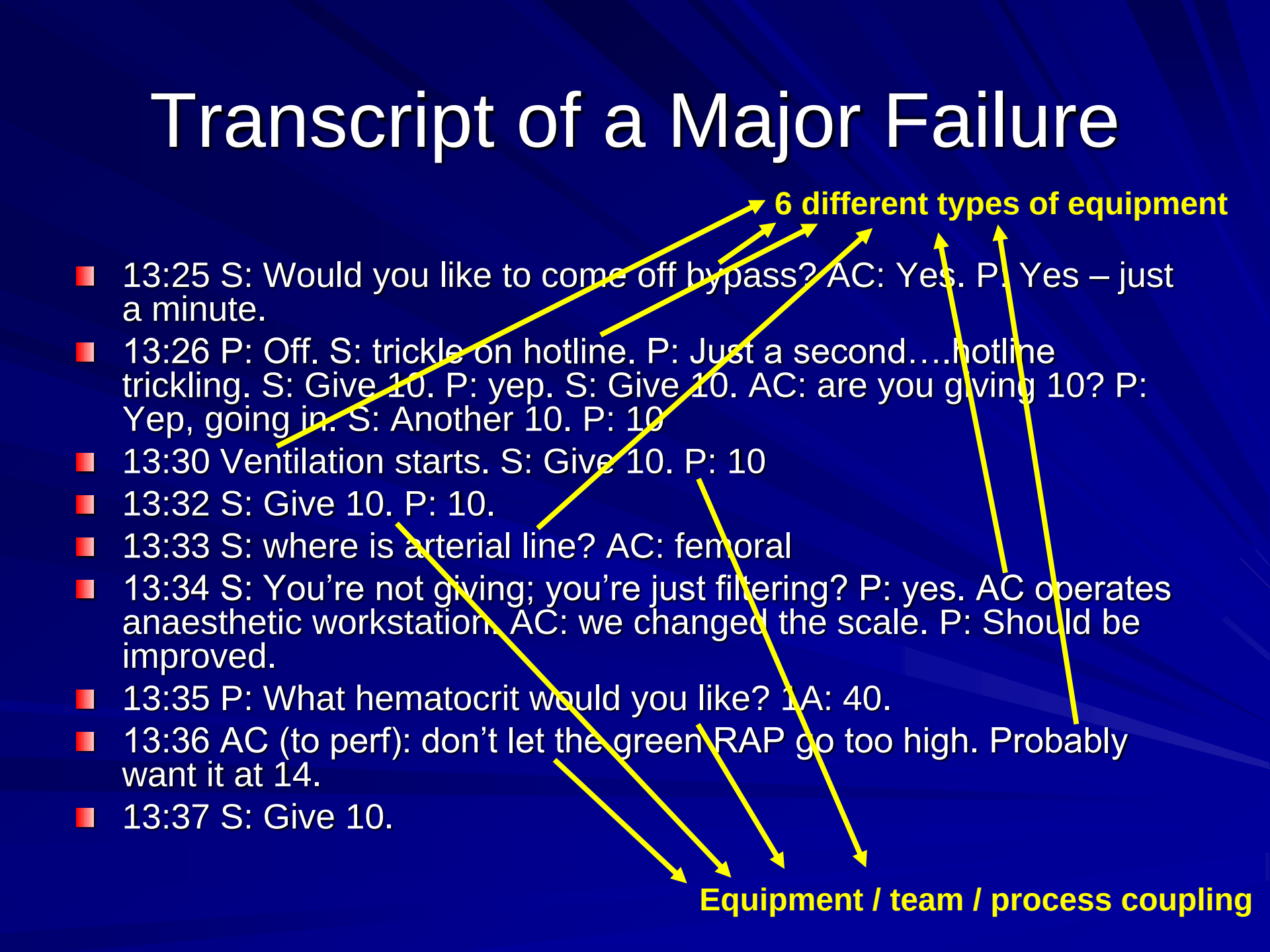
Major Failures

- **Paediatric Cardiac**
  - Swab causes compression of right coronary artery
  - Ex-sanguination during post-bypass heamofiltering
  - Omission of key surgical step
  - Premature separation from bypass due to breakdown in teamwork
  - Aortic homograft ruptured during sternotomy
  - Incorrectly labeled homograft
  - Difficult management of activated clotting time
- **Orthopaedics**
  - Multiple uncertainty leads to teamwork and task breakdown.

Examples of minor failures implicated in major failure sequences:

- **Communication/co-ordination** failures in 5 out of 8 major failures
- **Absences** in 4 out of 8 major failures
- **Equipment failures** in 4 out of 8 major failures
- **Vigilance/awareness failures** in 3 out of 8 major failures

Transcript of a Major Failure



- 13:25 S: Would you like to come off bypass? AC: Yes. P: Yes – just a minute.
- 13:26 P: Off. S: trickle on hotline. P: Just a second….hotline trickling. S: Give 10. P: yep. S: Give 10. AC: are you giving 10? P: Yep, going in. S: Another 10. P: 10
- 13:30 Ventilation starts. S: Give 10. P: 10
- 13:32 S: Give 10. P: 10.
- 13:33 S: where is arterial line? AC: femoral
- 13:34 S: You're not giving; you're just filtering? P: yes. AC operates anaesthetic workstation. AC: we changed the scale. P: Should be improved.
- 13:35 P: What hematocrit would you like? 1A: 40.
- 13:36 AC (to perf): don't let the green RAP go too high. Probably want it at 14.
- 13:37 S: Give 10.

Transcript of a Major Failure

- 13:39 P: Filtration stopped. AC: What's the crit? P: 40. AC (to P): I think we ought to continue + discussion of new plan. Meanwhile, surgeon takes the MUF line out. 1A is involved in planning, but thinks the agreement is to concentrate the blood in the pump.
- 13:40 1A: got a gas? AC: reads out bloodgas
- 13:41 Surgeon asks for more calcium.
- S: I took out the MUF line. P: We've started filtering again. S: I'm glad I said something. How much volume did you take out? P: Not a lot.
- 13:42 MUF line replaced. P: MUFfing again. S: Give 10. S: Give another 10.
- 13:43 P & AC make new filtering plan.

New plan not clearly communicated

Task conflict; attention elsewhere

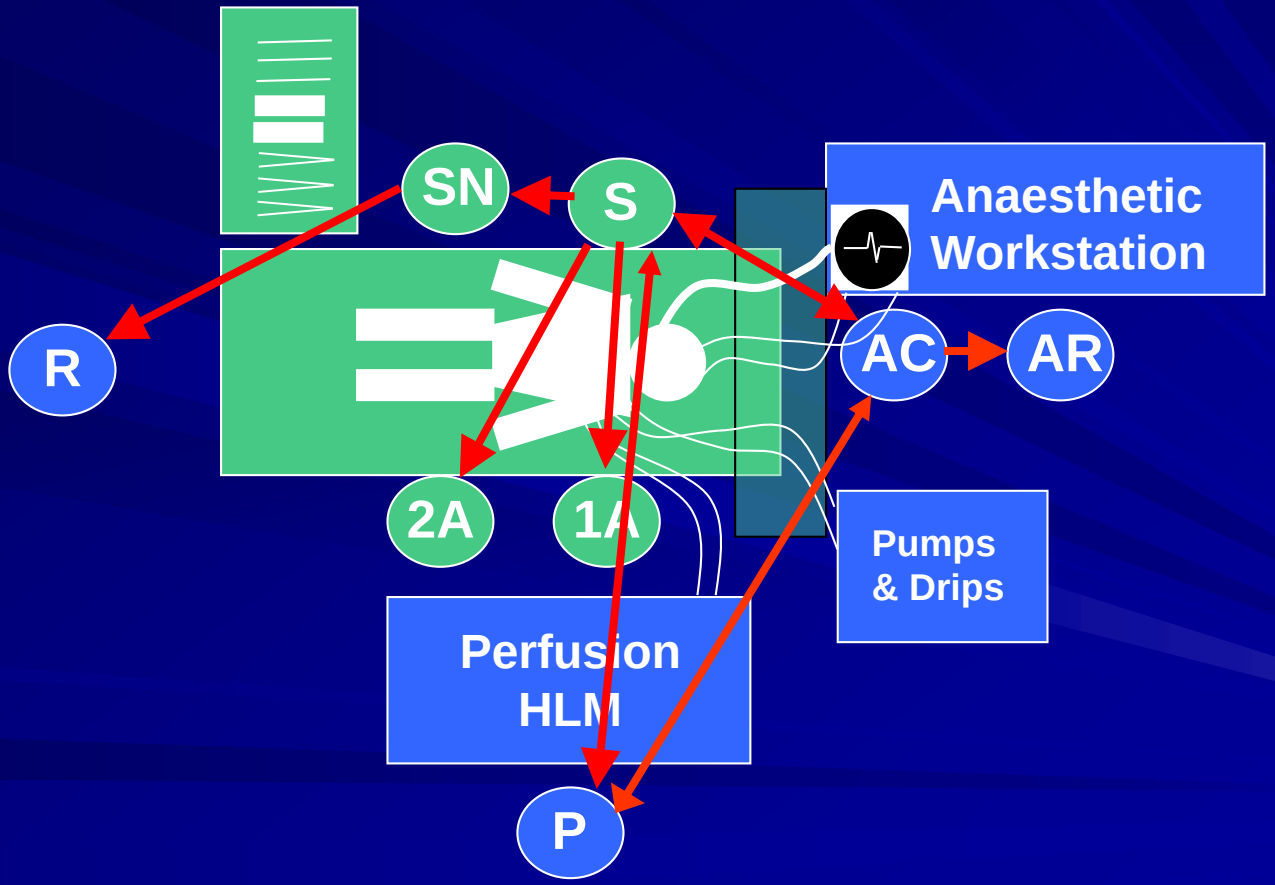
Fortuitous co-ordination

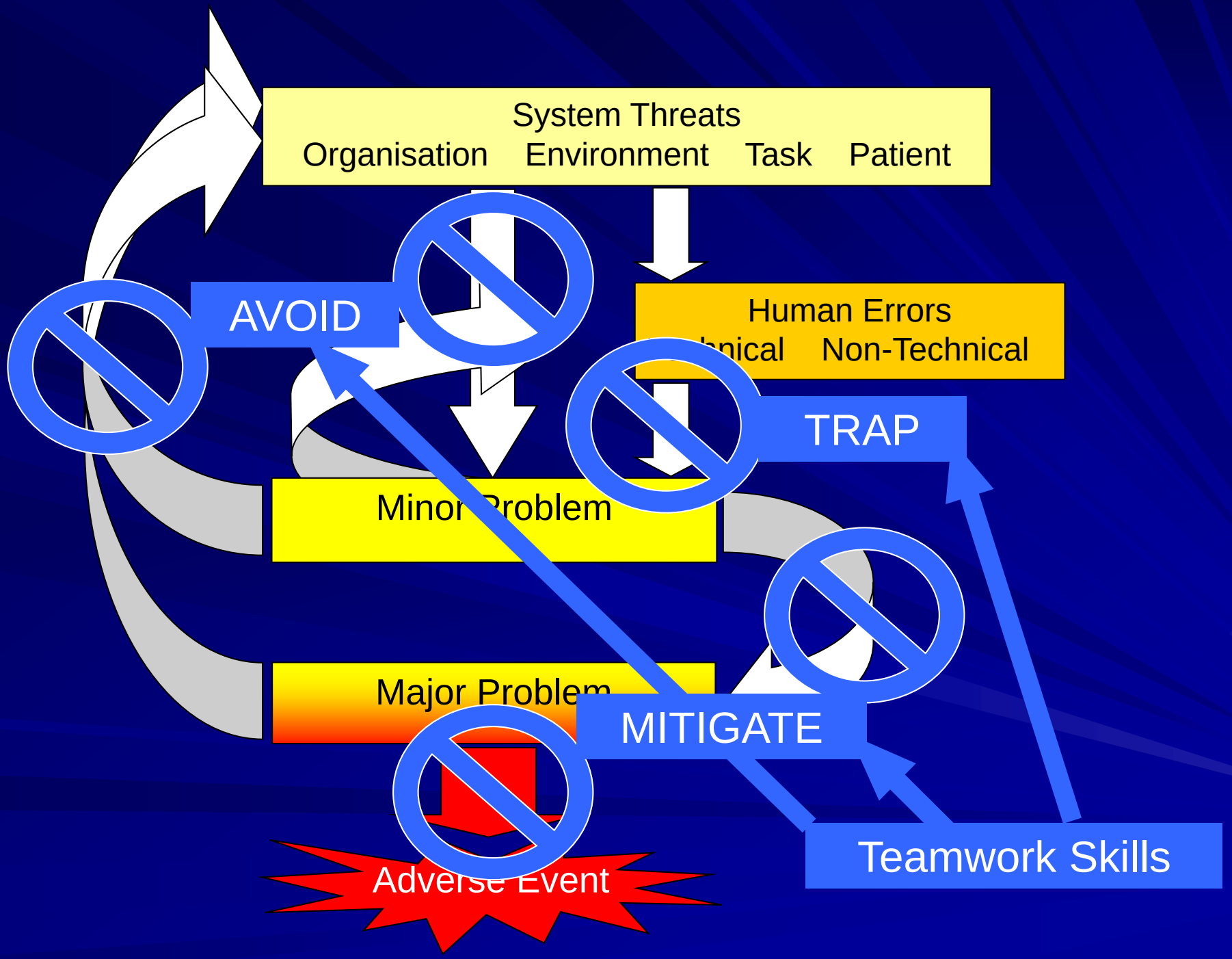
Early Mitigation

New plan co-ordinated

Error goes unnoticed for >120s

Teamwork in the Cardiac Operating Theatre



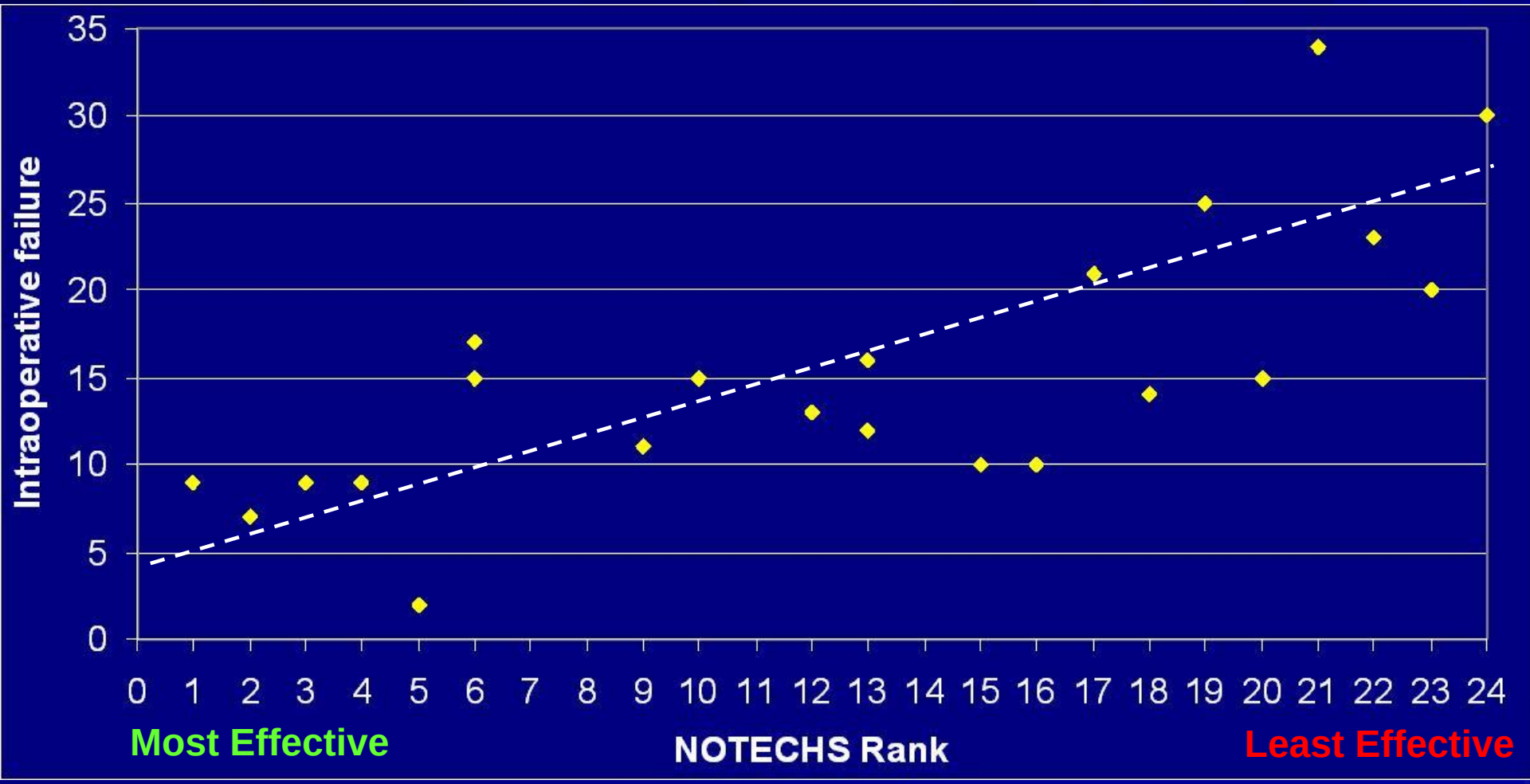

System Threats
Organisation Environment Task Patient
AVOID
Human Errors
nical Non-Technical
TRAP
Minor Problem
Major Problem
MITIGATE
Adverse Event
Teamwork Skills

Surgical NOTECHS

Dimensions	Elements
Leadership & Management	Leadership Maintenance of Standards Planning & Preparation Workload Management Authority & Assertiveness
Teamwork & Co-operation	Team building & Maintaining Support of others Understanding team needs Conflict solving
Problem Solving & Decision Making	Definition & Diagnosis Option Generation Risk Assessment Outcome Review
Situation Awareness	Notice Understand Think Ahead

Below Standard (1)	Basic Standard (2)	Standard (3)	Exceed(4)
Behaviour directly compromises patient safety and effective teamwork.	Behaviour in other conditions could directly compromise patient safety and effective teamwork.	Behaviour maintains an effective level of patient safety and teamwork.	Behaviour enhances patient safety and teamwork. A model for all other teams.

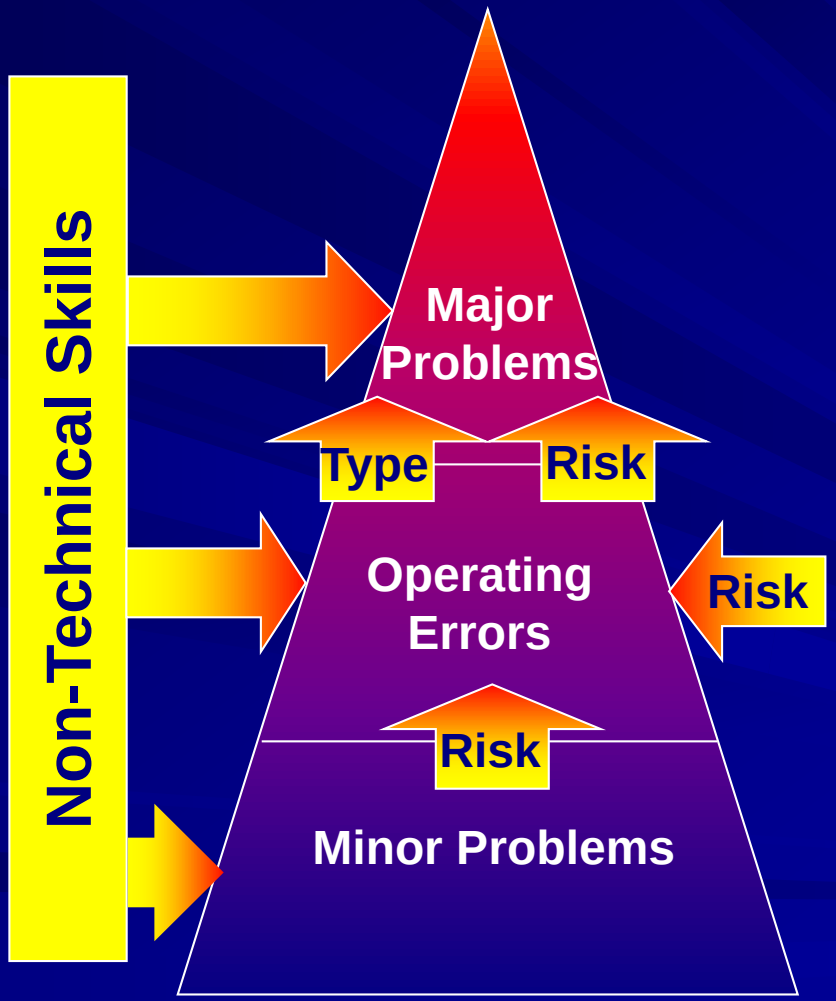
Failures and Non-Technical Skills (Paediatric Cardiac Surgery)



Spearman's Rho = 0.738, n=24, p<0.001

“Escalation” Mechanism

- Leadership & Management
- Teamwork & Co-ordination
- Problem Solving and Decision Making
- Situation Awareness



Mean Per Operation	
Paediatric Cardiac Surgery	Orthopaedic Surgery
0.29	0.04
5.75	4.89
9.5	13.1
N=24	N=18

Catchpole, K, Giddings, A, Wilkinson, M, Hirst, G, Dale, T, De Leval, M. (2007) Improving patient safety by identifying latent failures in successful operations. *Surgery* 142(1), pp.102-110.

High Reliability Organisations

- Trapping errors
- Identifying problems before they occur
- Extensive reporting systems
- Standards, Procedures & Checklists
- Clear shared goals

"…the transfer from the operating theatre to the intensive care unit is one of the most difficult stages in the care of a child."

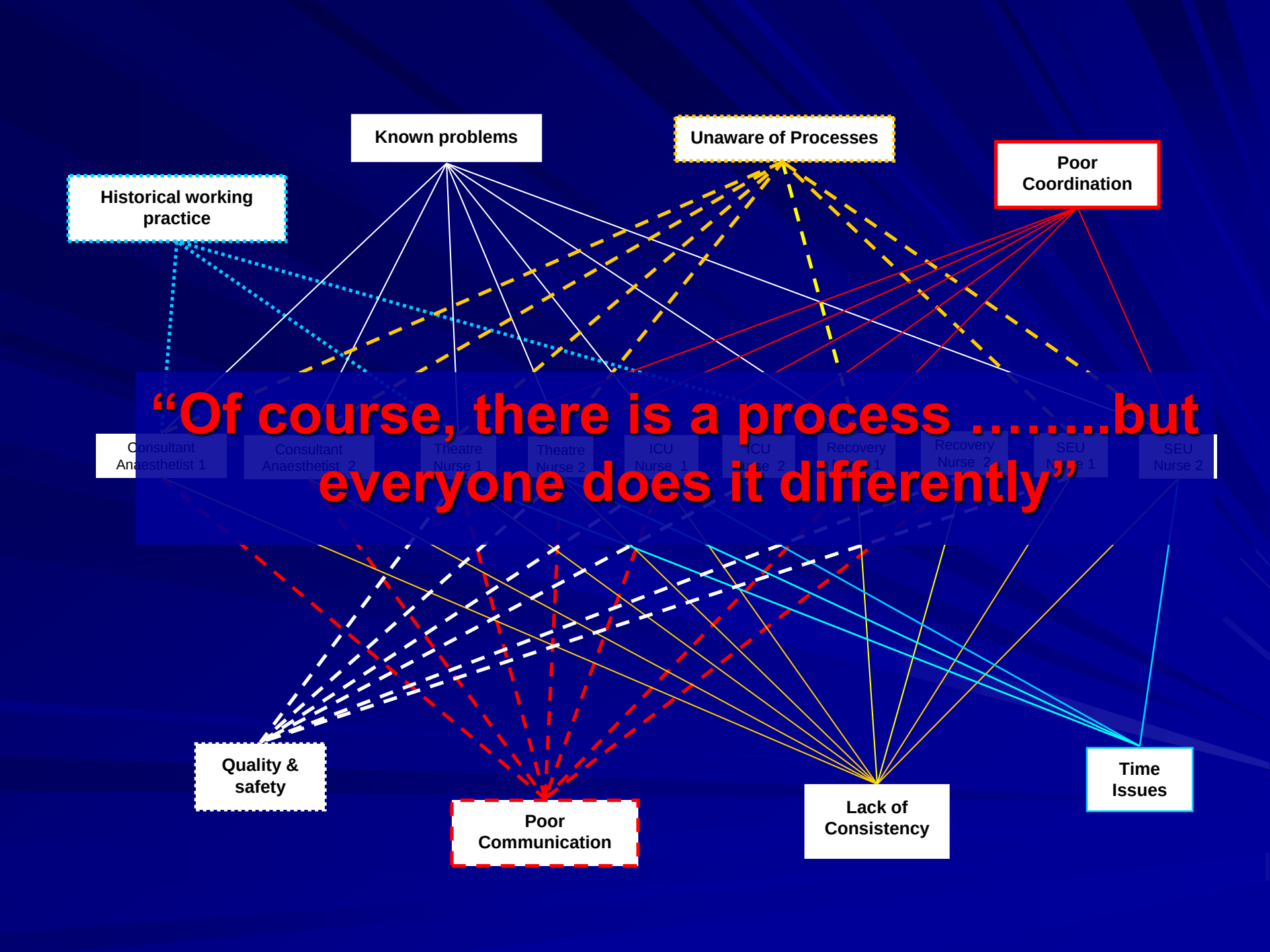
- p. 214, Learning from Bristol (2001)

NOTE

TANSFER OF:

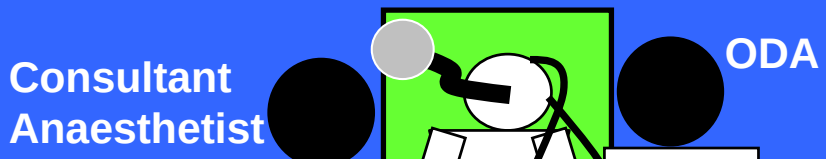
- safety-critical monitoring & support equipment from theatre to ICU

- patient care, information & plans from operating team to intensive care team


Known problems
Unaware of Processes
Poor Coordination
Historical working practice
Consultant Anaesthetist 1
Consultant Anaesthetist 2
Theatre Nurse 1
Theatre Nurse 2
ICU Nurse 1
ICU Nurse 2
Recovery Nurse 1
Recovery Nurse 2
SEU Nurse 1
SEU Nurse 2
"Of course, there is a process ……..but everyone does it differently"
Quality & safety
Poor Communication
Lack of Consistency
Time Issues

The Old Way

Nurse



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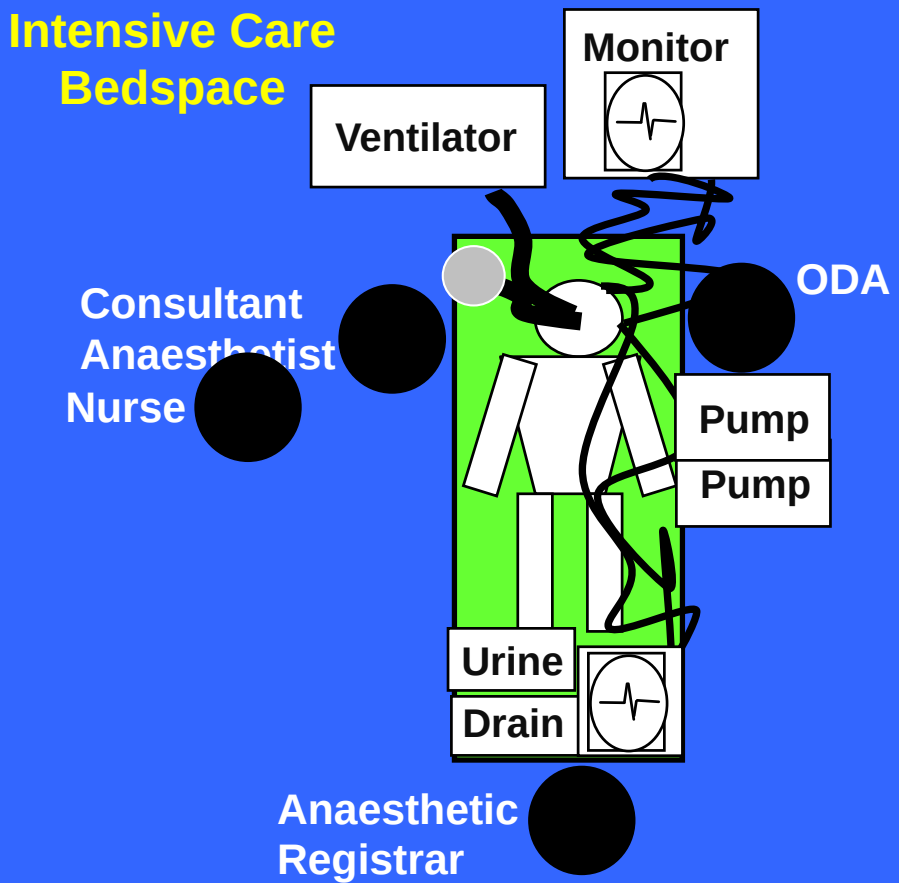
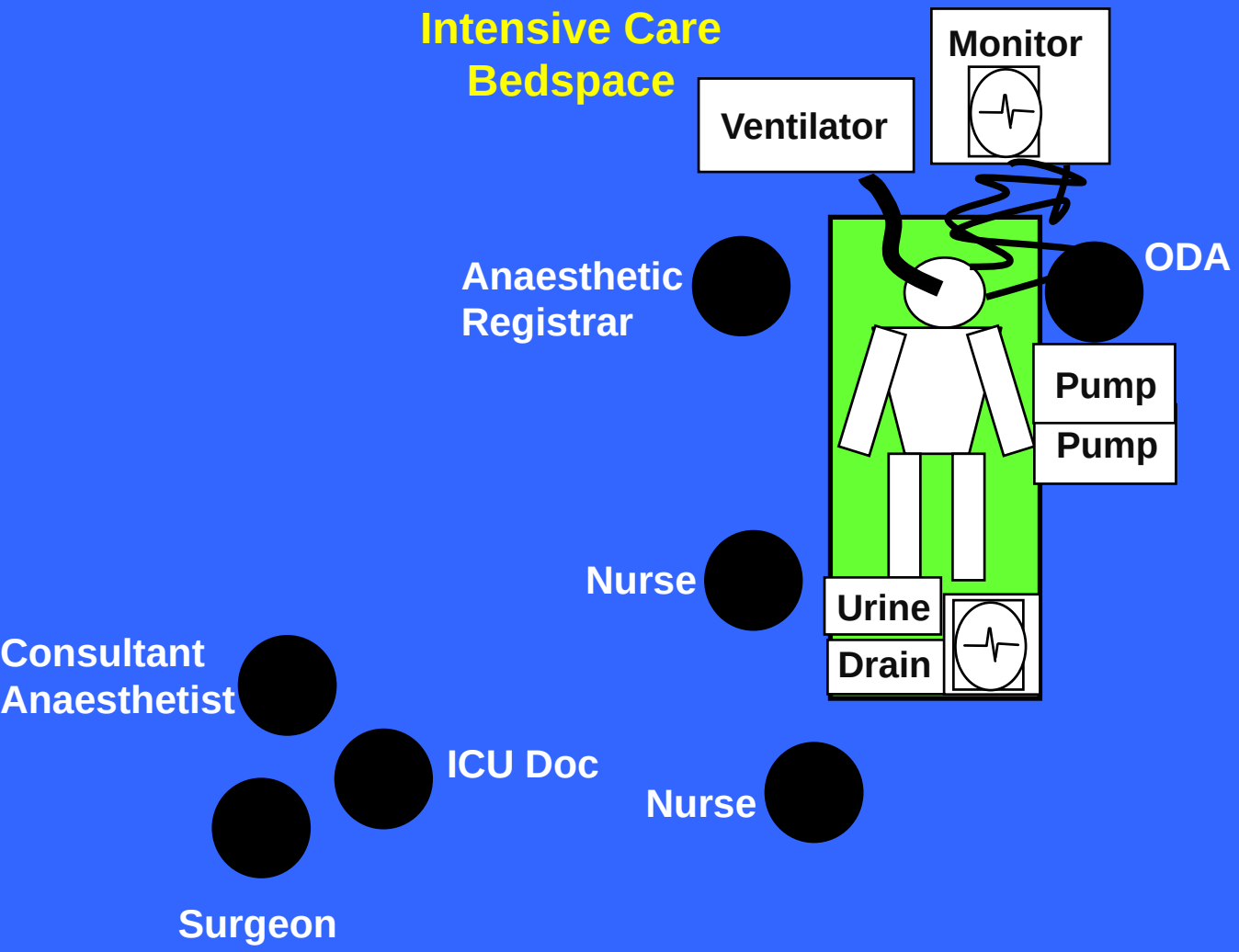

Intensive Care
Bedspace
Monitor
Ventilator
ODA
Consultant
Anaesthetist
Nurse
Pump
Pump
Urine
Drain
Anaesthetic
Registrar

The Old Way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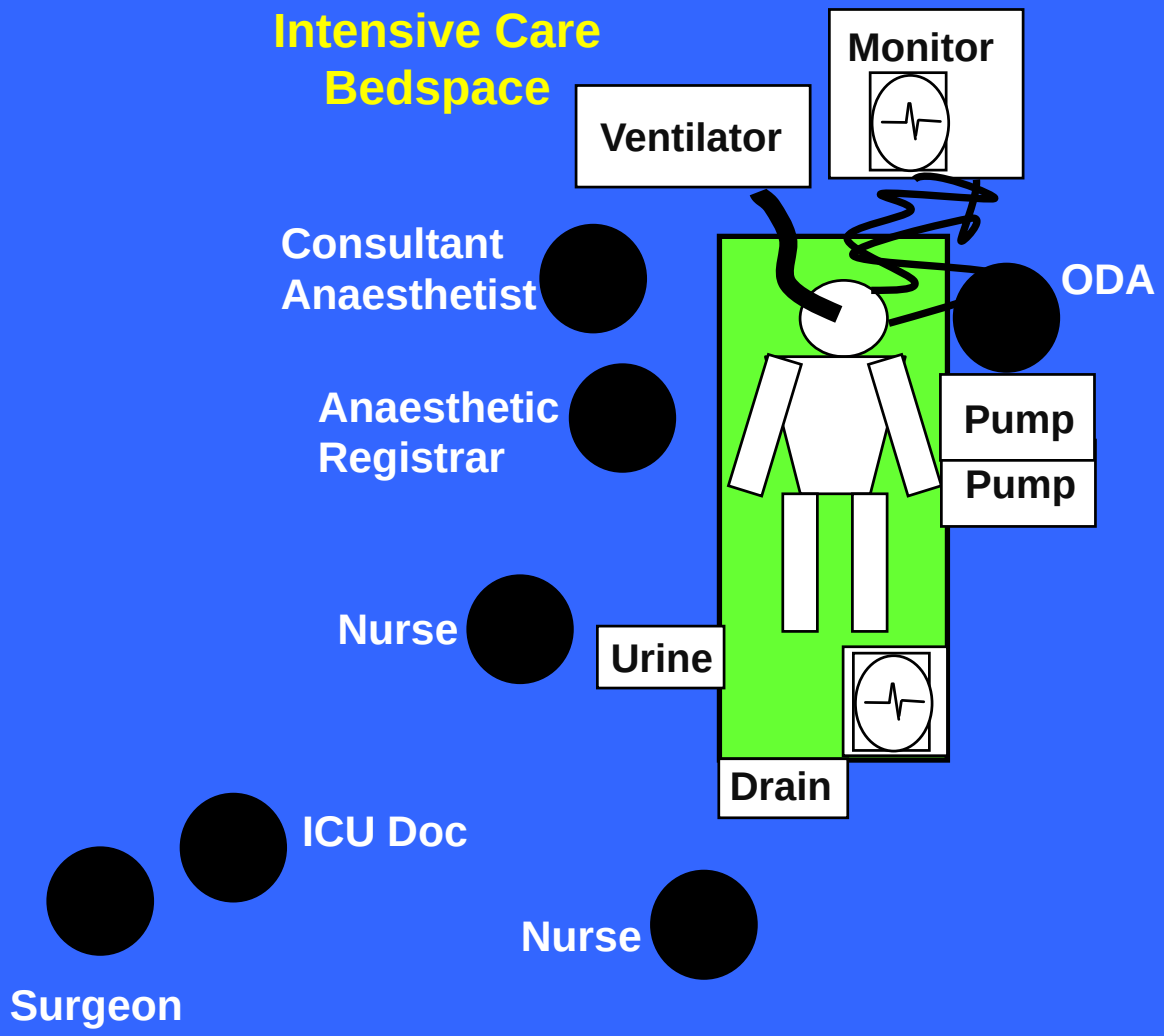
Anaesthetist
ICU Doc
Nurse
Surgeon

The Old Way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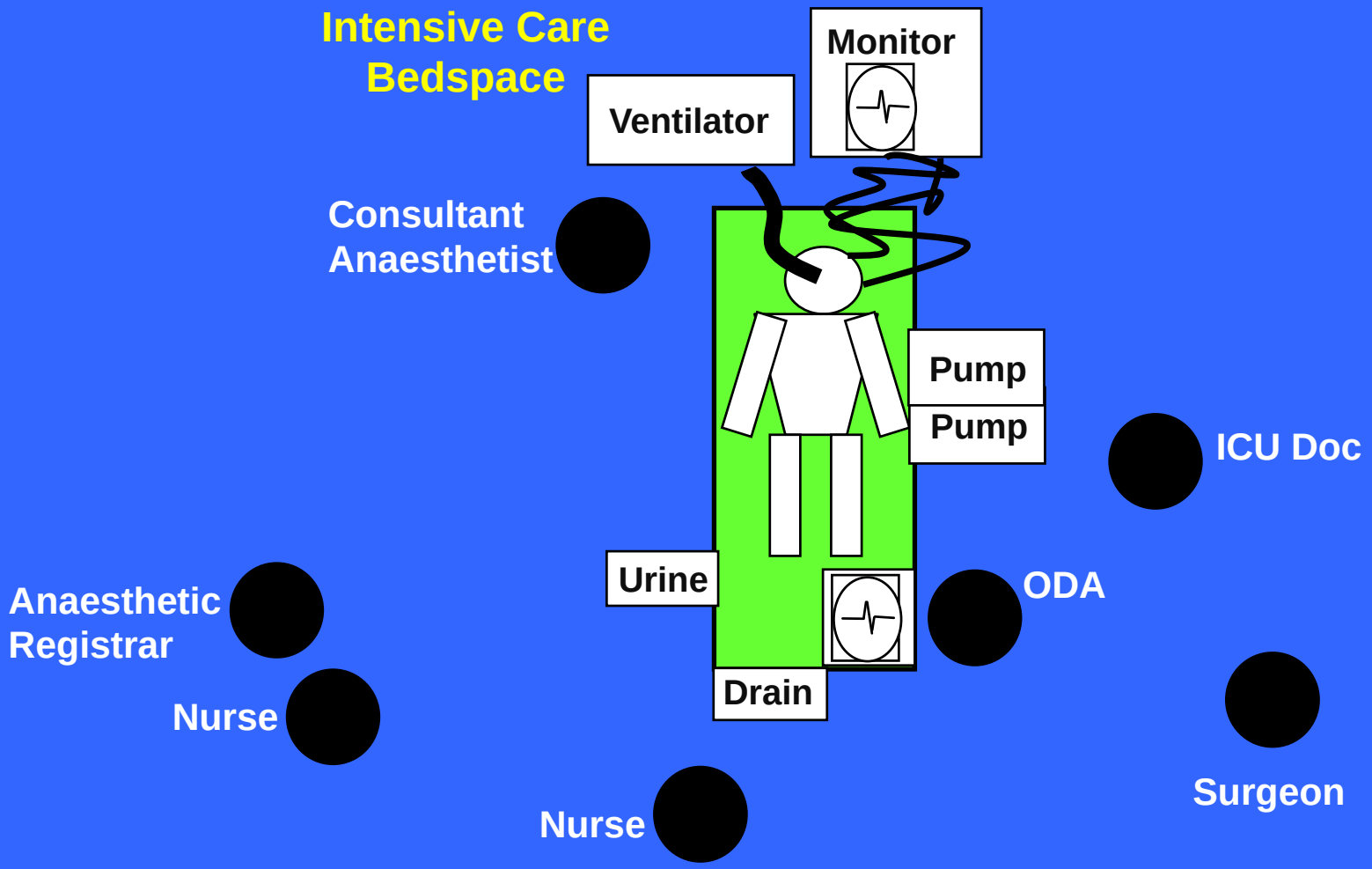
The Old Way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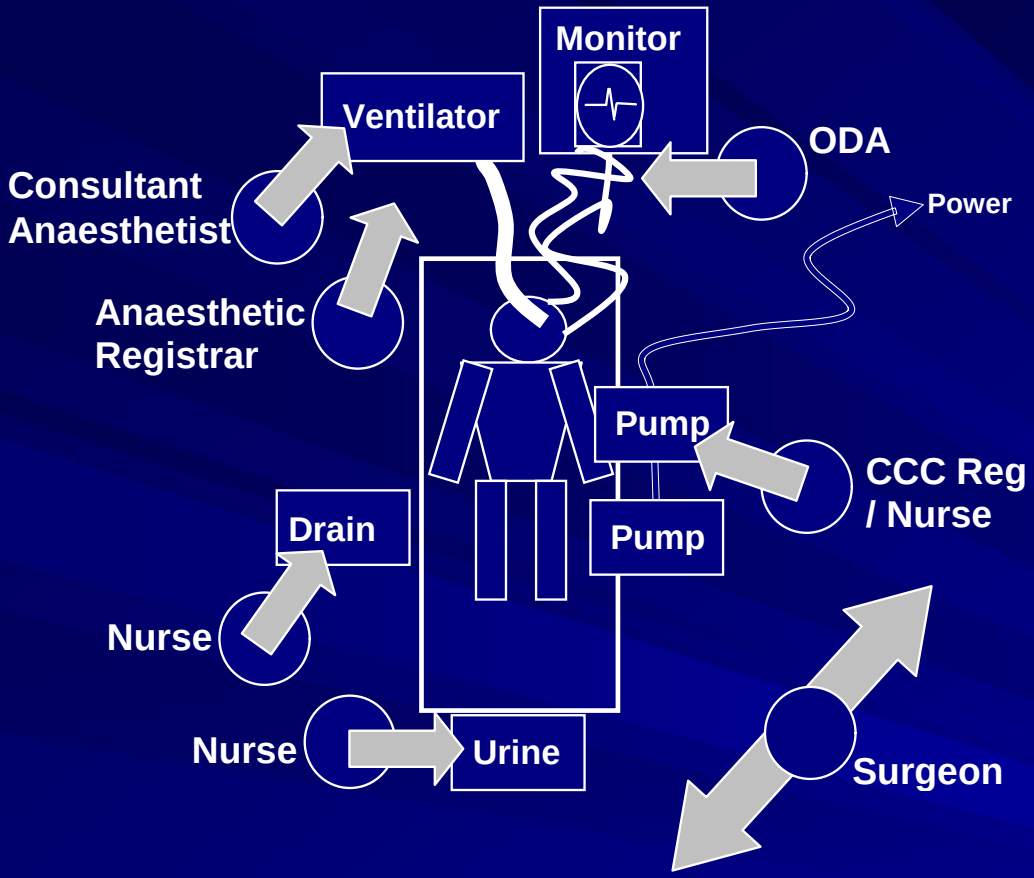
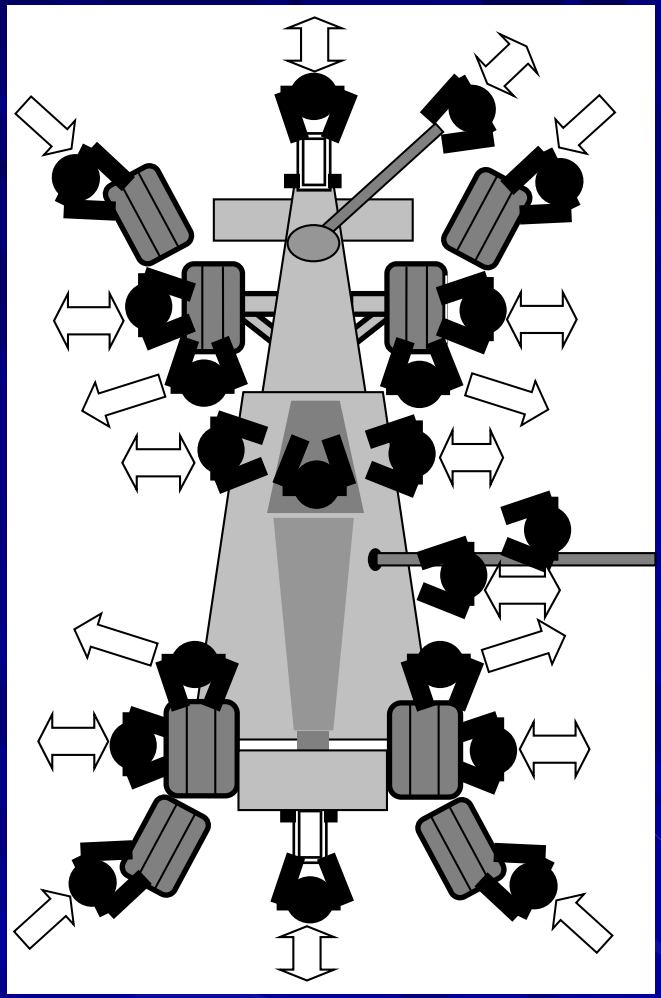
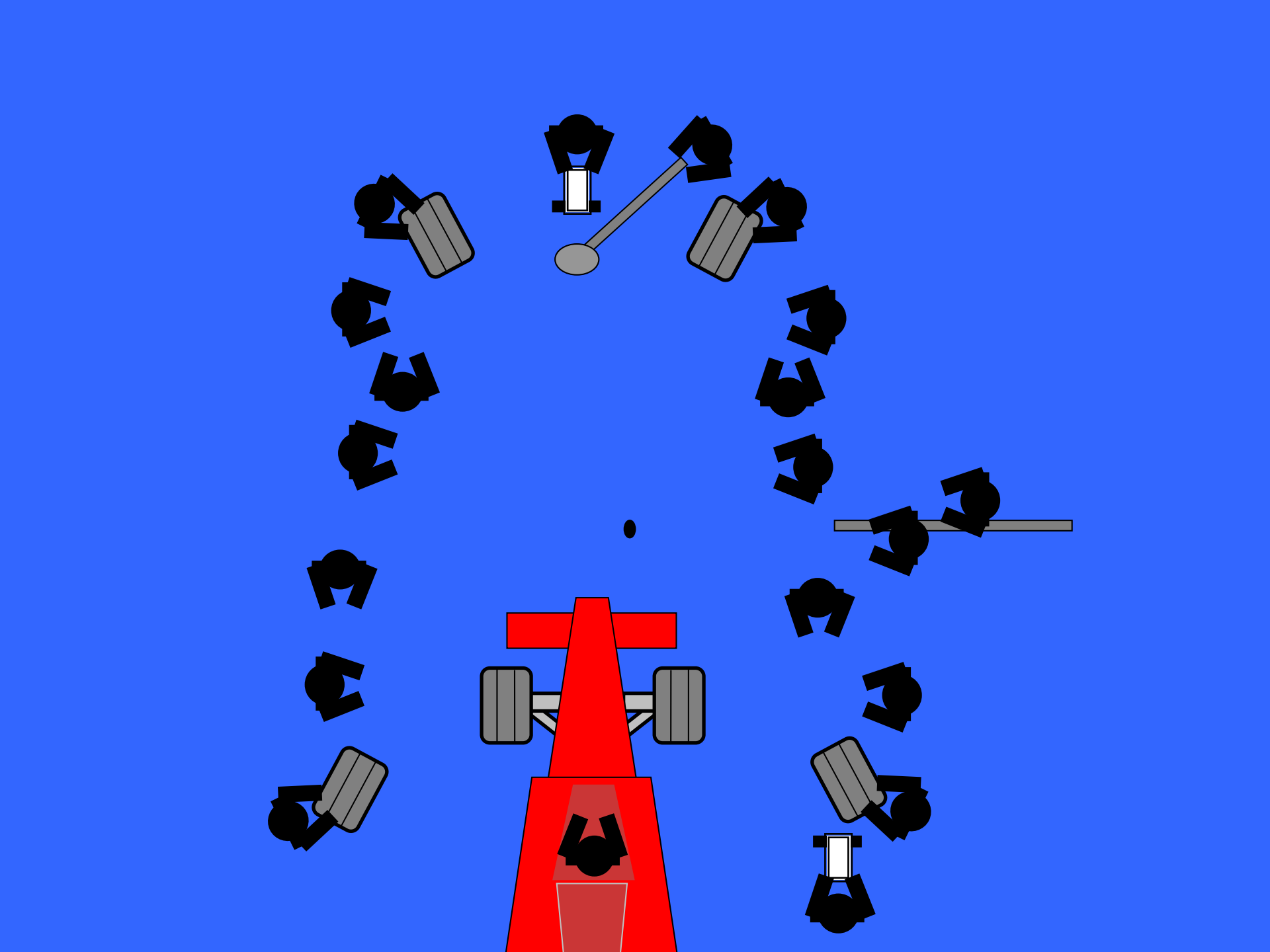
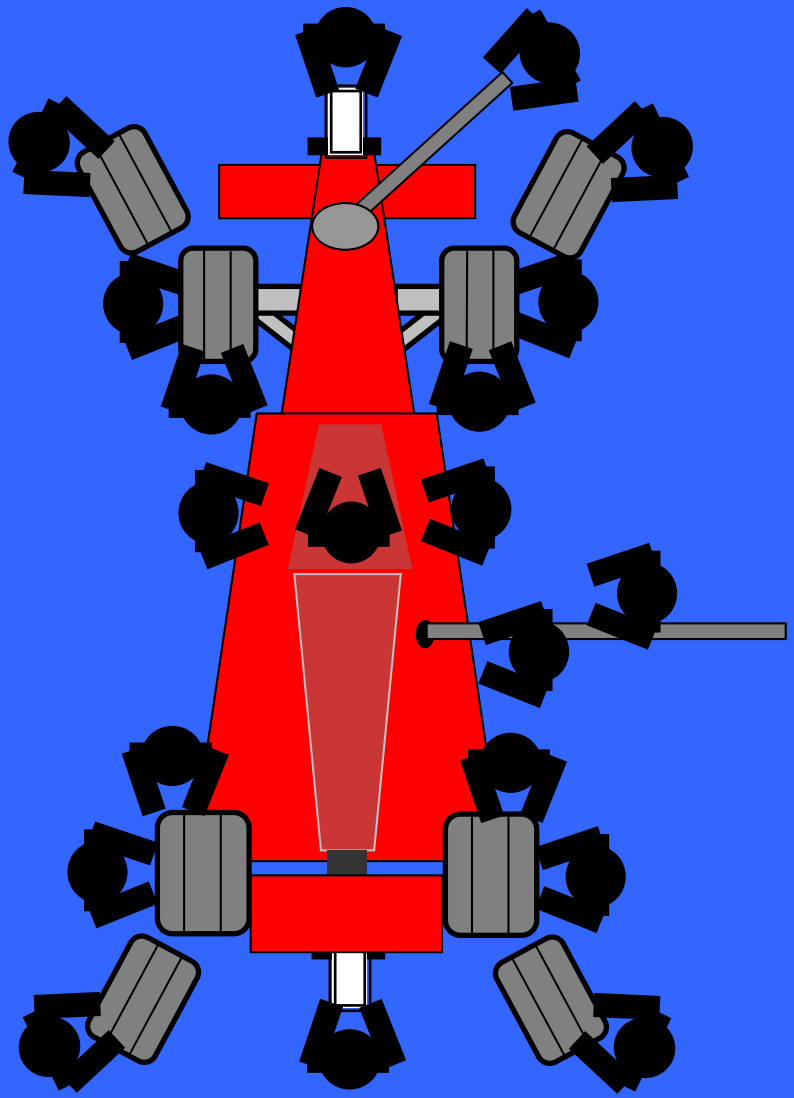
Nurse

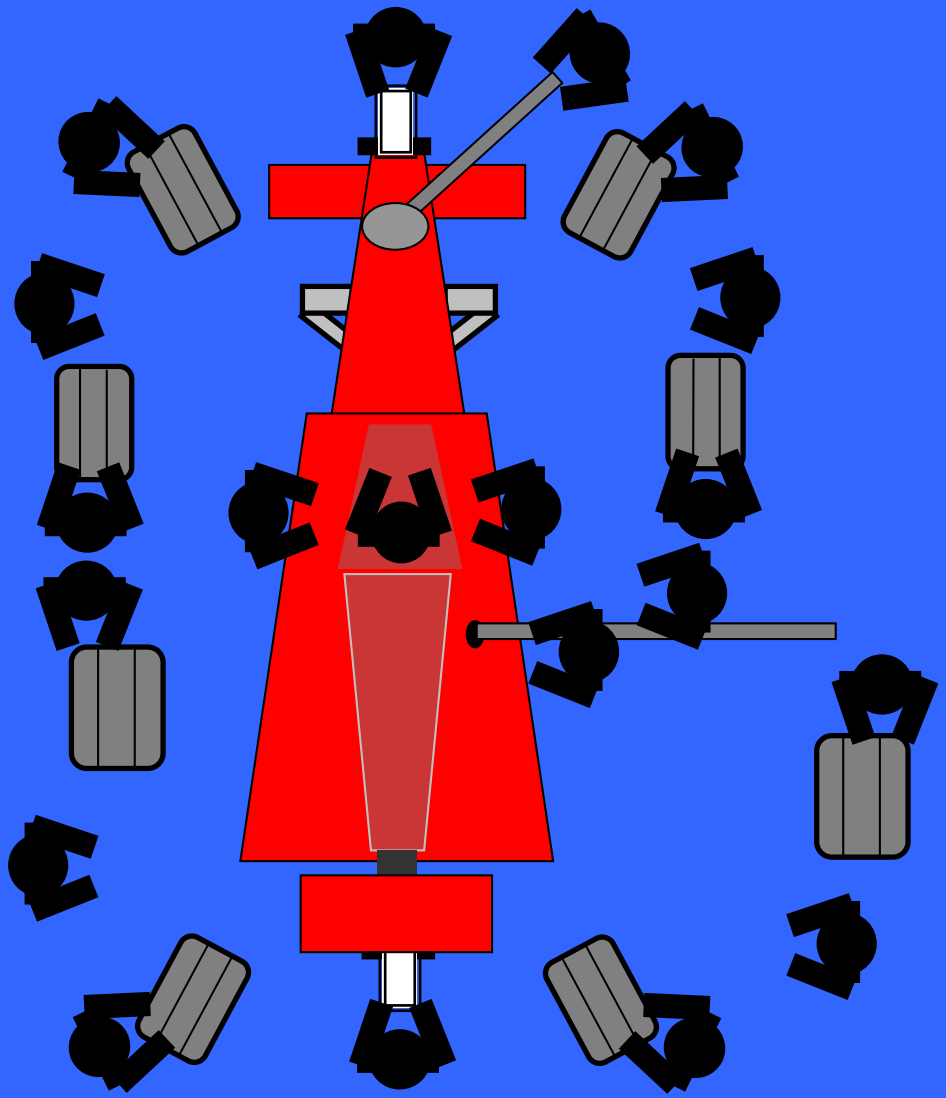


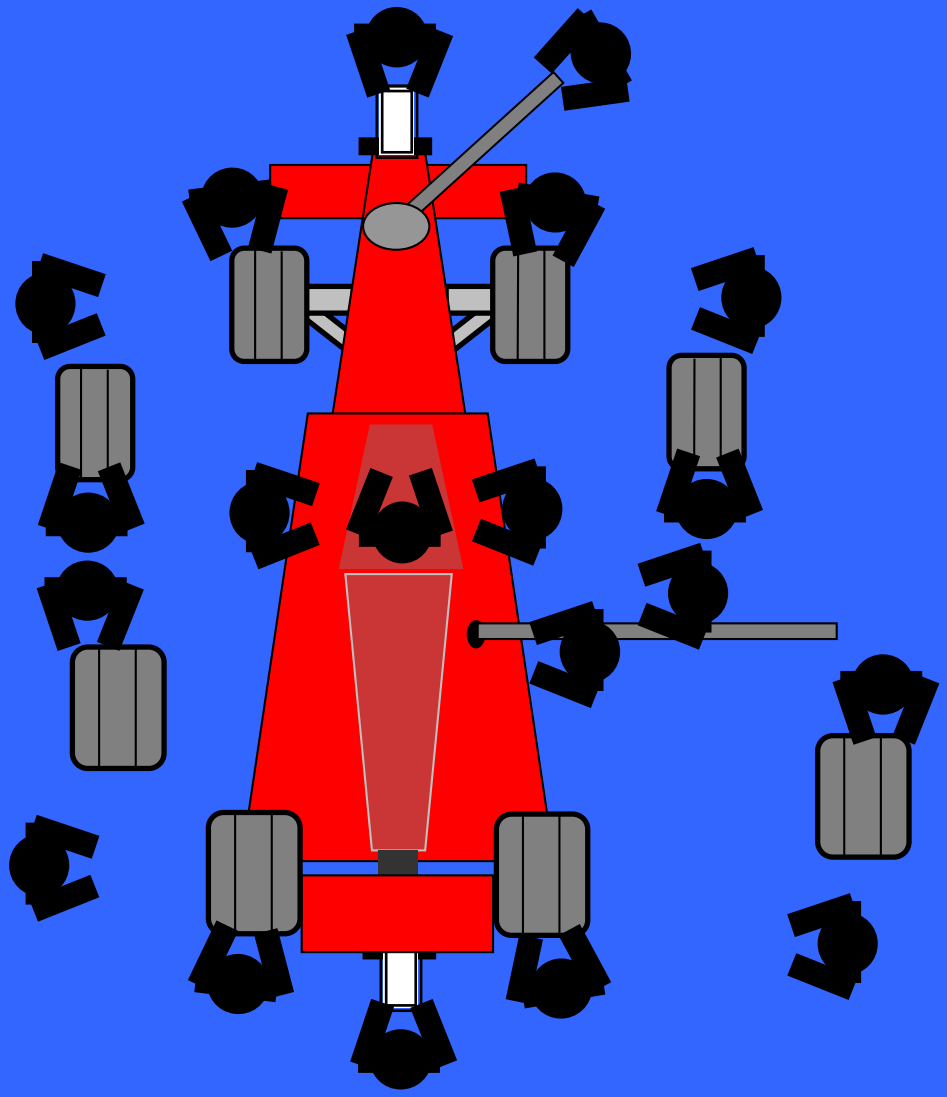


- Multiple specialists
- Complex tasks
- Complex interfaces
- Time pressure
- Need for accuracy









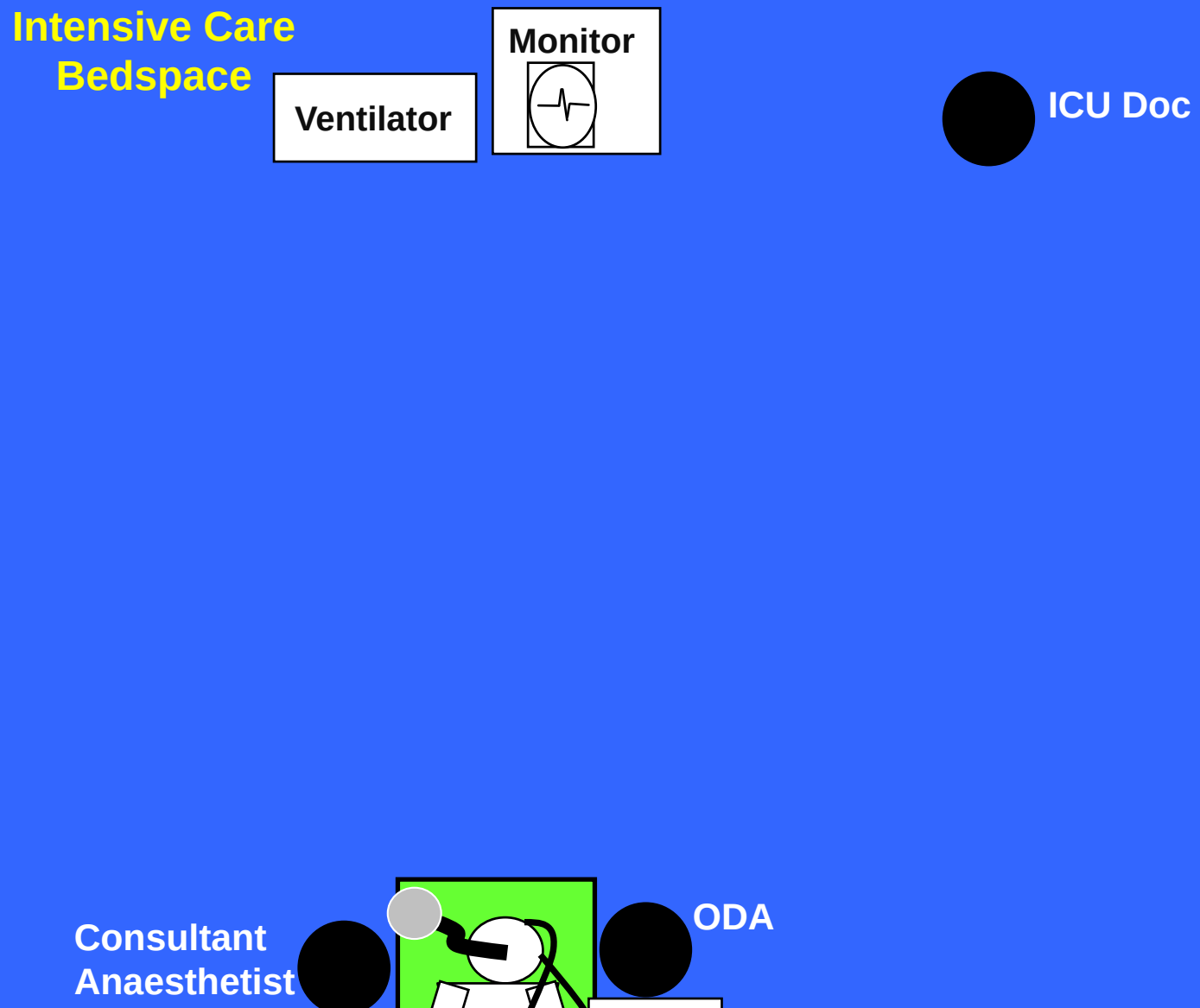
Lessons from F1 and Aviation

~~Technology~~

~~Training Regimes~~

- Process Organisation
  - Task Allocation
  - Task sequence
  - Discipline and composure
- Teamwork
  - Leadership
  - Involvement
  - Briefing
- Threat and Error Management
  - Checklists
  - Predicting and Planning
  - Situation Awareness

The New Way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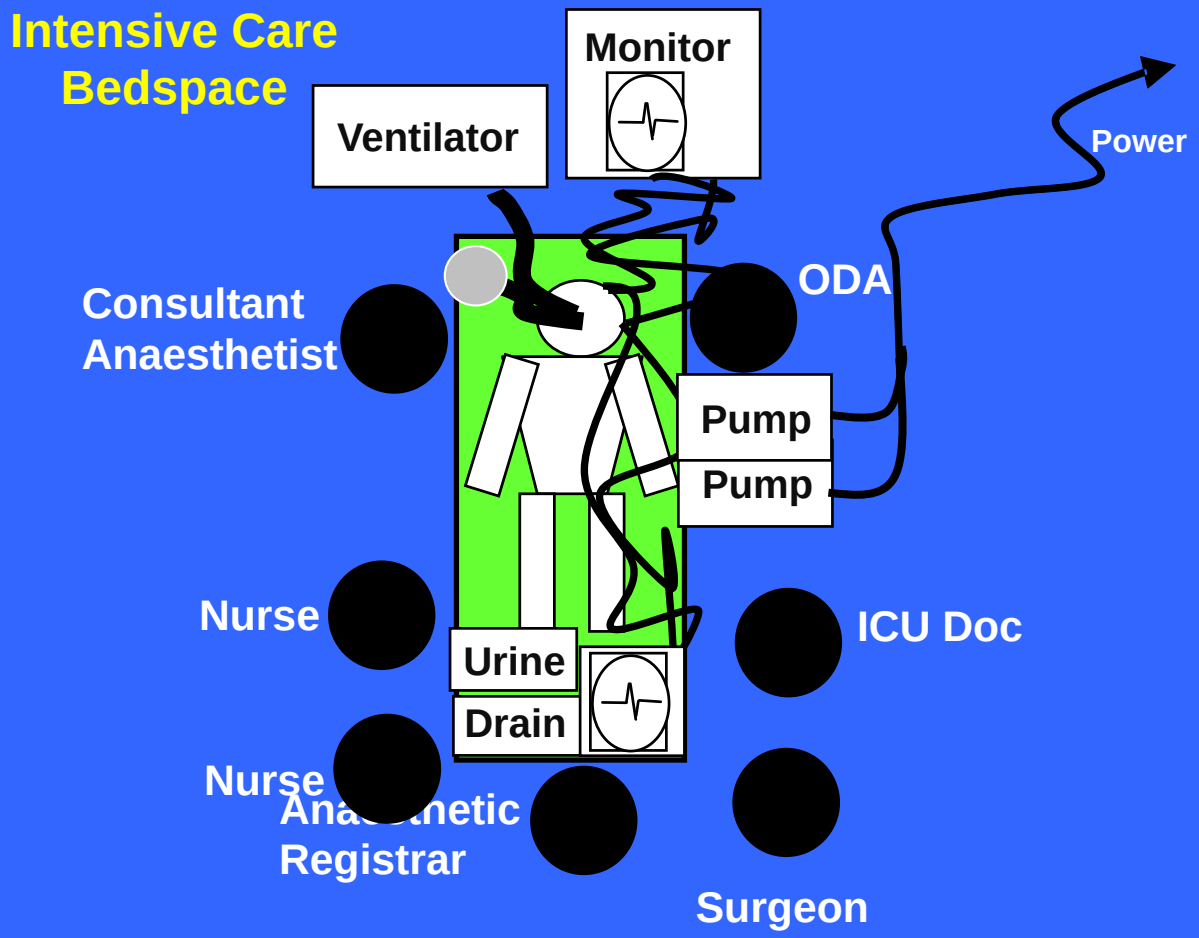
The New Way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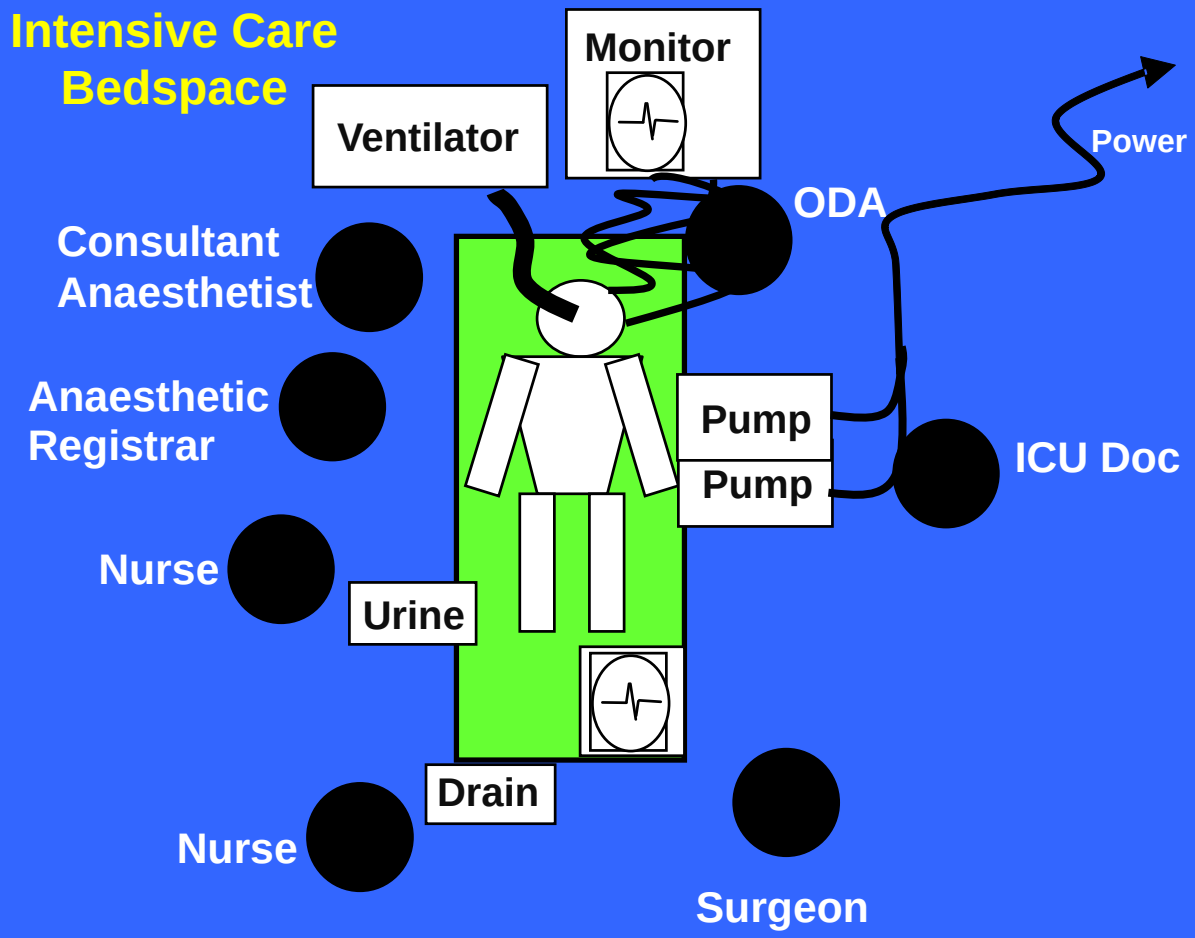
The New Way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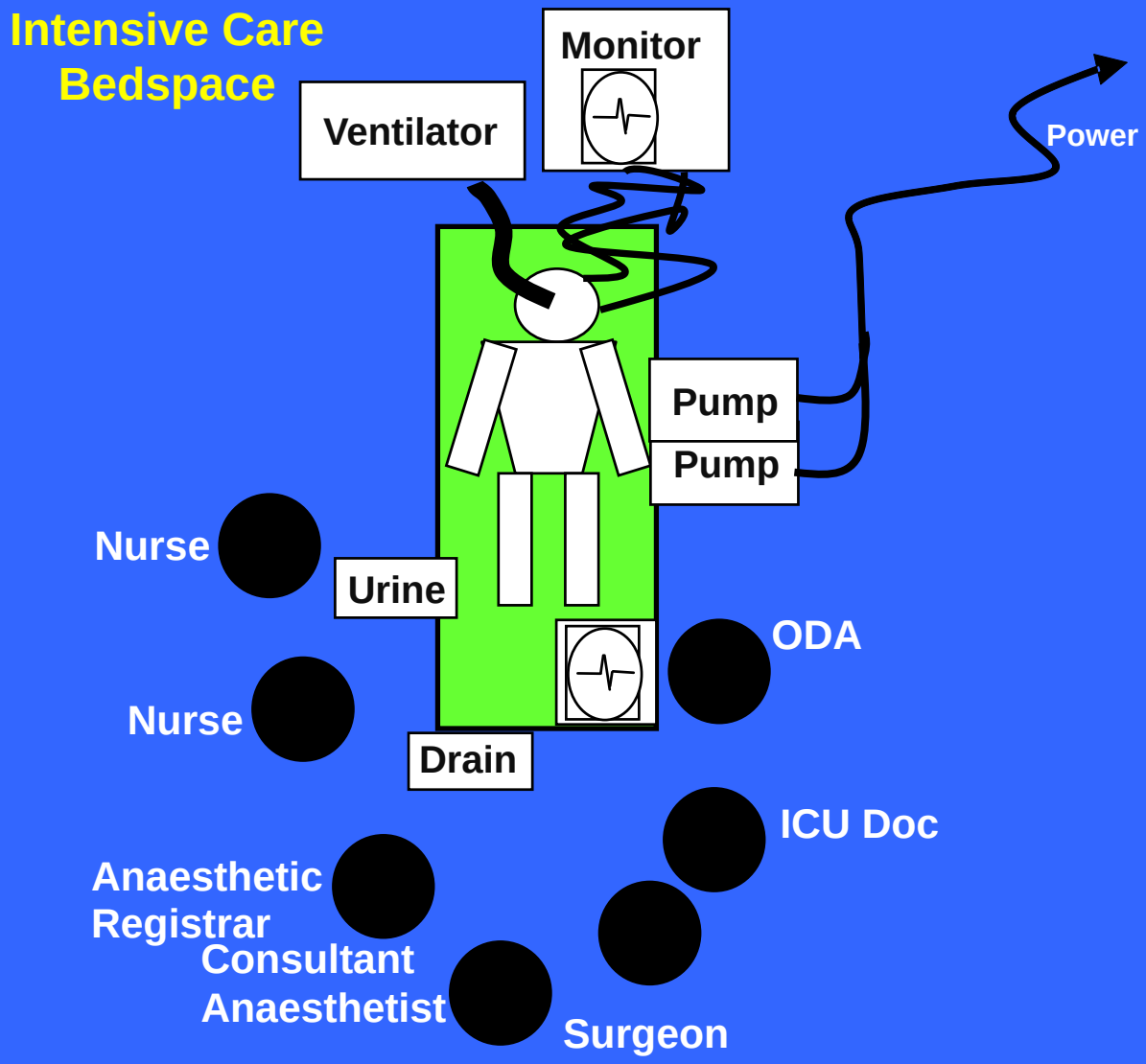
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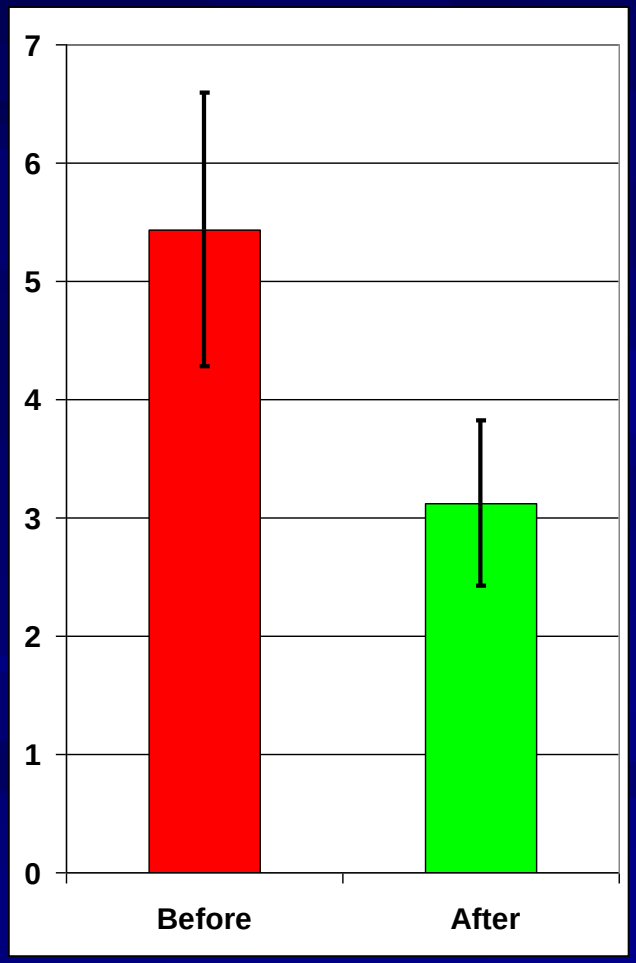
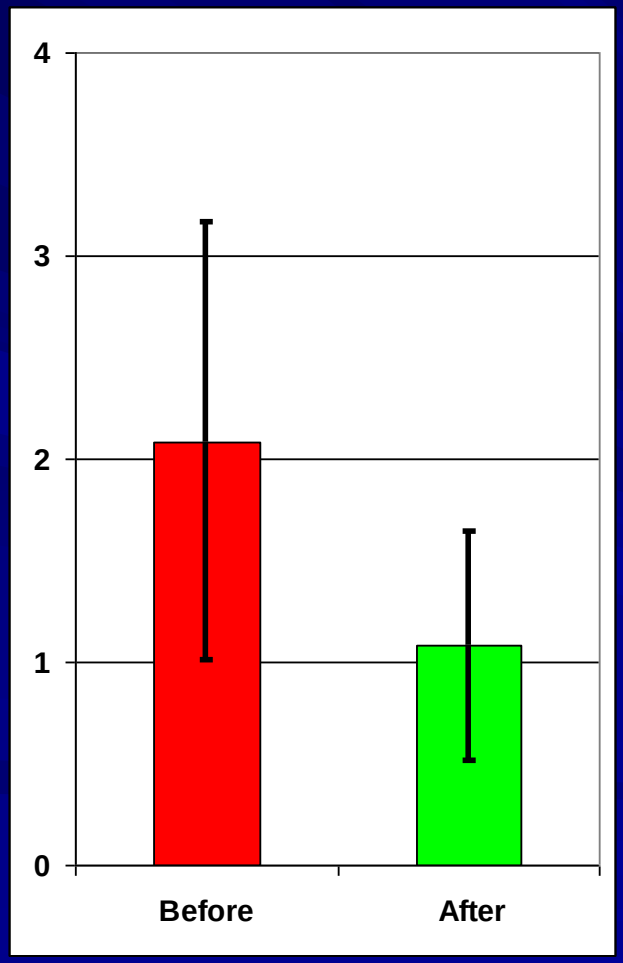
Performance improvements with new handover protocol

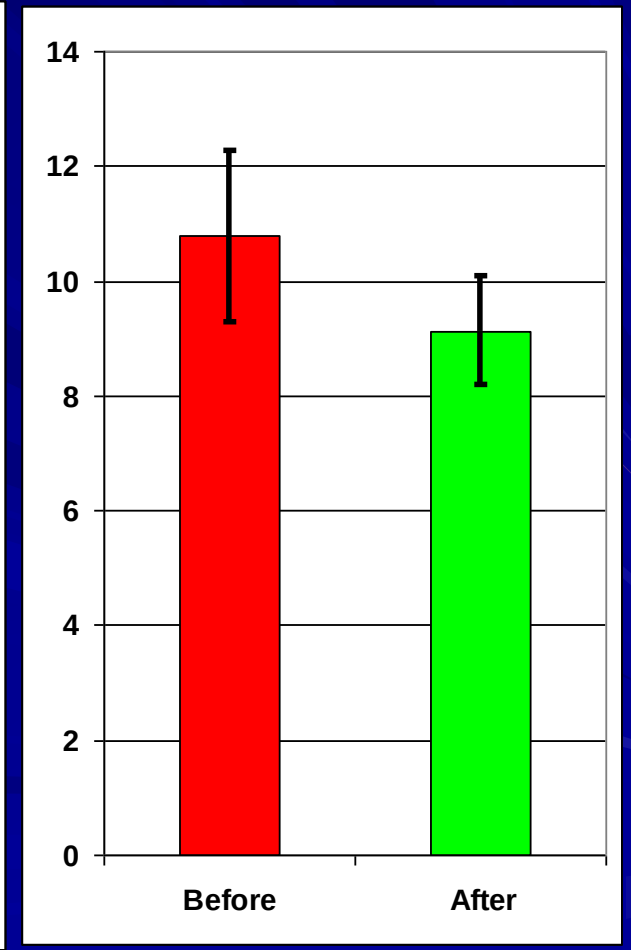
Observation of 23 pre- and 27 post- handovers, balanced for operative risk



Number of Errors



Information Omissions

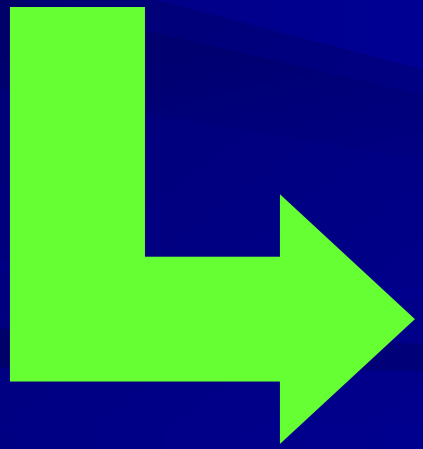


Duration (mins)

Acceptance of Change

"This is great….

……but we can make it better"



Continuous Improvement
High Reliability

Systems Thinking

NOT individual blame

Process Thinking

NOT just skill, technique or experience

Team Thinking

NOT about having the “best” people

Continuous Improvement

NOT accepting “that’s just how it is”

Thank you for listening