

# Assessing Handovers: The Formula 1 Model

QRSTU

Quality Reliability Safety & Teamwork Unit



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# High Reliability Organisations

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

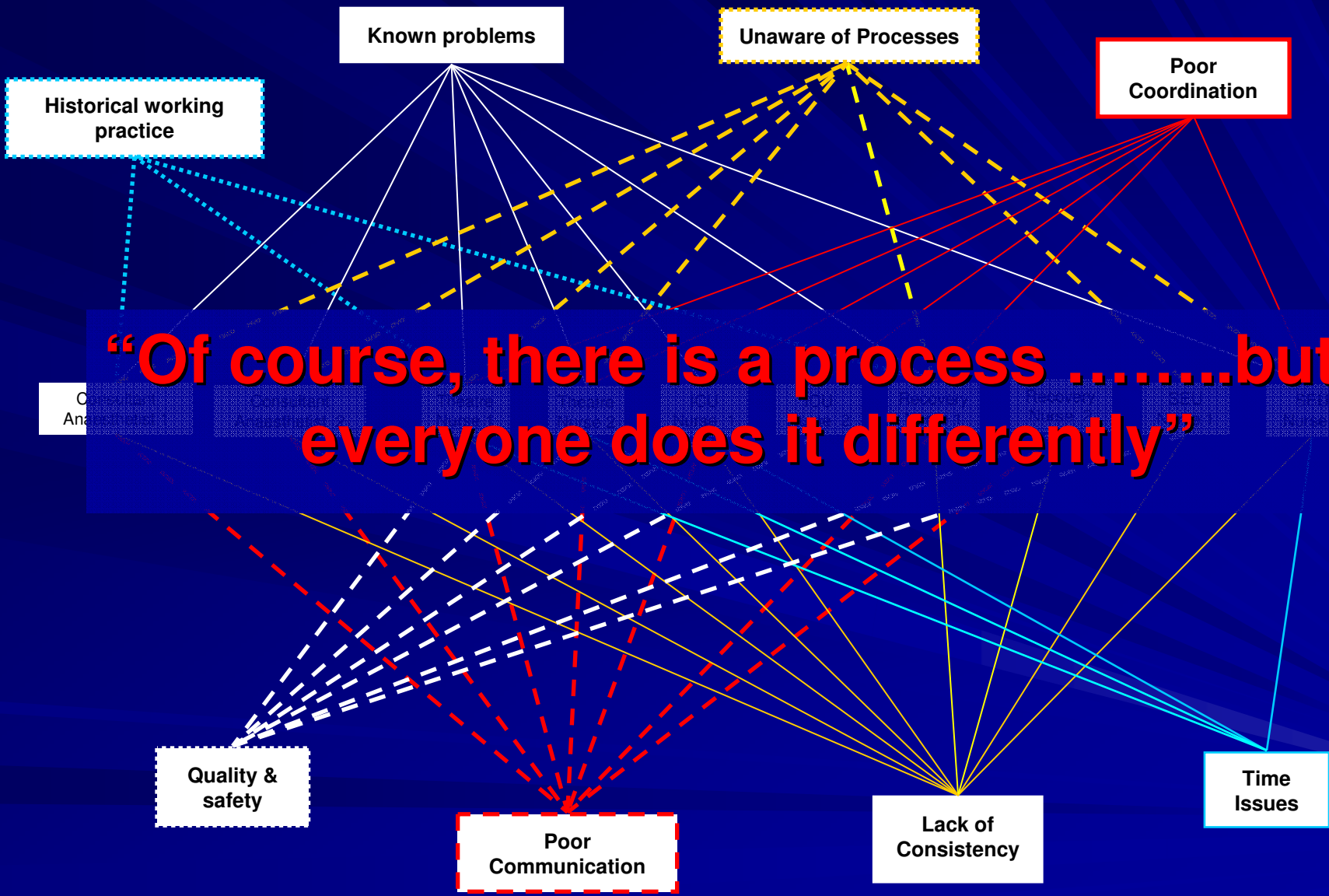
*“...the transfer from the operating theatre to the intensive care unit is one of the most difficult stages in the care of a child.”*

- 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**



**“Of course, there is a process .....but everyone does it differently”**

# The Old Way

Intensive Care  
Bedspace

Ventilator

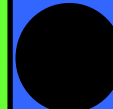
Monitor



Nurse



Consultant  
Anaesthetist



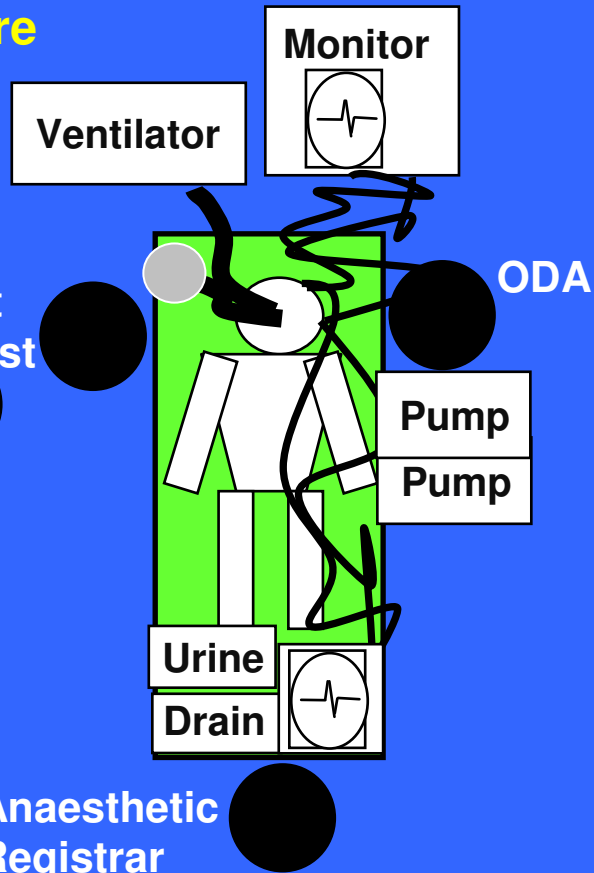
ODA

# The Old Way

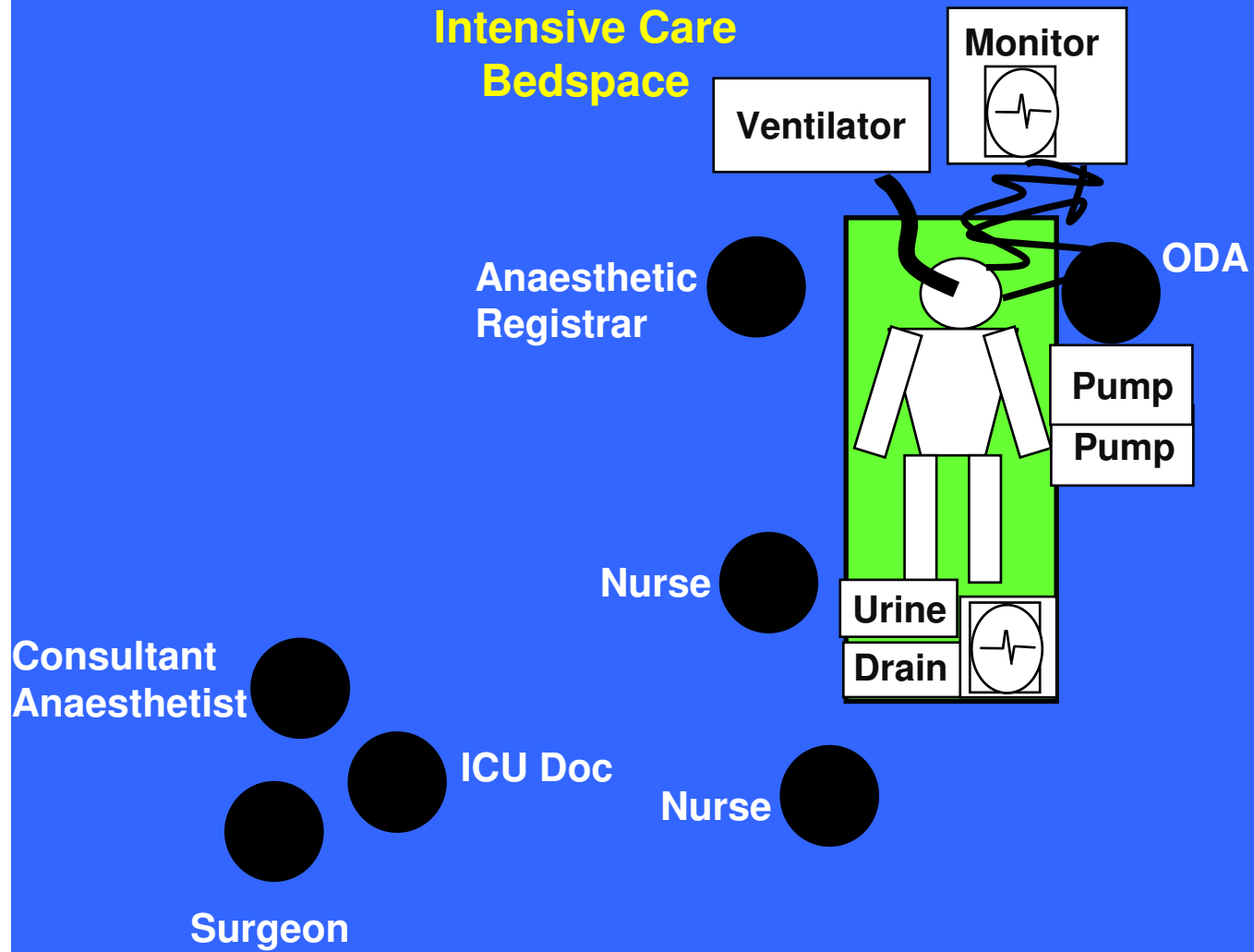
**Intensive Care  
Bedspace**

**Consultant  
Anaesthetist  
Nurse**

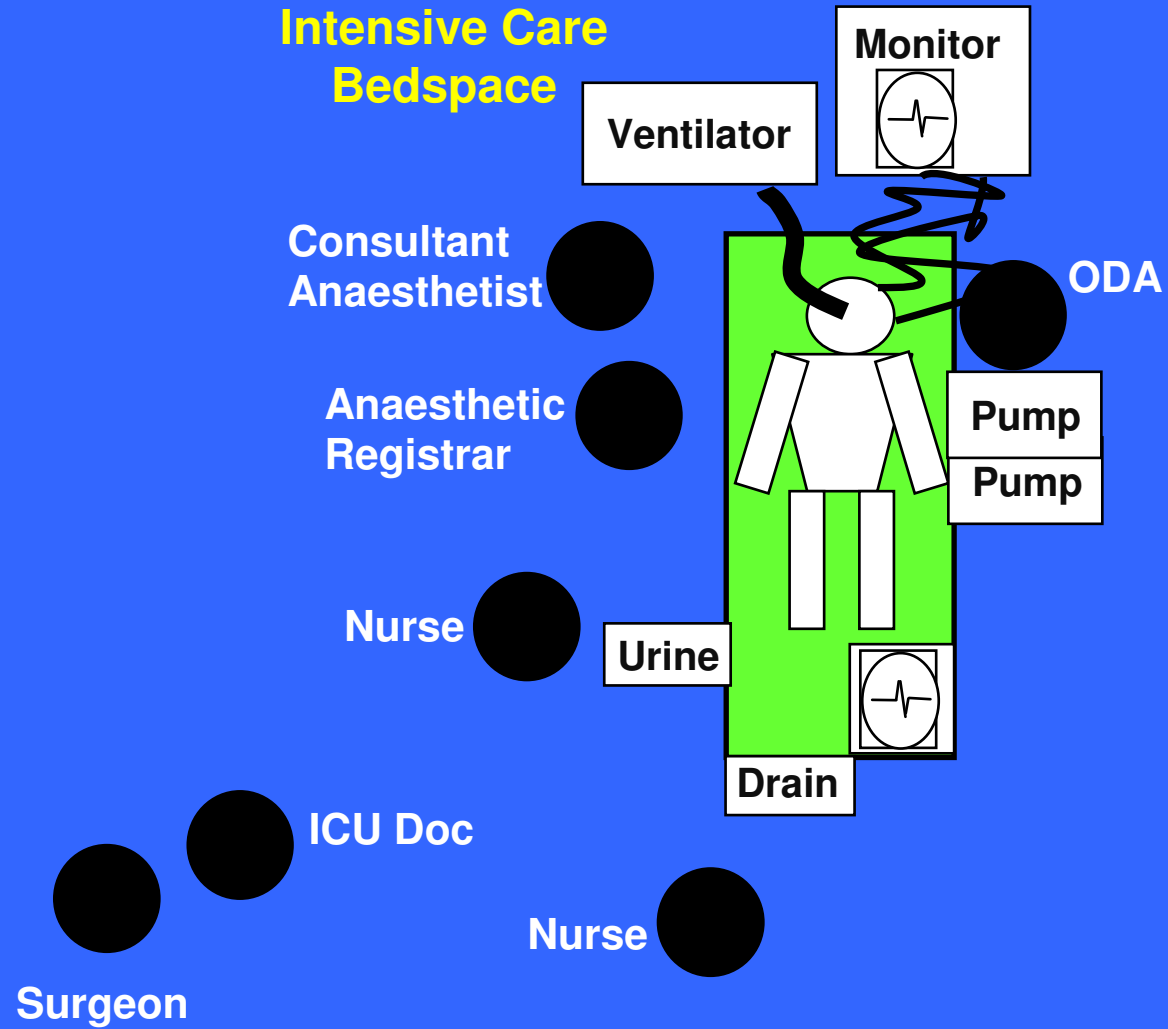
**Anaesthetic  
Registrar**



# The Old Way

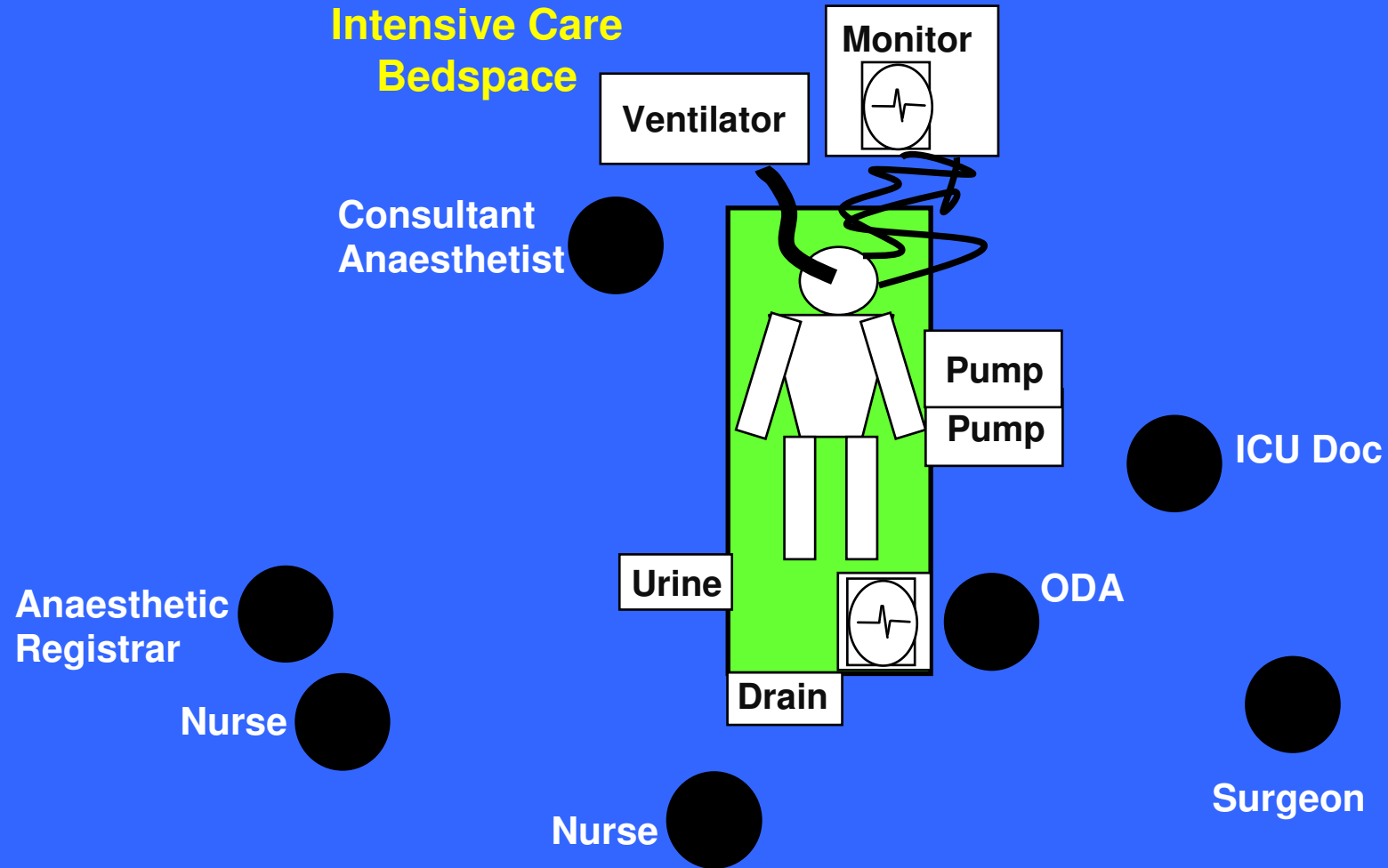


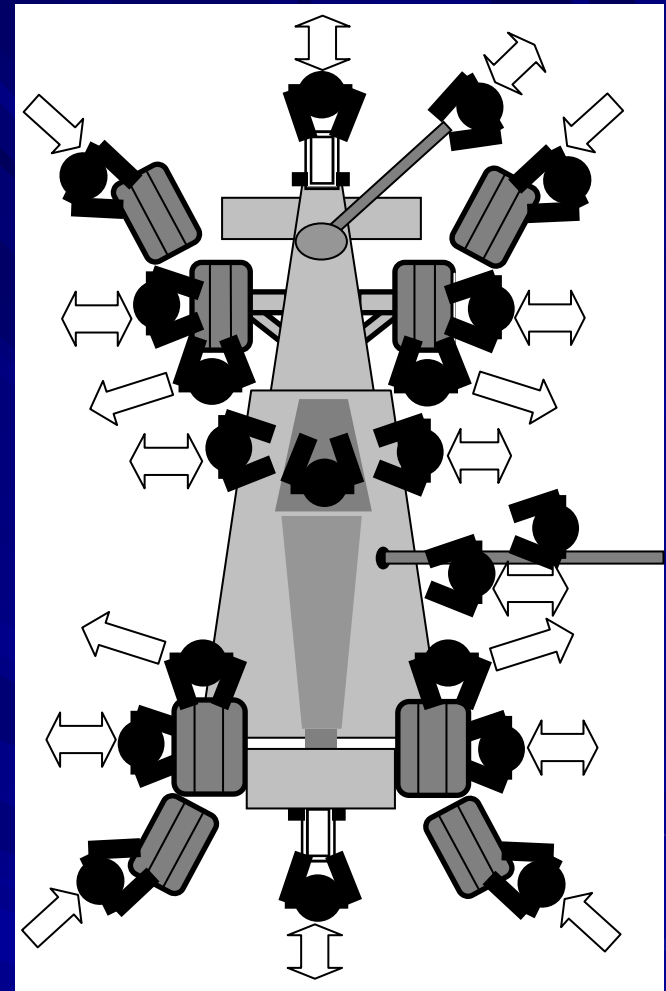
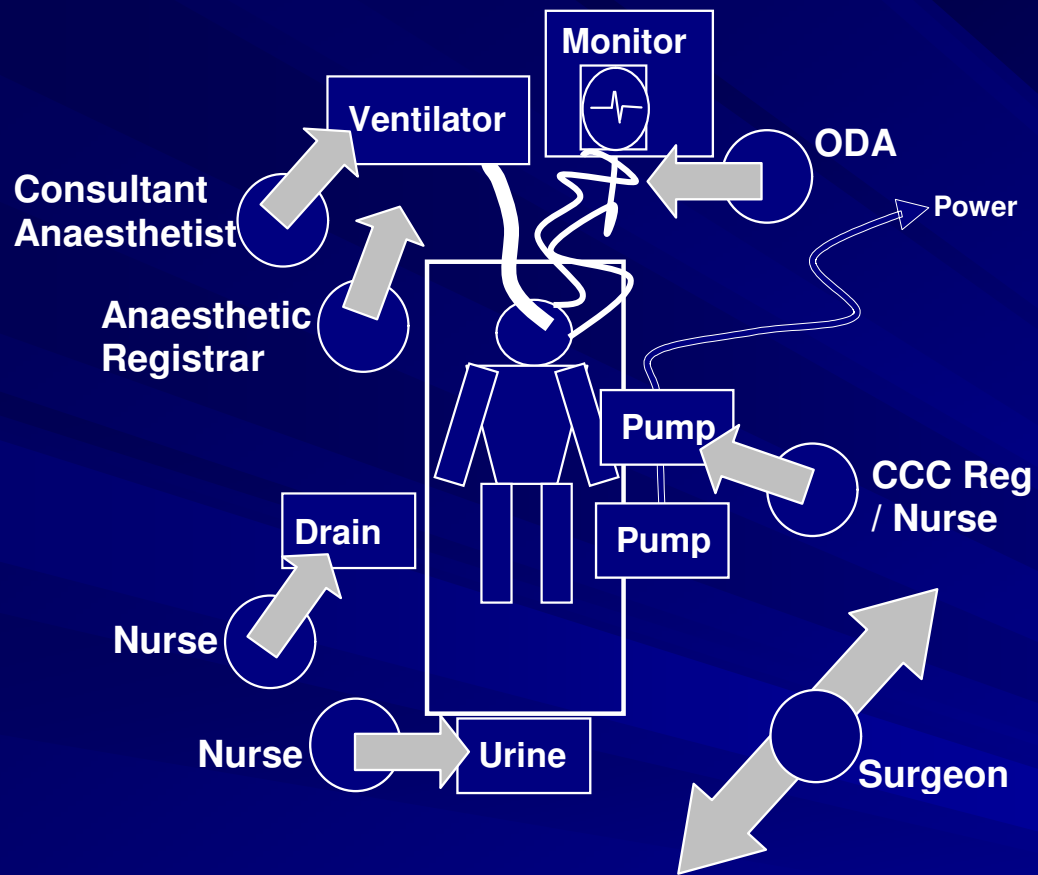
# The Old Way



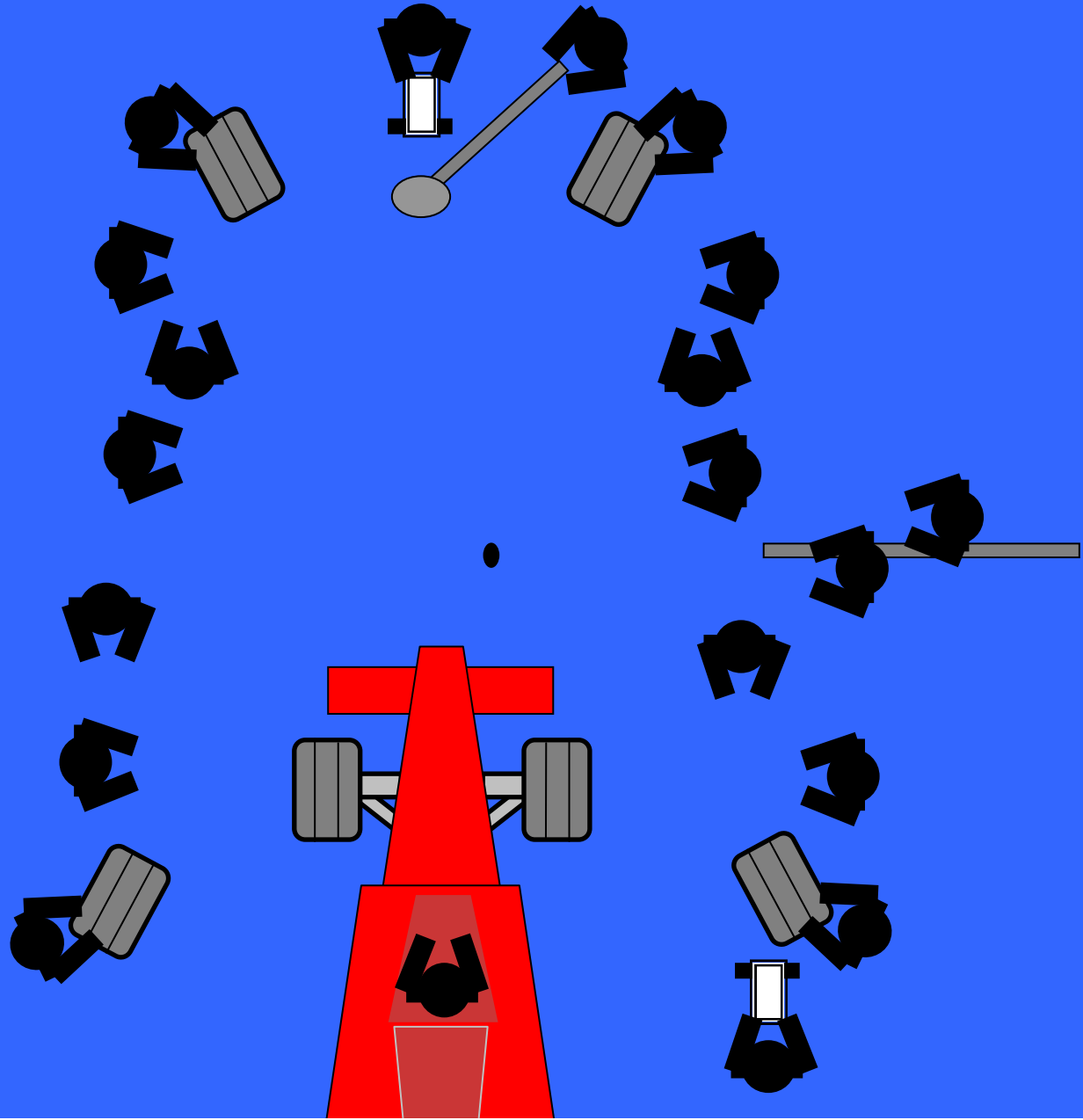


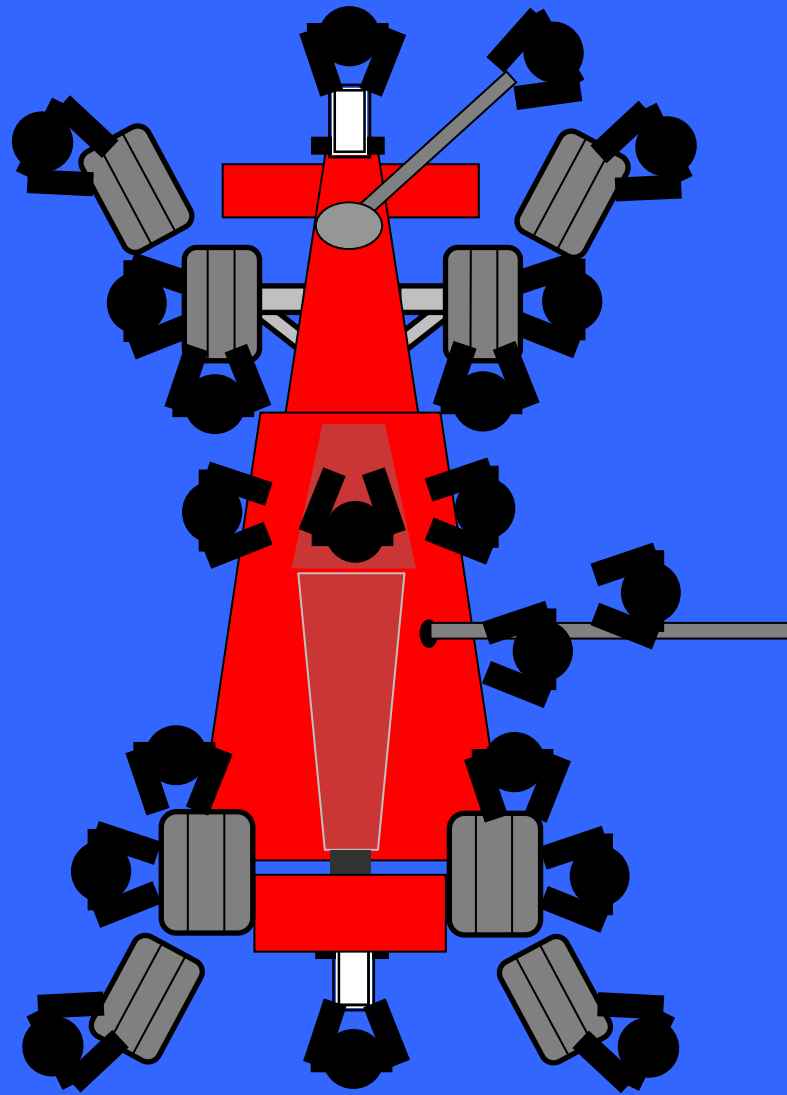
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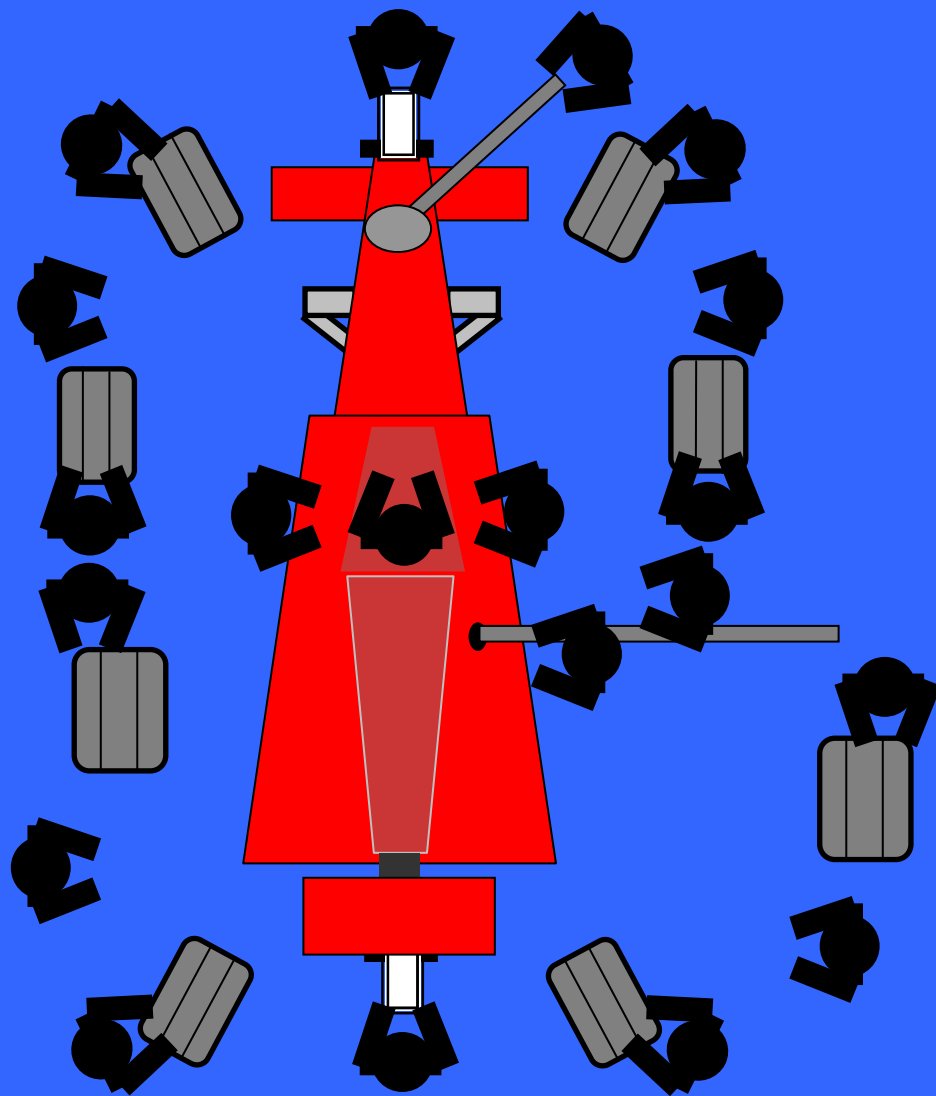


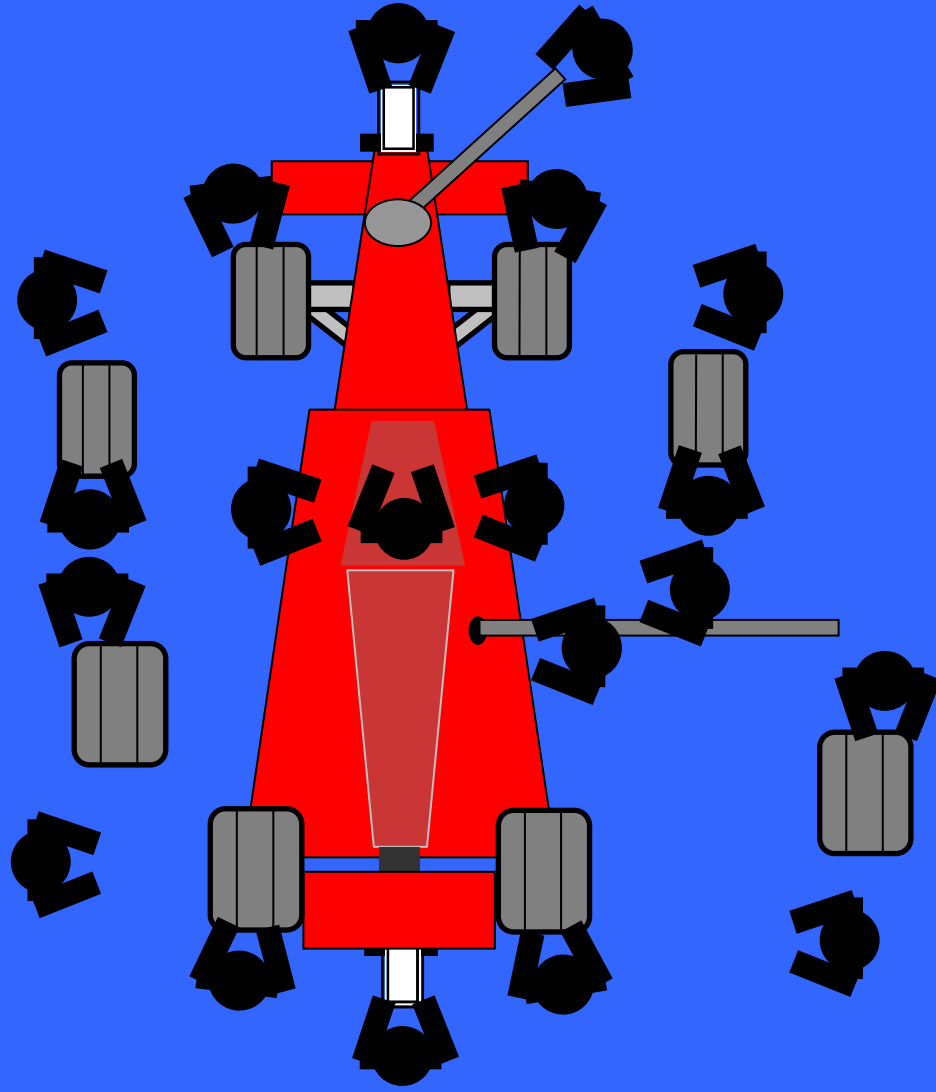


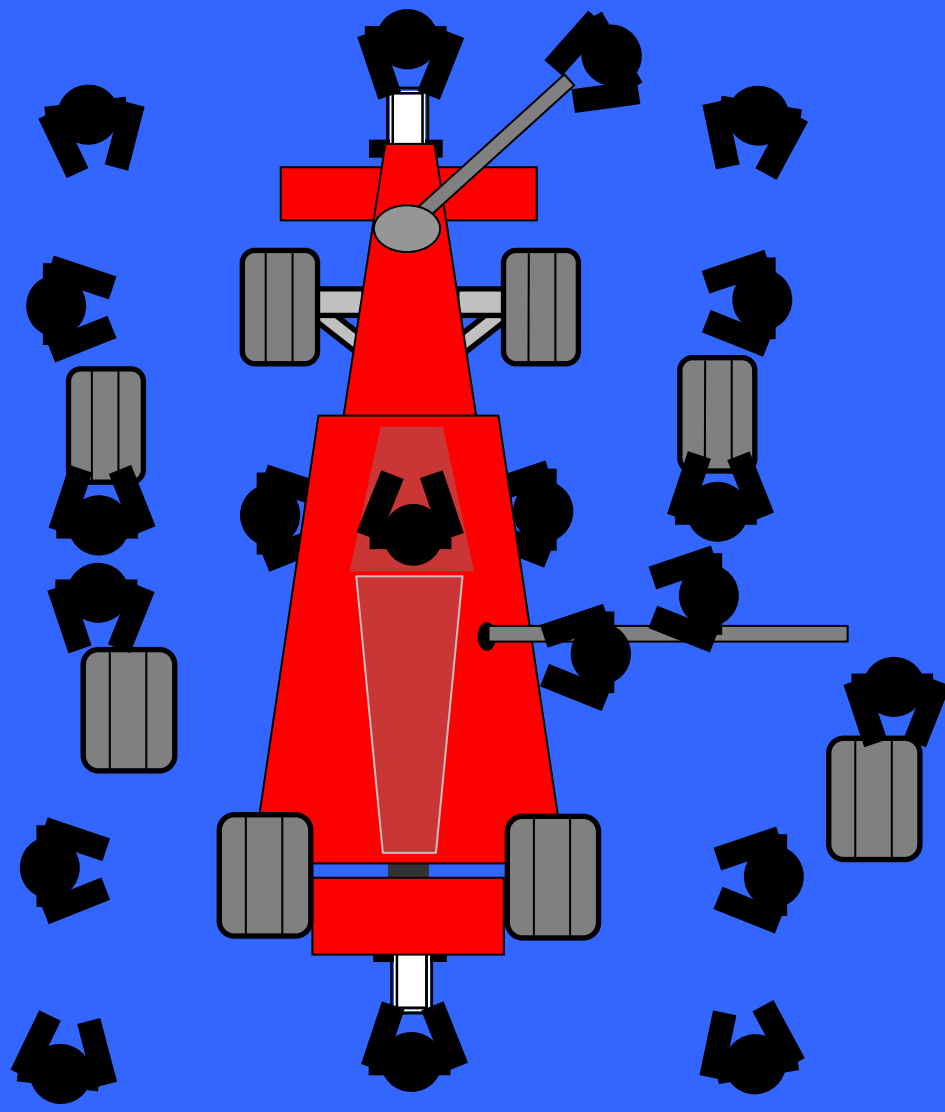
**Multiple specialists**  
**Complex tasks**  
**Complex interfaces**  
**Time pressure**  
**Need for accuracy**











# 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








# Process Organisation

## Pit Stop




## Handover

- Task sequence  
A rhythm and order to events  Needed clearly defined stages in process
- Task allocation  
Team members have defined tasks  Ventilation: Anaesthetists  
Monitoring: ODA  
Drains: Nurses
- Discipline and composure  
Explicit communication strategies to ensure calm and organised atmosphere  Comms limited during equipment phase  
Order for briefing (Anes; Surg; Discuss;Plan)  
No interruptions

# Teamwork

## Pit Stop




## Handover

- Leadership  
Who is in charge?  Anaesthetist has overall responsibility  
Defined moment for transfer to intensivist
- Involvement  
All team members encouraged to speak up  Speaking up explicitly encouraged  
Opportunities built into discussion
- Briefing  
Before every race/flight for shared picture & goals  Information transfer & discussion phase  
Supported by Thursday / Friday JJC

# Threat and Error Management

## Pit Stop

## Handover

- Checklists  
Established in 'safe' cultures  Transfer of ventilation settings  
Transfer of information; became the admission note
- Predicting and Planning  
FMEA to identify weaknesses  Formal FMEA identified need for ventilation transfer sheet  
Anticipation and contingency  
Safety checks built into process
- Situation Awareness (SA)  
See; Understand; Predict  Consultants maintain SA by standing back  
'Overview' by most able team member  
Safety checks enhance SA

# Overview of the New Process

Prior to  
Transfer



**Patient Transfer Sheet  
obtained from theatre**

**Bedspace &  
equipment prepared in  
CCC**

# Patient Transfer Form

## PATIENT TRANSFER FORM Surgery to Cardiac Critical Care Handover

DATE  /  /   
TIME

### PATIENT DETAILS

Name  Age  Weight  kg

### VENTILATOR SETTINGS

a) Mode (i) Pressure control   
(ii) Volume control   
(iii) SIMV Pressure Mode   
Volume Mode

b) Rate

c) I-time

d) Tidal Volume or PIP (actual, not above PEEP)

e) PEEP

f) F<sub>i</sub>O<sub>2</sub>

**NOTE:**  
Ventilator to be configured only by CCC Registrar or  
Advanced Respiratory qualified Nurse

### MONITORING LINES

Number <input type="text"/>	Location of <b>Central</b> Line (circle)	Left	Right
	Location of <b>Arterial</b> Line (circle)	Left	Right

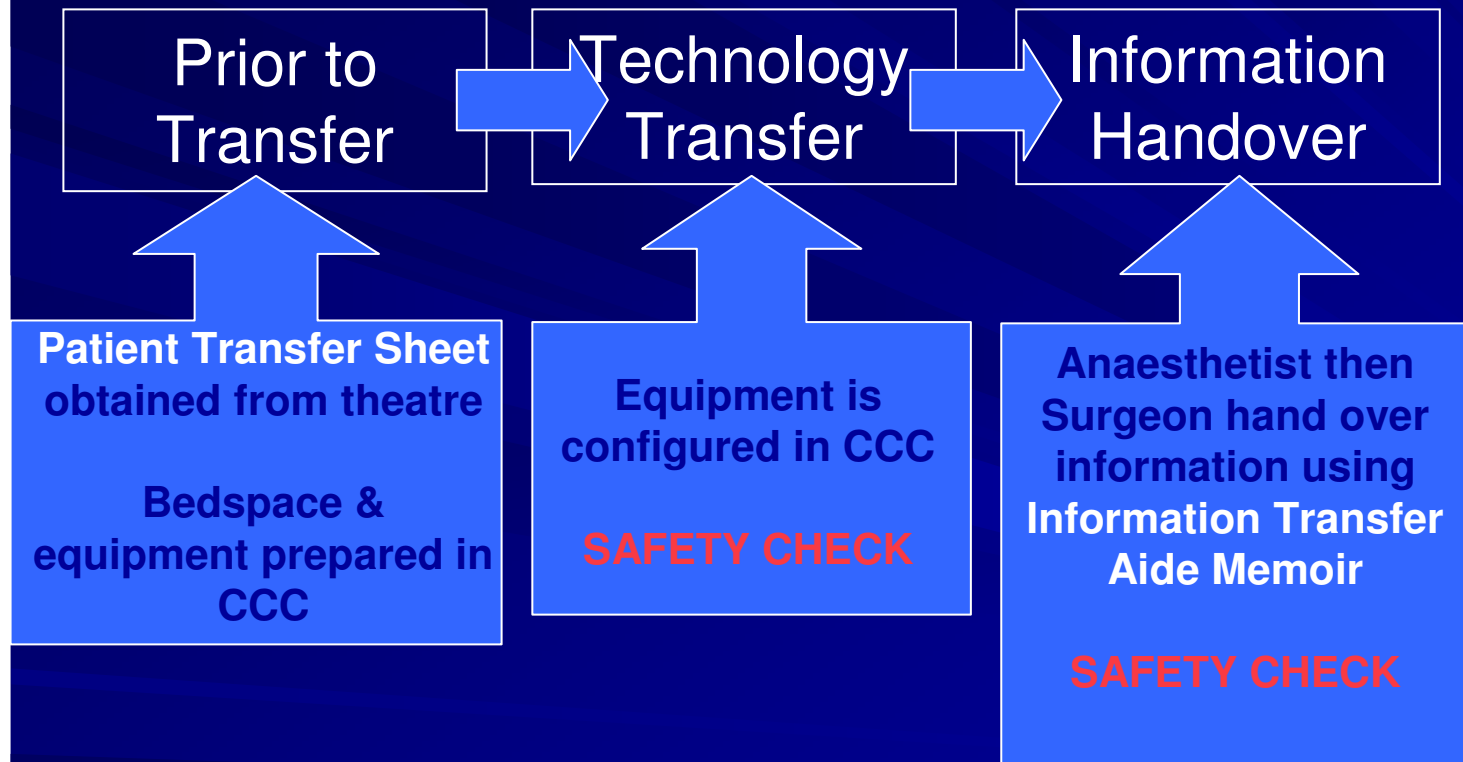
### VASOACTIVE AGENTS (Tick)

Dopamine <input type="checkbox"/>	Milrinone <input type="checkbox"/>	Adrenaline <input type="checkbox"/>
Nitric Oxide <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### OTHER

Chest Open  Notes

# Overview of the New Process



# Information Handover

## Handover Aid Memoir

### PATIENT DETAILS

Name Age Weight  
Preop Diagnosis & JCC plan  
Preop condition

### OPERATIVE COURSE

Anaesthetic problems  
ETT size, Line locations (problems)  
Operation performed  
CPB CC CA times  
Weaning from CPB & course

### PRESENT STATUS

Haemodynamics  
Infusions  
Ventilation  
TOE/Echo  
Bleeding (products given / ordered)  
Antibiotics

### PLAN

Anticipated problems / recovery  
Immediate care strategy

**Operating Team**

## Handover Aid Memoir

### PATIENT DETAILS

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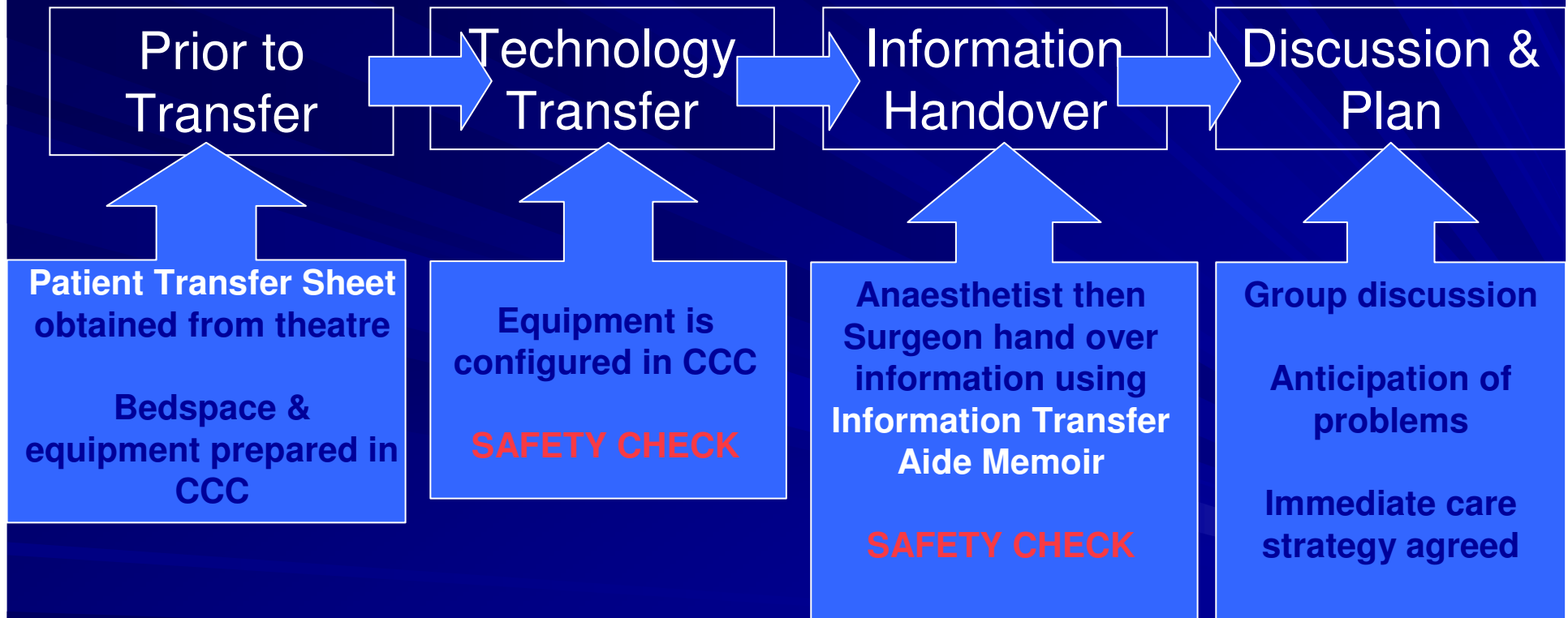
Haemodynamics  
Infusions  
Ventilation  
TOE/Echo  
Bleeding (products given / ordered)  
Antibiotics

### PLAN

Anticipated problems / recovery  
Immediate care strategy

**Critical Care Team**

# Overview of the New Process



**Training time = 30 minutes**



# Resistance to Change

“It’s fine as it is”

“We’ve always done it like this”

“We don’t have time to do it like this”

“It might make things worse”

“But so many other things are wrong”

“Surgery isn’t like motor racing”

# Making the Change

- Identify the problem
  - Break it down
  - Generate multiple solutions
- Involve everyone
  - Be visible
  - Obtain support and establish “Champions”
  - Use the most negative people
  - Don’t listen to “No”
- Make the change
  - Gather evidence
  - Plan, Do, Check, Act

# The New Way

Intensive Care  
Bedspace

Ventilator

Monitor



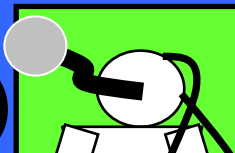
CCC Reg

Nurse

Nurse

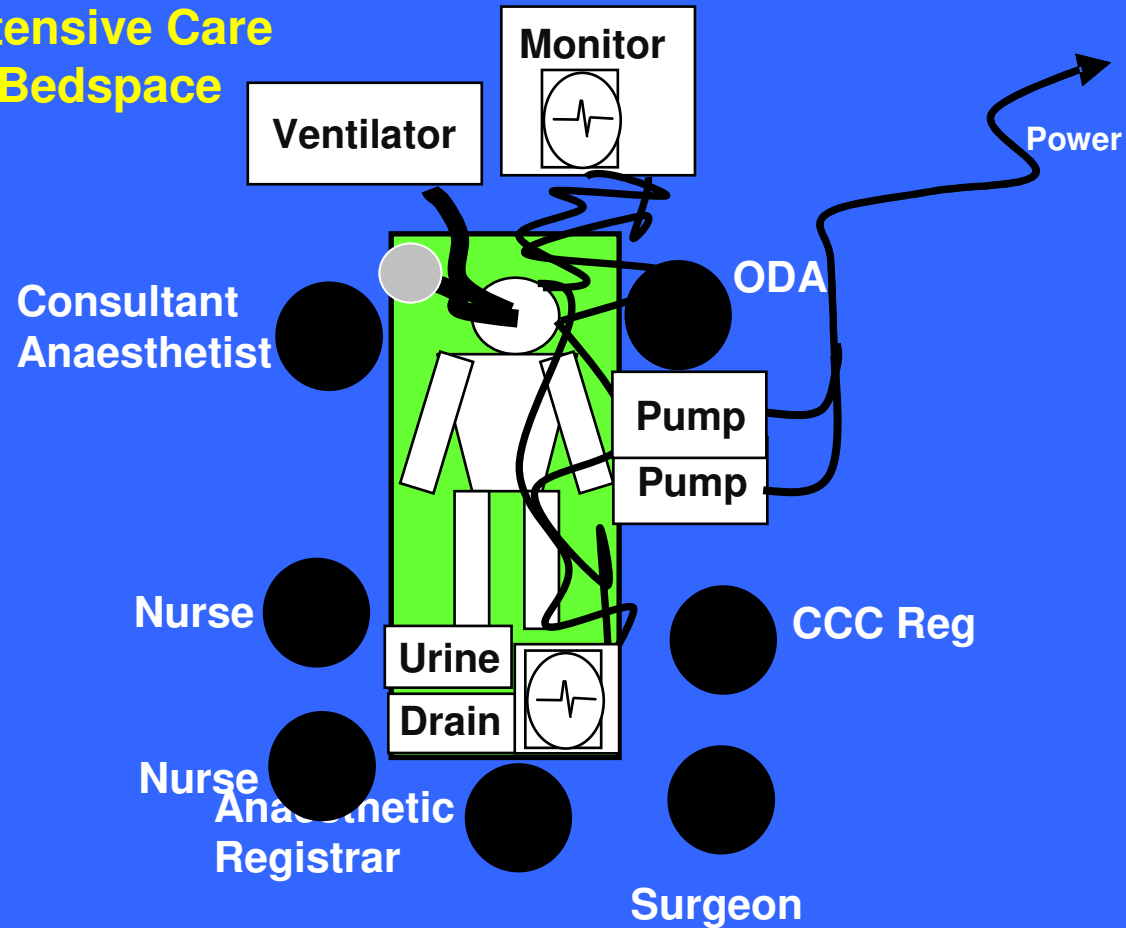
Consultant  
Anaesthetist

ODA



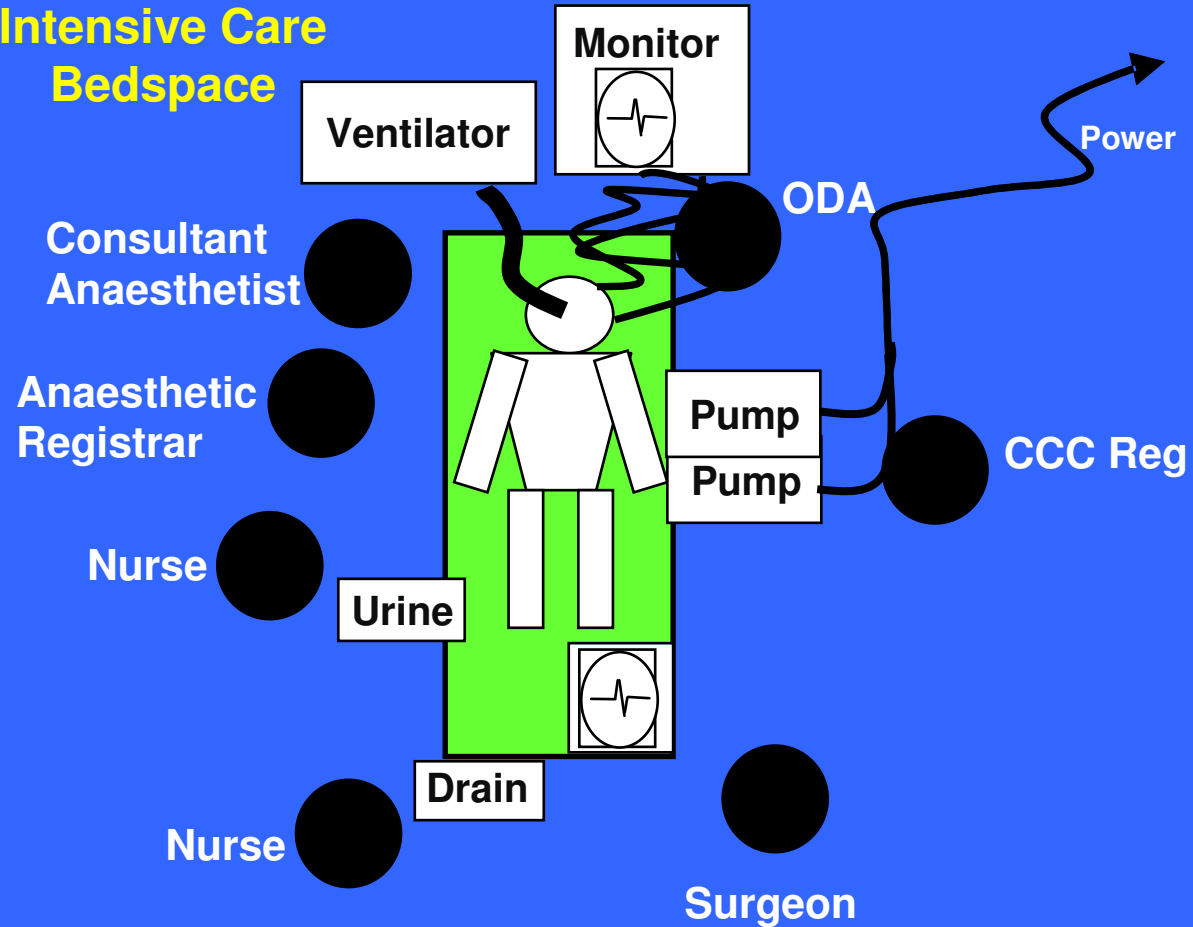
# The New Way

Intensive Care  
Bedspace



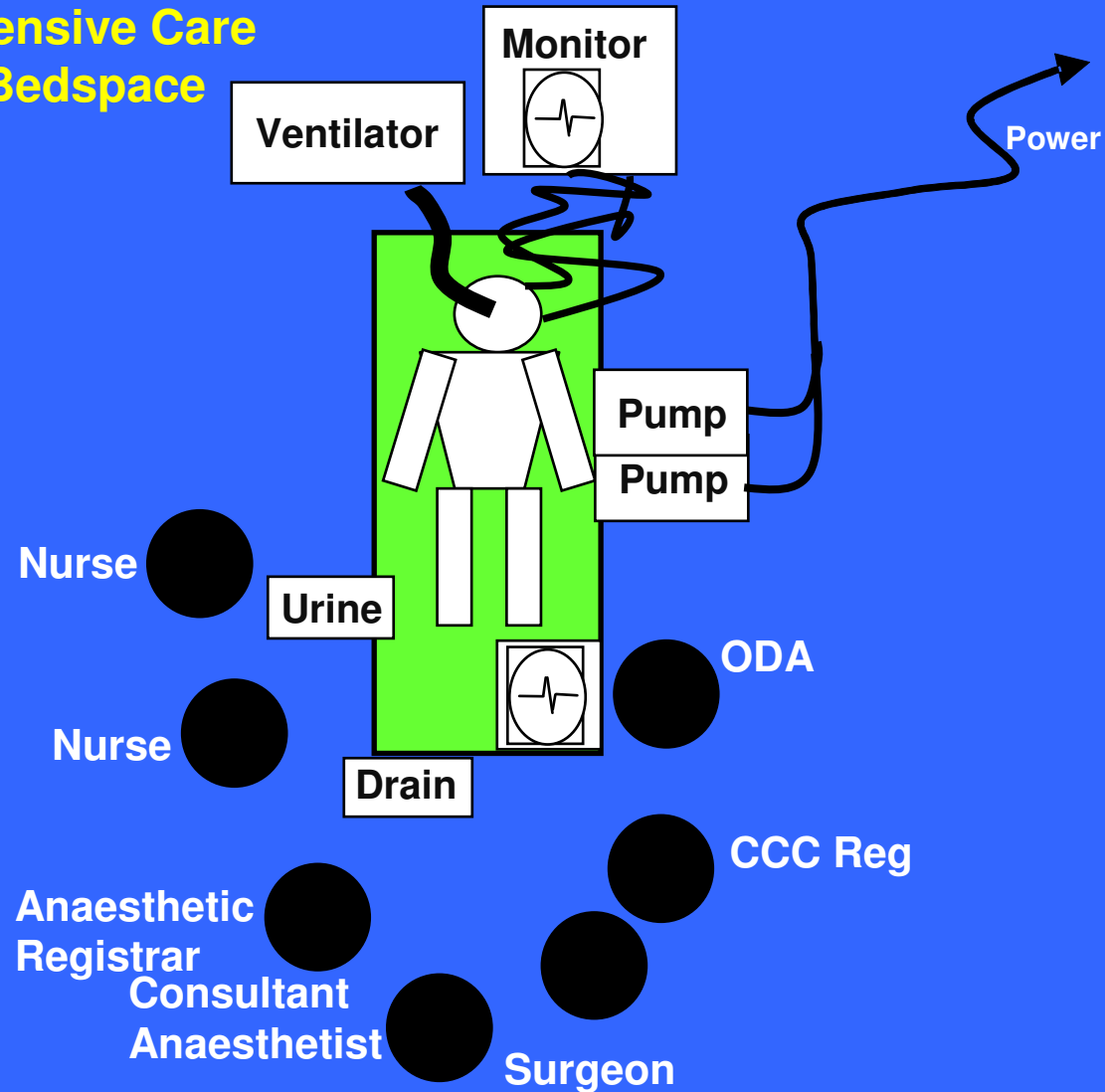
# The New Way

**Intensive Care  
Bedspace**



# The New Way

Intensive Care  
Bedspace



# Observational Measurement

HANDOVER ASSESSMENT CHECKLIST

RECORD TIME ARRIVED AT ICU BAY  :  :

**In ICU**

**Preparation**

Ventilator running on test lung TM

Monitor & alarms already set TM

Pump stand is already prepared (IF portable system not in use) WE

**Ventilation**

Ventilator set up WE

Patient moved from bag to ventilator easily

Time off ventilation is minimised

**Transfer of Monitoring**

Transfer monitoring lines from portable equipment

Equipment is zeroed and configured appropriately

Patient Status is checked

Tension on lines is minimised

Minimum time off monitoring

**Setup Infusion Pumps**

Infusion pumps are transferred to pump stand

Infusion pumps are plugged in

Infusion pumps are checked for correct functioning

**Drains/Urine/Workspace**

Drains are located safely and put on suction

Urine bag is located safely

Lines are neatly organised

Patient Status is checked

**Briefing**

RECORD TIME BRIEFING STARTS  :  :

**Preparation**

All equipment is ready and configured

Present are: 2 ICU Nurses  AC  AR  CS  SR  CI

All personnel are attentive

**Management**

AC oversees briefing LT

AC checks readiness to brief TM

Well ordered LT

Anaesthetist speaks first LT

Surgeon speaks second LT

Discussion is saved for the end LT

**Briefing Content**

Name  Age  Weight

Preop. Diagnosis  Preop. condition  Anaesthetic problems

Op Performed  CPB Time  CA Time

Problems in theatre  Problems weaning from CPB

Present status : Haemodynamics  Ventilation  Infusions  TOE/Echo

Bleeding  Blood products  Antibiotics

Plan: Wake & Wean  Time to Review  Ventilation  ECMO Risk

RECORD TIME BRIEFING FINISHES  :  :

**Leadership & Teamwork**

GOOD: Good co-ordination; good communication; mutually supportive; assertive, calm, encouraging leadership.

BAD: Poor co-ordination; poor communication; unsupportive; non-vocal, aggressive, unassertive leadership.

Very Bad					Very Good
1	2	3	4	5	

**Task Management**

GOOD: Plans made prior to actions; good task prioritisation; maintenance of standards; using resources; the right things happening at the right time.

BAD: Actions made without plans; poor co-ordination; poor task prioritisation; poor standards; resources incorrectly or inappropriately used; delays

Very Bad					Very Good
1	2	3	4	5	

**Workspace and Equipment**

GOOD: Appropriate equipment not immediately available; correct operation of equipment; good alarm resolution; functionality and serviceability checked

BAD: Equipment not immediately available; poor operation of equipment; poor or slow alarm resolution; equipment not checked

Very Bad					Very Good
1	2	3	4	5	

**Situation Awareness**

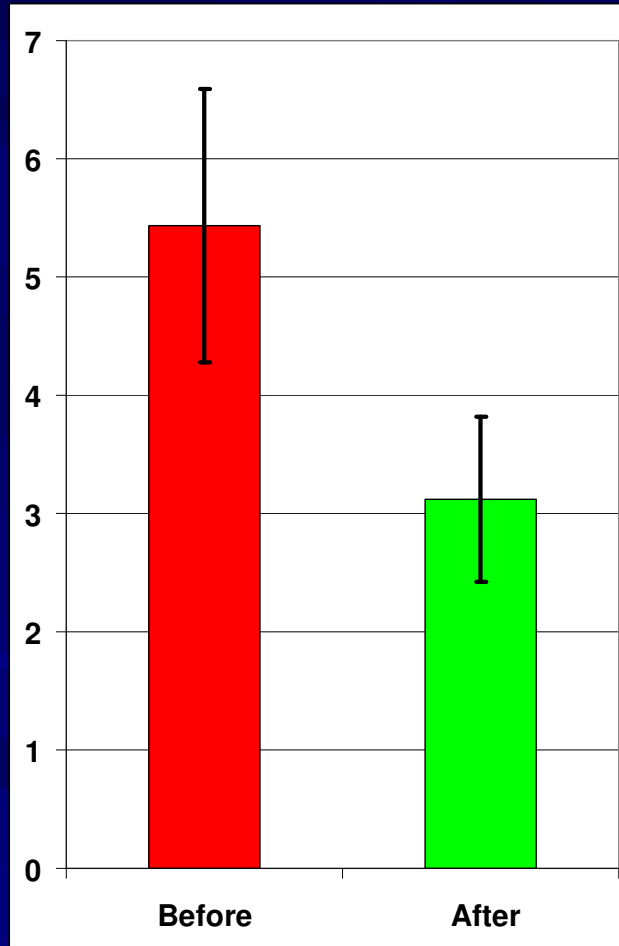
GOOD: Monitors visible; monitoring reliable; monitoring information gathered; pump displays visible; pump information gathered; recognition of patient state; anticipation of patient state

BAD: Monitors not visible; monitoring unreliable; monitoring information not gathered; pump displays not visible; pump information not gathered; poor recognition of patient state; poor anticipation of patient state.

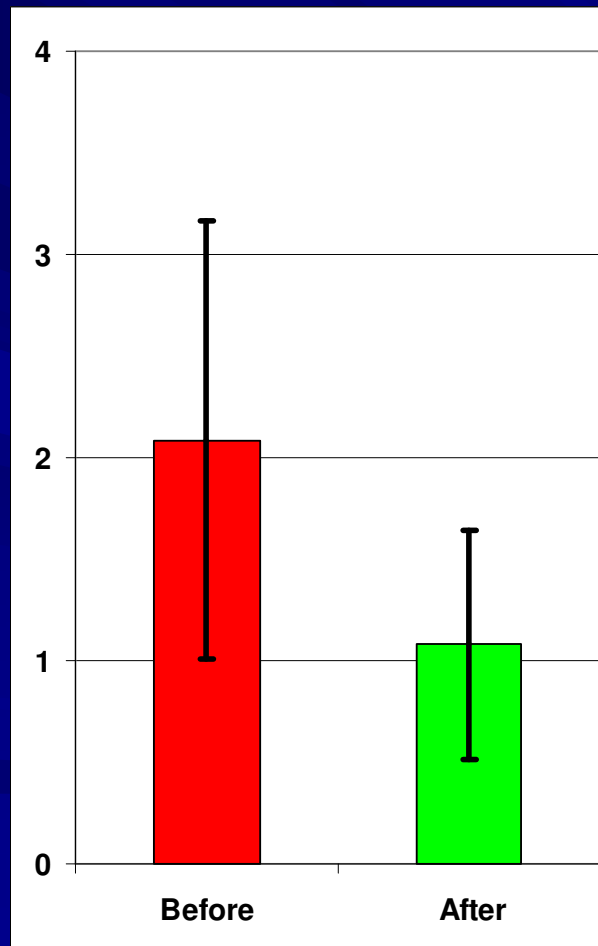
Very Bad					Very Good
1	2	3	4	5	

# Performance improvements with new handover protocol

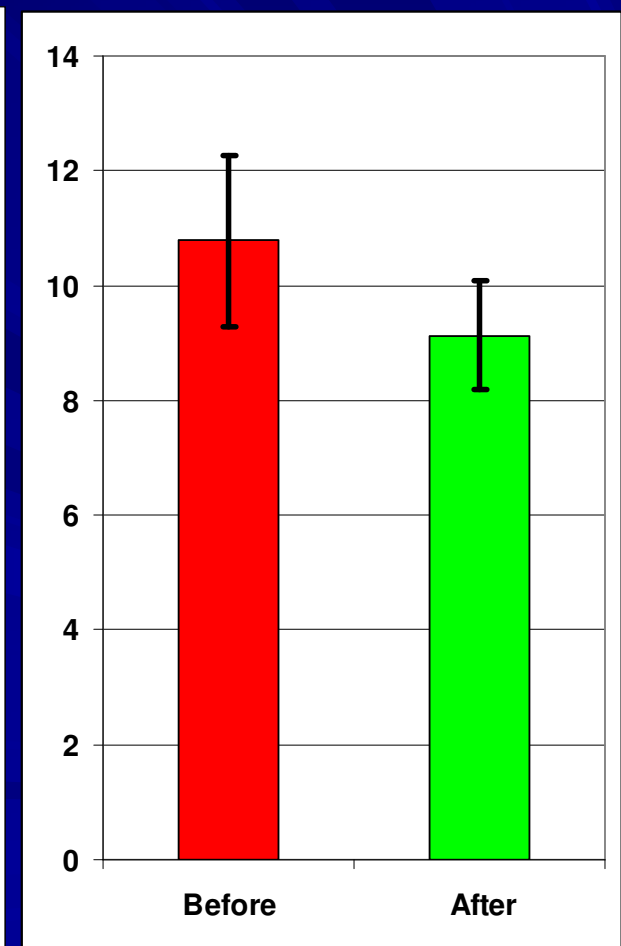
Observation of 23 pre- and 27 post- handovers, balanced for operative risk



Number of Errors



Information Omissions



Duration (mins)



# Reduction in Compounding Errors

Errors in **BOTH** Equipment AND Information:

**>1 in both**

**BEFORE**

39% (9)

**AFTER**

11% (3)

**>4 in both**

13% (3)

4% (1)

**Correlation**

$r=0.513$

$p<0.01$

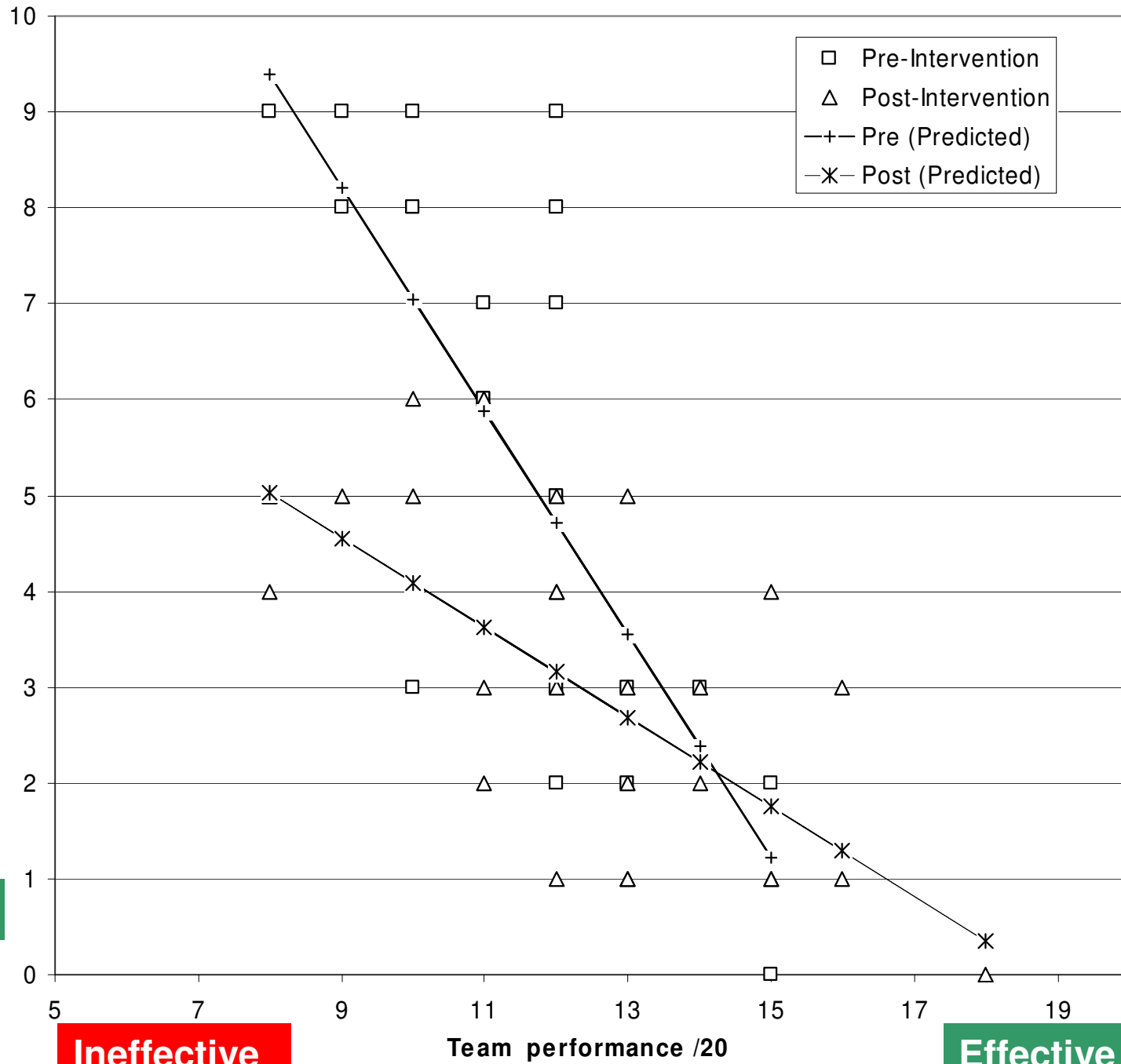
$r=0.262$

$p=0.186$

Poor

Number of Errors

Good



Ineffective

Effective

# Acceptance of Change

*“This is great....*

*.....but we can make it better”*

Consultant Anaesthetist, February 2007



**Continuous Improvement**  
**High Reliability**

# Essentials for Sustainability?

- Clinical focus for all interventions
  - To ensure it continues to happen
- Support from senior management
  - To provide prioritisation, motivation & continuity
- Iterative approach
  - Don't think your first solution will work
- Continuous Quality Improvement
  - Because you can always get better

# Selected Publications

- **Catchpole, K**, Bell, D, Johnson, S (2008). Safety in Anaesthesia: A study of 12606 reported incidents from the UK National Reporting and Learning System. *Anaesthesia* 63, pp. 340-346.
- **Catchpole, K**, Mishra, A, Handa, A, McCulloch, P (2008). Teamwork and Error in the Operating Room: Analysis of Skills and Roles. *Annals of Surgery*, 247(4), pp.699-706.
- Mishra A., **Catchpole, K**, Dale, T, McCulloch, P. (2008). The influence of non-technical performance on technical performance in laparoscopic cholecystectomy. *Surgical Endoscopy and other Interventional Techniques* 22(1), pp.68-73.
- **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.
- **Catchpole, K**, de Leval, M, McEwan, A, Pigott, N, Elliott, M, McQuillan, A, MacDonald, C, Goldman, A (2007). Patient Handover from Surgery to Intensive Care: Using Formula 1 and Aviation Models to Improve Safety and Quality. *Pediatric Anesthesia* 17(5), pp. 470-478.
- **Catchpole, K**, Giddings, A, De Leval, M, Peek, G, Godden, P, Utley, M, Gallivan, S, Hirst, G, Dale, T (2006). Identification of systems failures in successful paediatric cardiac surgery. *Ergonomics* 49(5-6), pp.567-588

# Thank you for listening

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