

Human Reliability Assessment

Managing risks in healthcare using
tools from the safety critical
industries

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The magnitude of the patient safety problem

- Adverse events occur in about 10% of all hospital admissions about 850,000 per year, with estimated costs amounting to about £2 billion per year, in terms of additional hospital days
- The NHS also pays out about £400 million per year in settlement of clinical negligence claims, with a potential liability of around £2.4 billion for existing claims.

Issues to discuss

- Is human error, inevitable, predictable or preventable?
- How have other safety critical industries coped with the problem of human error?
- What tools and techniques are available and can they be applied in a medical context?

Queens Medical Centre Nottingham 2001 – Fatal Intrathecal Injection

- “Two doctors could face manslaughter charges after the death yesterday of a teenager from a powerful anti-cancer drug that was wrongly injected into his spine” *[Guardian Feb 3, 2001]*
- Inquest recorded a verdict of accidental death and doctor apologised for “a genuine mistake from a lapse of concentration” *[Guardian Feb 3, 2001]*

Reactions to the Sentence

"For all the failures of the hospital systems and of the education and training of doctors highlighted by this case, nothing should disguise the fact that the doctors treating Wayne fell short of their professional responsibilities [and] are to blame for his death"

Patient's Solicitor

Reactions to the Sentence

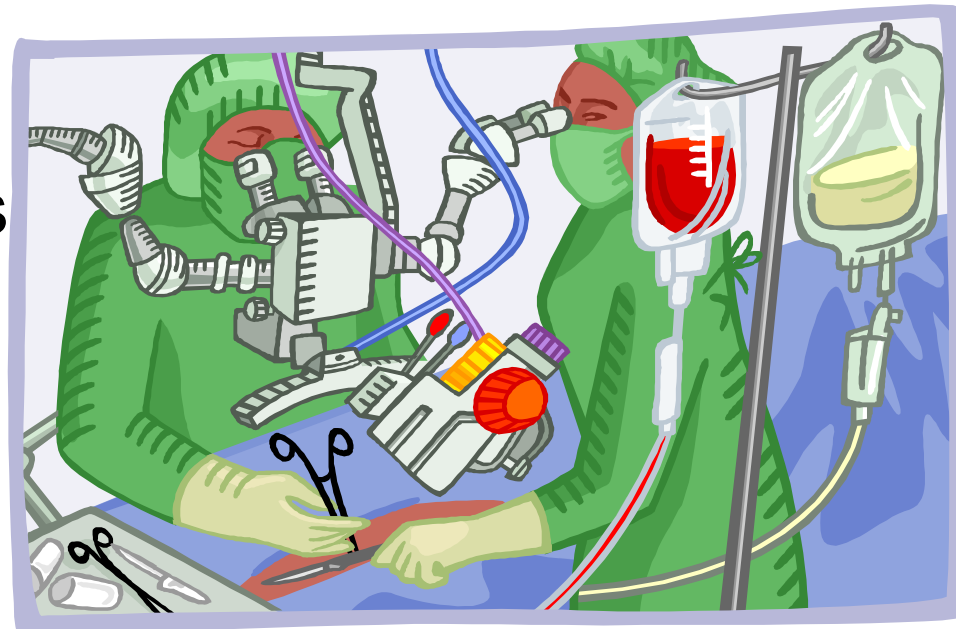
Dr Borman said the decision to jail Dr Mulhem for the manslaughter could damage government efforts to change the way the NHS deals with medical errors.

"There have been previous cases of this particular error and it is very disturbing that an individual doctor has been found culpable when in reality it is a failure of multiple parts of the system."

"It is also comes at a time when the government is trying to get doctors to report errors and to learn from mistakes and to move away from the blame culture."

The systems view: Incidents are mainly due to deficiencies in the system which set people up to fail

- Poorly designed equipment
- Impractical procedures
- Inadequate training
- Time pressure /stress
- Distractions
- Unclear Roles and responsibilities





Skill based slips

“

Your cell phone is on your desk, next to the mouse. As soon as you finish writing an email you want to click on “Enter” and instead of using the mouse you find yourself using the cell phone on the table....

“

I had two patients with similar conditions. One needed some antibiotics. I wrote the prescription on the wrong chart.



Skill based slips

“

I had just started preparing some tea when I heard the cat meowing behind the kitchen door because it was hungry. I opened a cat food can and I started pouring some of the content in the tea pot instead of in the cat's bowl.

“

I was dealing with two patients. I had taken blood from both of them and produced the labels. I kept the two specimens with the respective notes but managed to put the wrong label on the bloods.

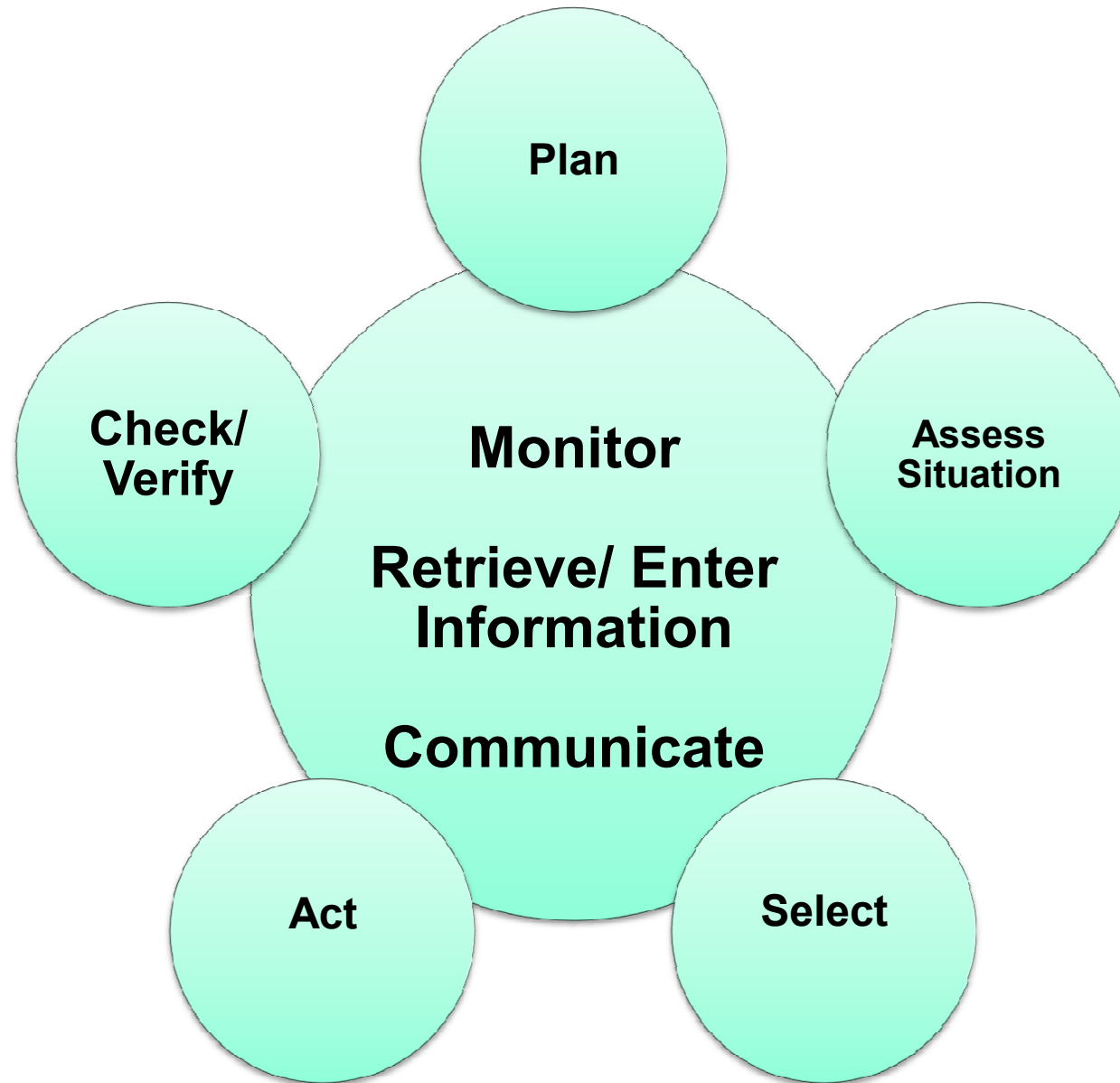
Rule based mistakes



A patient on the asthma ward suddenly becomes very wheezy. The staff give the patient a nebuliser. It fails to improve his condition and so they repeat the treatment.

The staff had forgotten that this patient was only on their ward because of bed shortage on the appropriate ward. He was not an asthmatic, the “wheeziness” was because the patient had inhaled a pen top.





What do people do in healthcare tasks?

3. Selection errors

Failure type (What)

- SEL1 Selection omitted
- SEL2 Selection incorrect

Risk Factors (Why)

- Recognition of requirement for selection
- Labelling quality
- Physical proximity of similar items
- Time pressure
- Distractions
- Experience / training

Selection Error Example



Action

- Executing a plan to achieve one or more objectives or goals
- Can be single action (e.g. Pressing a switch)
- Can be a sequence of actions (task) e.g. Set up a syringe driver

Action error example

- A patient is connected to a transport ventilator and his lungs are ventilated with 100% oxygen.
- A blood test shows that the oxygen levels are higher than required and the Consultant decides to reduce the inspired oxygen concentration.
- This is done via a switch changing the concentration from 100% to 'Air Mix' (60%)

Action error example

- The Consultant goes to the ventilator and flicks a switch and turns to other duties associated with the patient.
- He returns after a couple of minutes and has a 'sixth sense' that something is not right.
- He recognizes that the ventilator is silent and realizes that he flicked the On/Off switch instead of the Oxygen Concentration switch





Oxygen
concentration
Switch

On-Off Switch

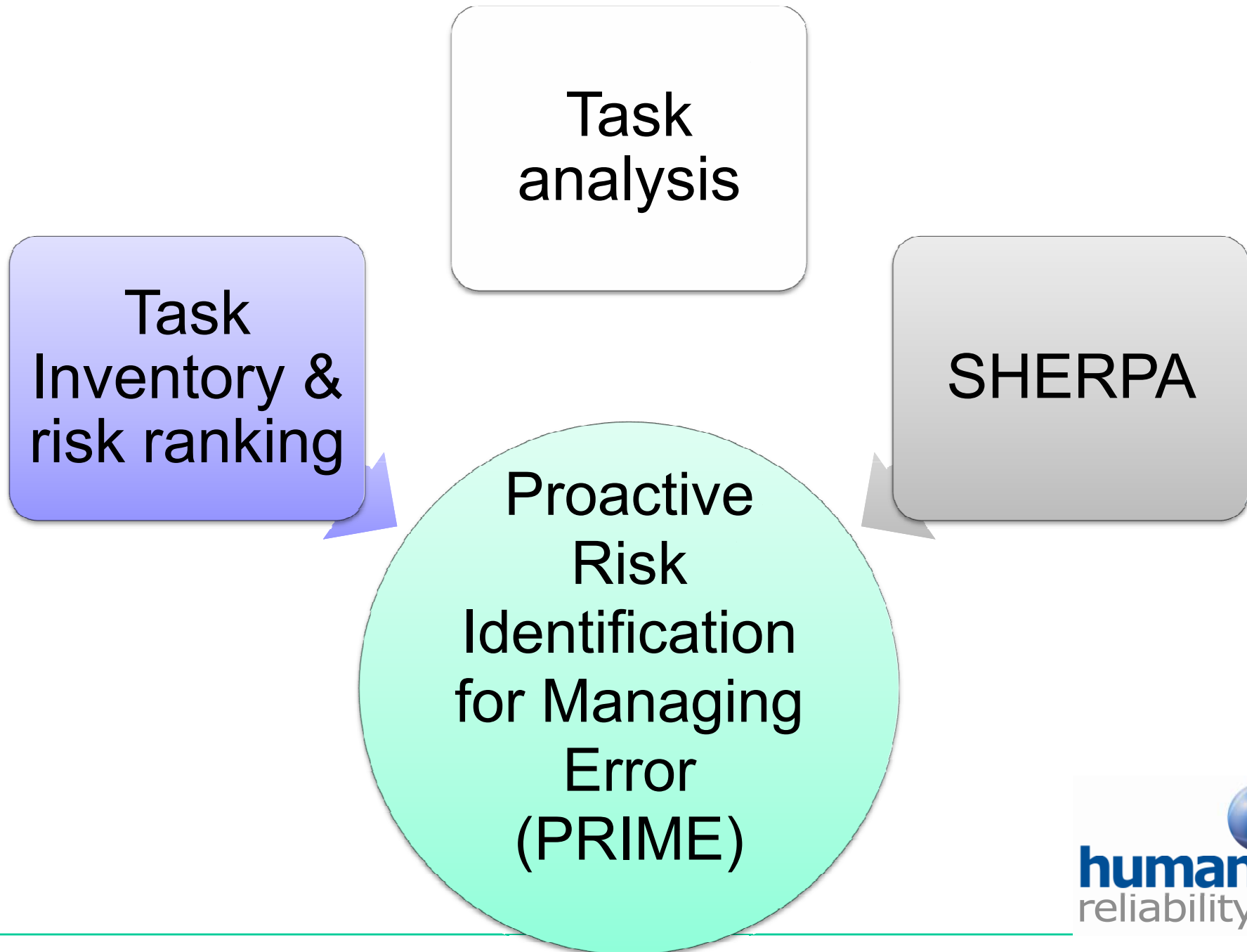
4. Action errors

Failure type (What)

- ACT1 Action omitted
- ACT2 Right action wrong object
- ACT3 Action incomplete
- ACT4 Action too early/late
- ACT5 Action too fast/slow
- ACT6 Action too little/too much

Risk Factors (Why)

- Clarity of cue to start or finish the action(slip)
- Likelihood of previous misdiagnosis (mistake)
- Effectiveness of error prevention barriers
- Quality of procedure
- Distractions
- Time pressure
- Experience / training



Task Inventory for A & E Admissions

1 Deal with major injuries

2 Deal with resuscitation

3. Deal with minor injuries

3.1

Perform registration

3.2

Perform Triage

3.3

Perform clinical assessment

3.4

Administer pain relief

3.5

Do investigations

3.6

Establish diagnosis

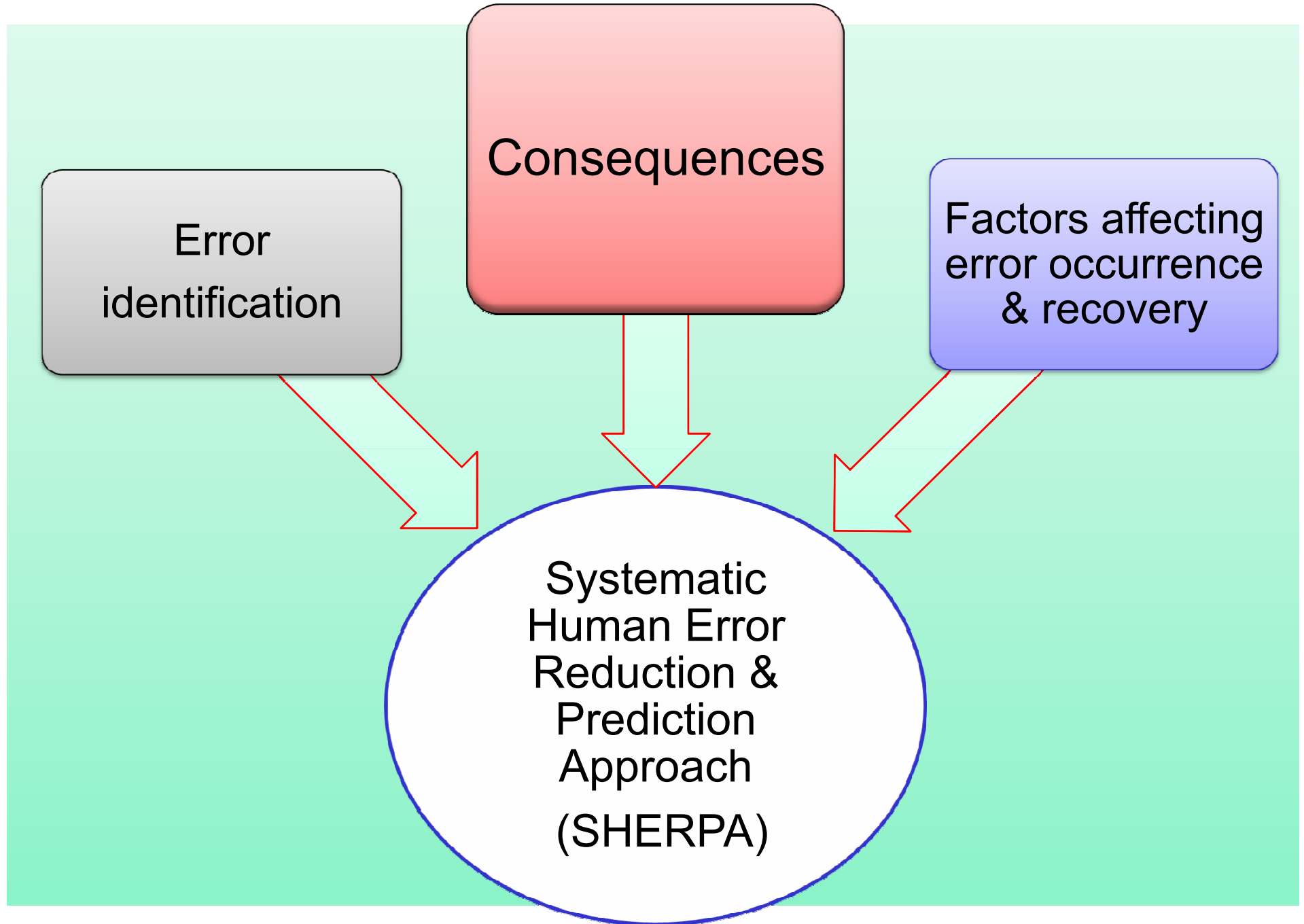
Screening Risk analysis for activities 1.1-1.6

ID	Description	Severity of Consequences	Likelihood of Error	Likelihood of Recovery	Risk Ranking Score
3	Deal with Minor injury				
3.1	Perform registration	Medium (2)	Medium (2)	Low (3)	12
3.2	Perform Triage	High (3)	Medium (2)	Low (3)	18
3.3	Perform clinical assessment	Medium (3)	Medium (3)	Medium (3)	8
3.4	Administer pain relief	Low	Medium	Medium	4
3.5	Do investigations	High	High	Medium	18
3.6	Establish diagnosis	High	Medium	Low	18

High=3 Medium=2 Low =1 (Reverse scale for recovery)

Screening Risk analysis for activities 1.5.1-1.5.7

ID	Description	Severity of Consequences	Likelihood of Error	Likelihood of Recovery	Rank Score
3.5	Do investigations				
3.5.1	Gather blood test equipment	High	Medium	High	6
3.5.2	Produce labels	High	Medium	Low	18
3.5.3	Check label with patient	High	High	Medium	18
3.5.4	Apply label to bottle	High	Medium	Medium	12
3.5.5	Put bottle in sealed bag	High	High	Medium	18
3.5.6	Complete form attached to bag	High	Medium	Medium	12



Examples of Predictable Error Types

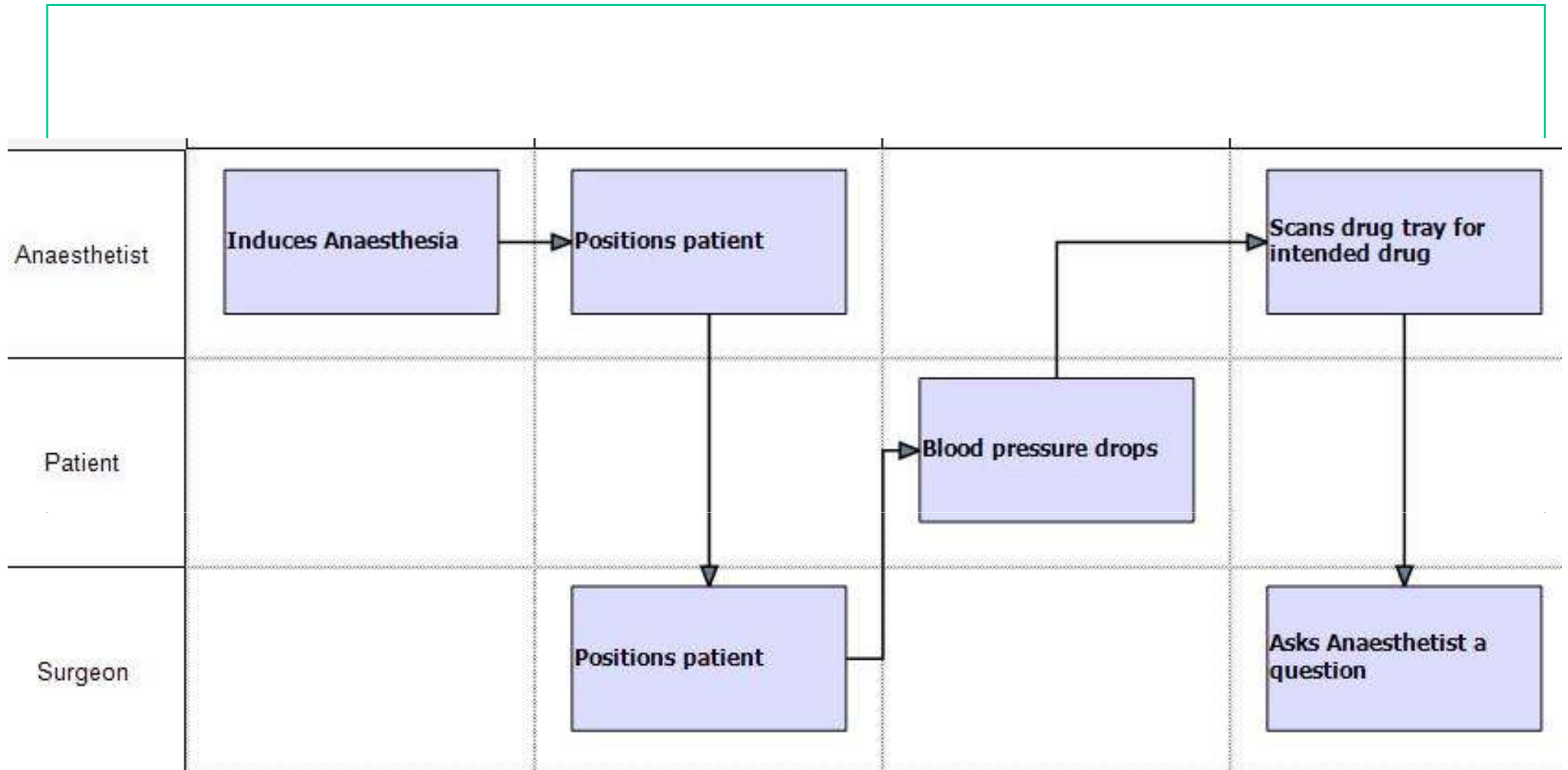
<i>Action</i>	<i>Checking</i>	<i>Information Retrieval</i>	<i>Information Communication Errors (Person to person)</i>	<i>Selection (between two alternative objects)</i>
Right action, wrong object	Right check, wrong object	Information not obtained	Information not communicated	Selection omitted
Action omitted	Check omitted	Wrong information obtained	Wrong information communicated	Wrong selection made
Action too late	Check too late	Information retrieval incomplete	Information communication incomplete	
Action too little	Check incomplete	Information incorrectly interpreted	Information communication ambiguous	

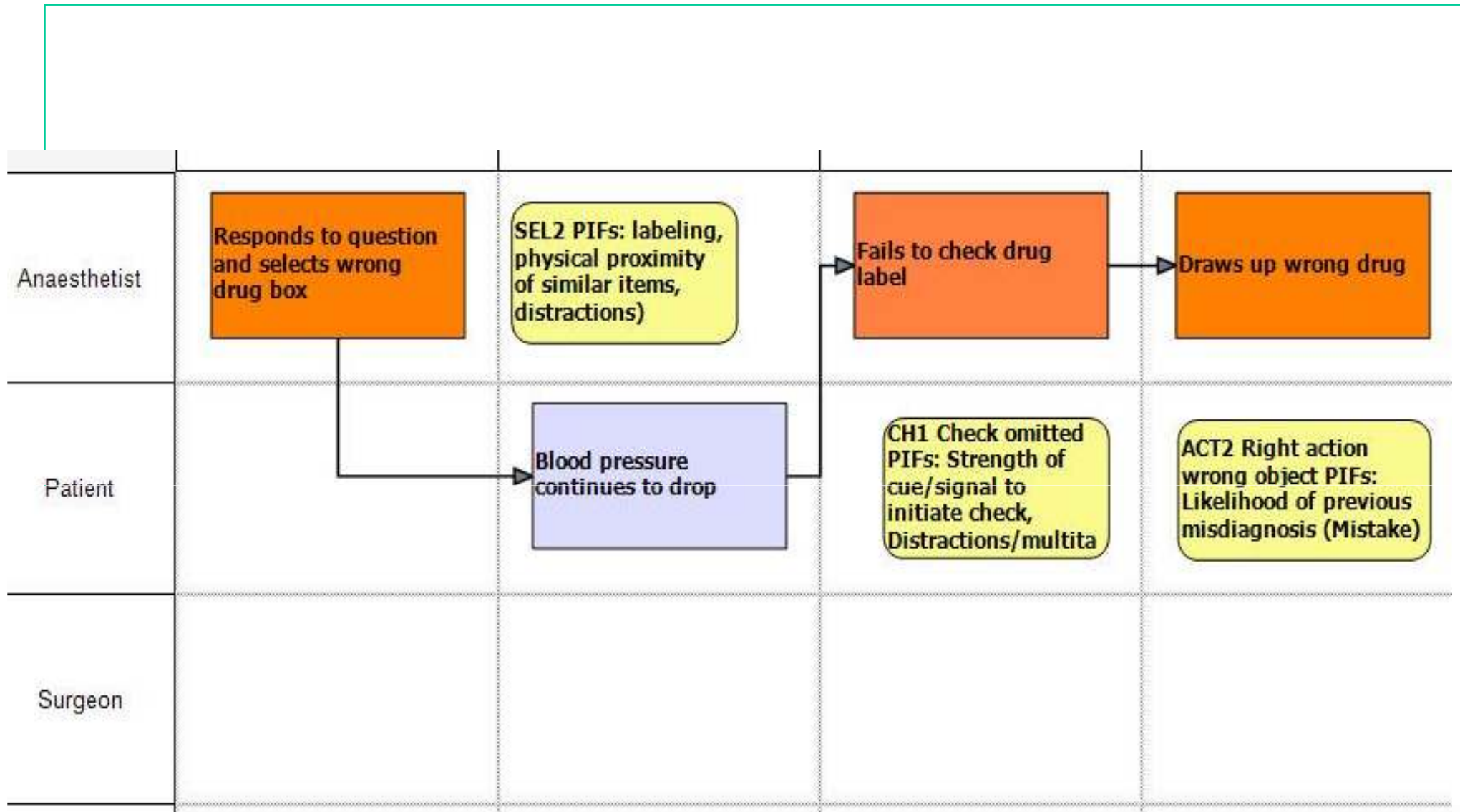
SHERPA Assessment table

Task step	Error type	Description	Consequences	Recovery / risk control measures	Risk Factors	Risk reduction action
3.5.3 Check label with patient	C1 Check omitted	Label not checked	Previous error not detected	Additional person may recheck	Roles & responsibilities Time pressure	Develop checklist
Change the oxygen concentration from 100% to 'Air Mix' (60%)	S1 Selection error	Wrong switch selected	Oxygen not supplied	None	Poor switch labelling	Redesign ventilator switches to clearly differentiate functions

Analysing incidents using the systems approach

- Map incidents using a graphical representation Sequential Timed Event Plotting (STEP)
- Identify failure points
- Classify into failure categories
- Evaluate causal factors





3. Selection			
3.1 It was not obvious that a selection needed to be made	Agree	Disagree	Reason for assessment
	Not applicable		
	Don't know		How did this unfavourable situation come about?
3.2 The labelling of the items from which the selection was made was potentially ambiguous/misleading	Agree	Disagree	Reason for assessment
	Not applicable		
	Don't know		How did this unfavourable situation come about?
3.3 The items to be selected were located physically close to other items	Agree	Disagree	Reason for assessment
	Not applicable		
	Don't know		How did this unfavourable situation come about?
3.4 Time pressure was excessive	Agree	Disagree	Reason for assessment
	Not applicable		
	Don't know		How did this unfavourable situation come about?

Selection Error Example



Conclusions

- Error is not inevitable
- Error is not random
- Error can be predicted
- Human reliability techniques developed in other industries can be applied to minimise patient harm