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TAME

Training Against Medical Error

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D1.2, Repurposed Paediatric cases in English

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TABLE OF CONTENTS

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1. INTRODUCTION

This deliverable reports how St George's University of London introduced Medical Error (ME) cases to the Partner Country Universities (PCUs) and produced the Virtual Patient cases. The appendices show supporting information provided to the partners at meetings and online.

The original plan for Deliverable 1.2, was to take patient cases which SGUL already possessed, and modify these for delivery as interactive medical error cases.

After careful scrutiny at the beginning of the project it was accepted that suitable cases were not available for adaptation, i.e. case that would cover the range of categories of errors required. This in part was because during the previous year, our knowledge of medical error had moved forward considerably, and during that time the medical error expert Dr Jonathan Round had developed a new categorisation of error, termed the '10 Deadly errors' (section 2.4).

The decision was taken to create completely news cases and to create theses as interactive Virtual Patients in a single step. Deliverable 2.1 of workpackage 2 talks about how the cases were then further modified by the PCUs into their local language and culture.

2. CREATION OF CASES

2.1. Agreeing case topics

The nature of the cases was dependent upon the learning outcomes of Paediatric etching and the variety of situations students should be exposed to when training against medical error. The cases, some based on real life situations demonstrate the collective errors that occur in practice.

During the kick-off meeting all partners were presented with an overview of the case structure, and provided with the outline of the individual cases and their associated learning objectives. Discussions took place to consider: what is error, what makes a good case, how are they written and what learning is expected once the students have completed them. Partners discussed the categories of practitioner errors, the 10 'deadly errors that commonly occur. They agreed the six cases that were proposed. More details and the outline of the cases and the 10 'deadly errors' can be found in section 2.3.

2.2. Case Development

The SGUL cases were written by the SGUL Paediatric consultant Dr Jonathan Round, who has considerable experience in the creation of Virtual Patient cases. Cases were created to incorporate the 10 deadly errors (section 2.4), and to meet the outlined learning objectives.

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The 6 paediatric cases address the learning objectives identified at the start of the project. Initially two cases (were created which were reviewed at SGUL; the review team consisted of the case writer, a Problem-Based Learning (PBL) tutor, medical education experts and the project manager. During the review process cases were checked for functionality, content and how suitable they were for delivery in a PBL setting. Small changes were made based on the feedback. The case links were distributed to the partners, to provide an insight to the case structure before the PCUs were trained in writing and adapting the cases. Following this partners were provided with the exports of each of the cases which they could install in their versions of OpenLabyrinth (OL).

2.2.1. Structure of cases

The cases are shorter than the online decision making interactive Virtual Patient cases, but more complex and to reflect the real life situations that doctors would face and how their cases can lead to different forms of Medical Error.

Partners are provided with links to the cases which consisted of a branched tutor version which includes the case summery (like a tutor guide) at the start of the case to allow the tutor to familiarize themselves with the case before the tutorial with the students, tutorial 1 and 2.

During the tutorial students at each PCU will start with tutorial 1 for each case, a version of the case without the commentary at the start and at the end. This will be the bulk of the case and students will discuss and generate learning objectives they have identified as a group, which they need to learn more on. After the tutorial students will be required to do some independent learning and feedback for the next tutorial.

Tutorial 2 is where the students will come back and provided feedback on what they have learnt and information gathered. Once they have discussed their finding they will open tutorial 2 of the cases which is the commentary that describes the cases and the medical errors that occur in the case.

2.3. Principles behind creating error steps in VPs

2.3.1. Categorization of error: the practitioner viewpoint

Medical and Healthcare error is a large cause of mortality and morbidity.

Medical error is complex, but can be simplified into 10 basic types of error, each of which can occur at specific and predictable points in a patient episode. Medical error requires multiple approaches to combat its effects to address these different causes. These range from system based approaches to practical training to cognitive exercises.

Educational strategies are able to address many types of error, initially by making healthcare professionals aware of the issues, types of error and when they will occur. Further theoretical practice of using this

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information in case based discussions will enable the learnt information to be integrated into clinical thought processes and habits.

Tutorials based around real cases are the most effective way of changing behavior and therefore outcomes.

2.3.2. Intervention

A set of educational resources is developed to be used by tutors to assist learning in medical error and develop changed behaviours.

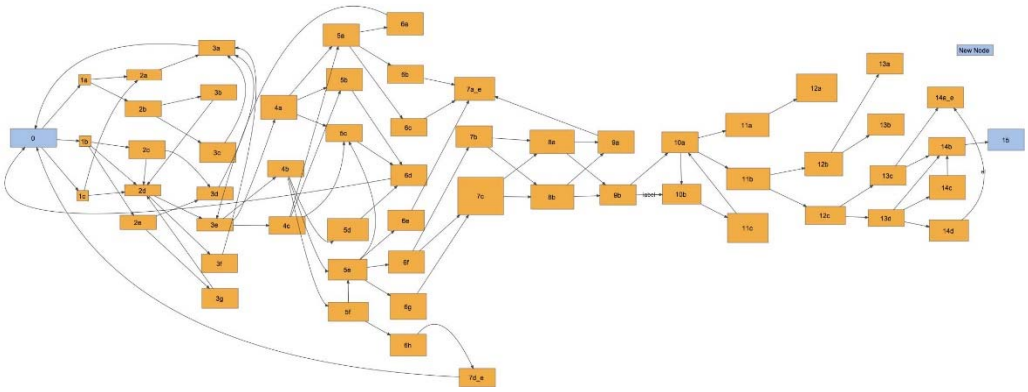
- Six virtual patients, adapted from real cases, written to make it likely that users will make poor choices. These are termed error virtual patients (EVPs). Each case will focus on two or three types of medical error.
- Resources to complement each case, focusing less on the clinical issues and more on the decision making and cognitive aspects of case management.
- Tutor training to maximize the potential impact of these resources.
- These are incorporated into PBL type tutorials with medical students looking at error awareness, recognition and avoidance.

Preparation of Virtual Patients

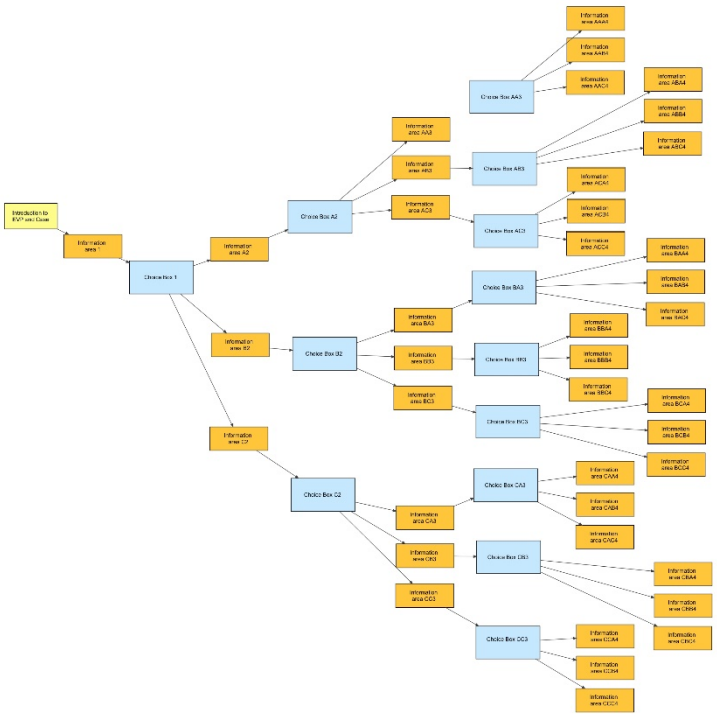
This section will cover the basics of case structure, creating errors at switch points, the nature of outcomes and how this can be used in the assessment of the TAME project from an educational viewpoint.

Cases are 'one-tutorial' (as opposed to the two- or three- tutorial cases used in PBL). This is to contain discussion and allow a greater diversity of cases in a given amount of curriculum time. Each case will have a number of switch points allowing a clinical decision, and each of these points will incorporate the potential for a medical error.

The basics of writing an EVP are discussed in the accompanying "Writing the Perfect Error Virtual Patient" paper. In essence, EVPs focus much more on 3-4 key decision points where there are several very different paths that can be taken. Between these, a large amount of information is given in a chunk, simulating clinical case management. By contrast, traditional VPs have many minor decision points.



"Traditional VP"



Error Virtual Patient

2.4. 10 Deadly errors

Errors switches or choices can be built into the cases in relatively predictable ways.

- **Bravado/Timidity**

This error occurs when practitioners exceed or do not meet the expectations of their skill level. Examples could be a surgeon taking on unassisted a difficult emergency case, or a doctor deciding not to take control of a resuscitation situation.

Here, users will be given a set of options above, at, or below the skill level of the practitioner through which the VP is seen from. Choices above this level will be promoted by showing the advantages of a bold course of action/dangers of doing little. Overly timid choices will also be promoted by suggesting this is a safe route.

- **Insufficient skills**

This error occurs if a practitioner does not have the required skillset of their role. It may occur through poor training, no training, or atrophy of skills.
This is a difficult error to mimic in an EVP, as it requires a lapse of training preceding the clinical encounter. However, an EVP can show the value of training by offering a set of training options at the beginning that the first person represented in the EVP can have, with the pro's and con's of each. Too much irrelevant training reduces time for case management, too little exposes the patient to underskilled management.

- **Poor communication**

The root of this error is not that there is insufficient information within the team, but that the information is not getting to the place where key decisions are made.
Here the player will be offered options that allow too much or too little information. Too little hinders effective clinical management, too much prevents efficient treatment.

- **Poor teamworking**

This is somewhat similar to poor communication. Again there is sufficient skill and personnel to meet the clinical needs, but it is poorly organized and the wrong people are doing the wrong tasks, leading to insufficient care.
Teamworking errors can be demonstrated in EVPs by giving the user various ways to deploy the clinical team described in the EVP, or by offering choices about who to involve in the care of a single patient.

- **Playing the odds**

This error occurs when the practitioner ignores an unlikely cause of presentation simply because it is unlikely.
For this error, users have to see an almost typical presentation of a common problem, but one that is also the presentation of a much less common condition. This other condition needs to be important to exclude. An example would be heartburn typically being caused by gastro-oesophageal reflux, but can also be caused by myocardial ischaemia. As a VP, it is important that this results in a different course of action.

- **Ignorance**

Simply, the practitioner does not know enough to solve the clinical problem. More worryingly still, they may not know that they do not know!
Ignorance is modeled in an EVP by offering users choices for which much knowledge is required, with "ask a specialist" as another option. In discussion, students will look at when they need to ask opinions, and when they should get on and make a decision straight away.

- **Sloth**

Doing things right is often not taxing, but sometimes requires more than minimal effort. With inadequate effort, key information may remain hidden. Practitioners will often favour diagnoses or paths that require less effort, even if the patient's presentation suggests more should be done.

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Sloth is not easy to model in EVP scenarios, as it requires minimal effort to select one option over another, even if one would require much more work in reality. This can be mimicked by offering the user one option with a large amount of data to review and another with a more focused set.

- **Poor triage**

Practitioners must prioritise between multiple tasks and duties effectively so that the urgent is done first, and that the sickest patients seen first. Poor triage will therefore lead to harm.
This error can be modeled in an EVP by offering multiple choices of what to do first, each reflecting a different level of urgency for the patient, or offering several different patients to see of varying unwellness.

- **Fixation/loss of perspective**

Fixation occurs when a practitioner arrives to a conclusion early in the course of assessing a patient. Further information is seen as confirming the initial impression, or ignored if it goes against this impression.
This error can be tested in EVPs by suggesting a particular diagnosis early in the case, then allowing into the case small details hinting this diagnosis is wrong. A choice is then offered between action in keeping with the initial impression and something taking into account the new information.

- **System error**

This error is less one that individuals can be involved in, but practitioners have an important role in alerting the institution (or system) to loopholes within practices and processes. Put simply, systems should be designed to make it difficult for healthcare to harm patients and simple to treat patients properly. Examples of system error include interchangeable connectors for oxygen and N_2O, a paging system inadequate for a major trauma, similar phials for NaCl and KCl, and a computer system that makes accessing results hard to find.
This sort of error is not easy to model in an EVP.

Description of the consequence of the decision

Following the choice made by the users, the next piece of information seen by the learner reflects the choice taken. This will of course be medical information, but will also contain language reflective of the positive or negative impact of the decision. This not only prefaces the next choice that must be made, but also creates in users some sort of emotional response. Put simply – users are relieved to have made good decisions and dislike having made what are seen to be poor decisions.

In TAME, most choices will typically be between 3 different options. Some will be excellent, some good but not ideal, and some poor.

2.5. Case outlines and Learning objectives

Learning Packages and Cases [Three cases are presented as exemplars]
Choices are denoted Excellent (E)/Good (G)/Poor (P)

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Exemplar Case 1 **Neonatology**

Case outline

An infant is born at 34 weeks gestation following preterm labour. He endures a difficult birth ending in an emergency caesarian in response to an abnormal CTG. After resuscitation, he is admitted to the neonatal unit for oxygen and feeding. After 4 hours he develops increasing difficulty in breathing, low temperature and grunting. His oxygen saturation levels fall. He is intubated and ventilated and a chest radiograph taken.

Choice 1 Give antibiotics (E)/give surfactant (P)/give steroids (P)

He improves over the next 3 days and is extubated. Feeds are started, and he begins to put on weight. 2 days later he develops increased work of breathing, tachypnea and increased oxygen requirements. He has bounding pulses and a systolic murmur near the left clavicle. A second chest radiograph is taken showing a large heart and pulmonary oedema.

Choice 2 Give diuretics (G)/give ibuprofen (E)/give antibiotics (P)

He once again improves and remains on the neonatal unit as he grows. After 3 weeks his weight is 50g above birth weight and he is now feeding well for himself. One of the nurses notices that he is mildly jaundiced and that his stool is a little pale. The parents are keen to take him home and have him reviewed in outpatients if need be.

Choice 3 Check bilirubin level, send home (P)/Check bilirubin level, request FBC and LFTs (P)/Check FBC, DCT, UEC, TFTs, urine, LFTs and a split bilirubin (E)

Learning Objectives

Problems of prematurity
Transition at birth
Respiratory distress syndrome
Neonatal infection
Patent ductus arteriosus

Errors covered
Ignorance
Sloth

Exemplar Case 2 **Difficulty in Breathing**

Case outline

A 2 year old child is seen in a family practice setting with a mild fever, cough and mild difficulty in breathing. The doctor is told that he has had recurrent chest infections starting at 11 months and has had multiple courses of antibiotics. The patient is rapidly assessed with history and examined.

Choice 1 – take more history (E)/start antibiotics (P)/refer to local hospital (G)

Further history reveals that the child has a nocturnal cough and both parents smoke. There is a family history of asthma too. This will come out even if seen at the local hospital, when the patient returns in a couple of days (with antibiotics) or immediately. Smoking cessation support is offered. The child is started on as required salbutamol and improves.

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Two weeks later he is brought to the A+E by a childminder – he was playing at home and developed a cough and more difficulty in breathing. The childminder wonders if it was allergy to the cat as she has this too. Examination shows a wheeze on the right side of the chest and oxygen saturations are 85% only.
Choice 2 – Salbutamol nebulizer (P)/chest radiograph (G)/bronchoscopy (E)
A small toy is retrieved from the right main bronchus, but the child now has a more widespread wheeze

Learning Objectives
Normal respiratory findings in children
Stridor and wheeze causes
Childhood asthma
Croup
Pneumonia
Bronchiolitis
Inhaled foreign body

Errors covered
Fixation
Sloth

Exemplar Case 3 **Vomiting**

Case outline
A 6 month old girl is being observed in the emergency room, and the doctor sees with a view to her being discharged as the parents are used to his problems and are keen to go home. He is known to have GORD. This seems to be worse than normal with more vomiting and pain, possibly related to the reflux. There is no diarrhea, and the vomitus is liquid – water and juice similar to what he just drank. A full examination shows a pale, unhappy child with a mildly distended abdomen. Some blood tests have been done, which are normal.

Choice 1 - send home with safety netting (P)/surgical referral (E)/admit and antibiotics (G)
The child deteriorates with worsening observations, bilious vomiting, and a blood gas is done (if in hospital) which is normal. Other bloods are sent. The abdomen becomes more distended and a plain chest radiograph obtained. This does not show free air under the diaphragm, but does have several old fractured ribs.

Choice 2 – plain abdominal radiograph (P)/urgent ultrasound abdomen (E)/CT abdomen tomorrow (P)
(on correct track) intussusception is diagnosed on USS, and child taken for air enema reduction. This is successful. She starts to feed again.
On other tracks the child continues to deteriorate and then has red current jelly stool. Then has failed air enema leading to open reduction, intestinal resection and peritonitis, from which he recovers. She starts to feed again.
Choice 3 – Discharge to care of GP (P)/Refer to social services (E)/Refer to paediatrician to follow up (G)

Learning Objectives
Assessment of the GI system of a child

Causes of vomiting, diarrhea, abdominal pain and distension
Gastro-oesophageal reflux disease
Pyloric stenosis
Malrotation and volvulus
Intussusception

Errors covered
Playing the odds
Communication
Lack of skill

Case 4 **Growth**

Case outline

Learning Objectives
Infant and child nutrition
Normal growth in childhood
Normal nutritional needs for children
Hormonal control of growth
Monitoring growth – measuring and growth charts
Hormonal causes of disordered growth
Nutritional causes of poor growth
Cystic fibrosis
Coeliac disease
Cow's milk protein intolerance

Errors covered
Poor triage
Fixation

Case 5 **Seizures**

Case outline

Learning Objectives
Emergency management of seizures
Types of seizure in childhood
Investigation of seizures
Meningitis and encephalitis
Brain tumours
Non-accidental injury
Causes of coma in children

Errors covered

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Bravado
Insufficient skills
Fixation

Case 6 **Blue baby**

Case outline

Learning Objectives
Changes in the heart at birth
Assessing cyanotic children
VSD, Fallot's tetralogy and other heart defects
Presurgical management of children with CHD

Errors covered
Timidity
Poor teamworking
Poor triage

2.6. Partners next steps

Once the cases have been imported into the partner's install of OL they will be able to modify these cases to their local language and healthcare settings.

Partners should first translate the cases to their local language and then adapt to the case to fit their local healthcare setting and culture. After this process the cases should be peer reviewed to ensure the cases read well and the context is correct.

3. APPENDIX

3.1. Medical Error presentation

Presentation slides of the presentation that was given by Dr Jonathan Round at the kick off meeting in November 2015.

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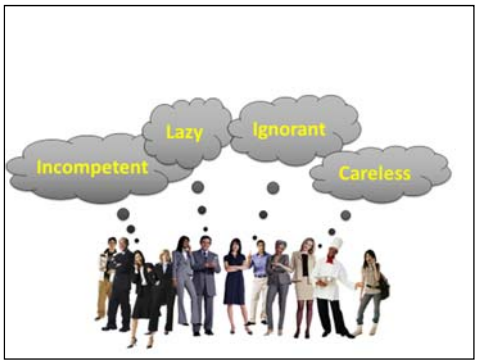
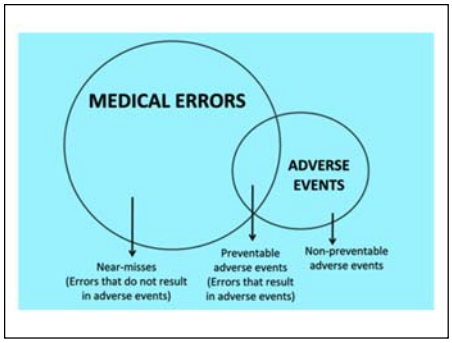
Medical Error

Jonathan Round





USA 1997: 44,000 to 98,000 patients die per year as a result of preventable medical errors[1]

1. Kohn KT, Corrigan JM, Donaldson MS. *To Err Is Human: Building a Safer Health System. Washington*, DC: National Academy Press; 1999.

D.1.2 Repurposed Paediatric cases in English

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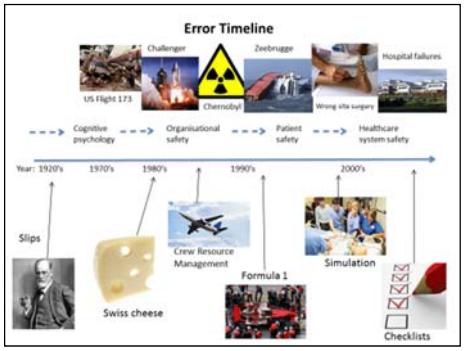

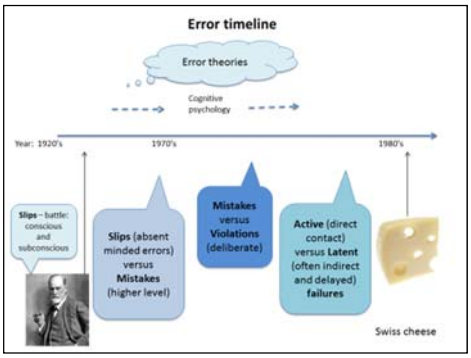

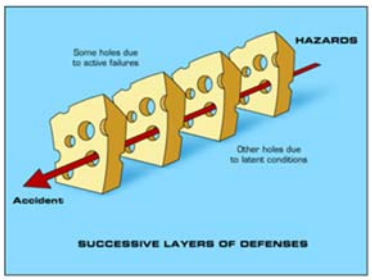

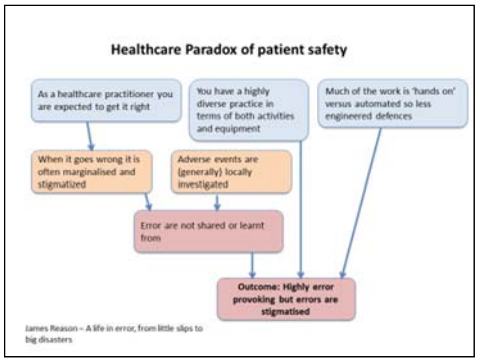

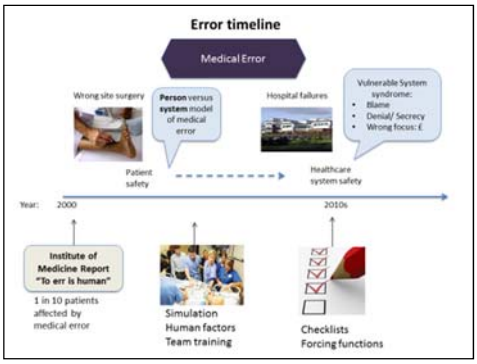

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Broad Classification of Error

System Based	Person Based
"properly designed work practises and workplaces will not allows harm to occur"	"properly trained people, working normally will not make mistakes"

System vs Person based

A well designed system should not allow error

Avoidance of blame

Systems must be designed and run by humans

System vs Person based

A well designed system should not allow error

Avoidance of blame

Systems must be designed and run by humans

Medicine is person based

Medicine is person delivered

Humans will not always perform as you wish

Humans are flexible

Humans can learn

System Error

- Failure to put in place adequate safeguards to avoid predictable human error

Table. Clinical Effectiveness of Safe Practices

Intervention	Results
Perioperative antibiotic protocol	Surgical site infections decreased by 93%*
Physician computer order entry	81% Reduction of medication errors[36,39]
Pharmacist rounding with team	66% Reduction of preventable adverse drug events[40]
	78% Reduction of preventable adverse drug events[37]
Protocol enforcement	95% Reduction in central venous line infections†
	92% Reduction in central venous line infections‡
Rapid response teams	Cardiac arrests decreased by 15%[34]
Reconciling medication practices	90% Reduction in medication errors[35]
Reconciling and standardizing medication practices	60% Reduction in adverse drug events over 12 mo (from 7.6 per 1000 doses to 3.1 per 1000 doses)[33]
	64% Reduction in adverse drug events in 20 mo (from 3.8 per 1000 doses to 1.39 per 1000 doses)[4]
Standardized insulin dosing	Hypoglycemic episodes decreased 63% (from 2.95% of patients to 1.1%)[38]
	90% Reduction in cardiac surgical wound infections (from 3.9% of patients to 0.4%)§
Standardized warfarin dosing	Out-of-range international normalized ratio decreased by 60% (from 25% of tests to 10%)[41]
Team training in labor and delivery	50% Reduction in adverse outcomes in preterm deliveries‖
Trigger tool and automation	Adverse drug events reduced by 75% between 2001 and 2003[42]
Ventilator bundle protocol	Ventilator-associated pneumonias decreased by 62%[43]

Leape & Berwick. Five Years After *To Err Is Human*, What Have We Learned? *JAMA. 2005;293:2384-2390*

System Error

- Failure to put in place adequate safeguards to avoid predictable human error

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Agents Addressing Error

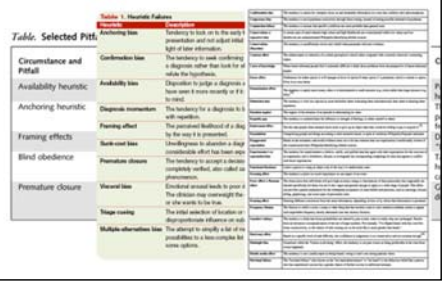
System Based

Committees
CEO
Safety Officer
National guidance
Protocols
Industry, pharma

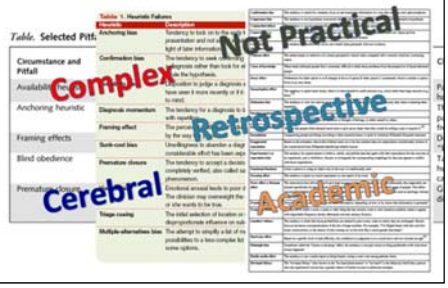
Agents Addressing Error

System Based	Person Based
Committees	You
CEO	Me
Safety Officer	Your students
National guidance	Your Colleagues
Protocols	
Industry, pharma	

Person Based Approaches



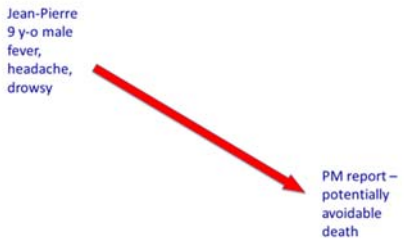
Person Based Approaches



Person Based Error – Key Concepts

#1 Errors occur at predictable times
#2 Errors are predictable in type
#3 Errors can be anticipated and avoided

Switch Points



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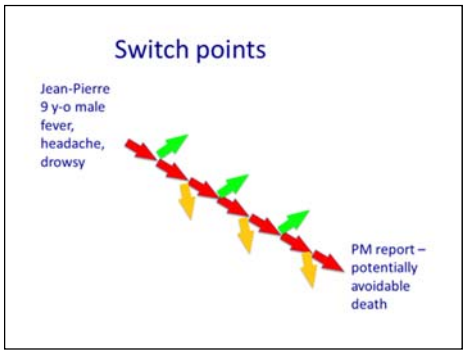

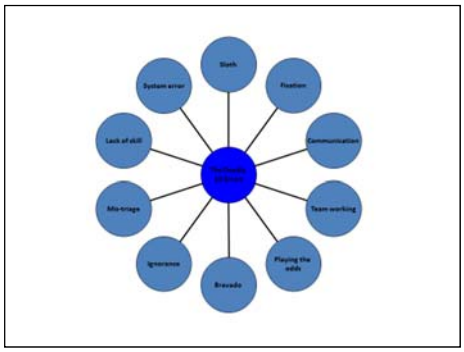

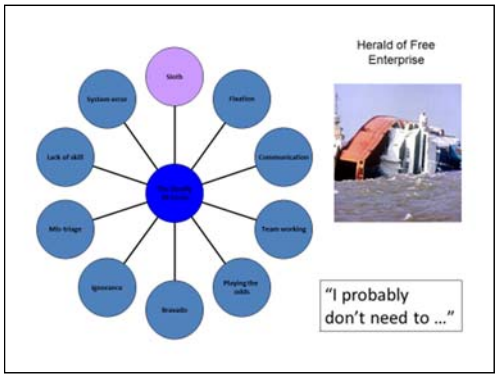

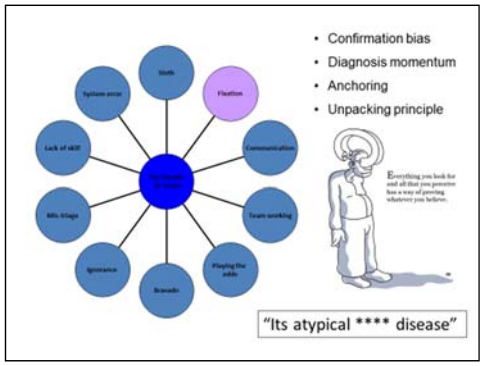

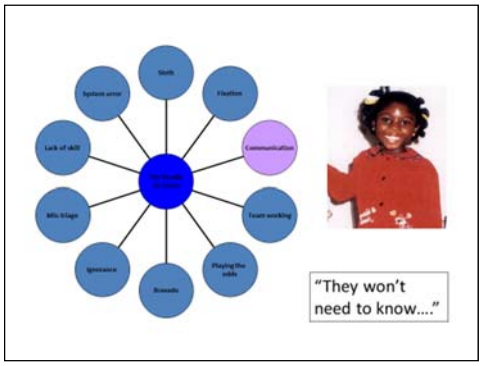

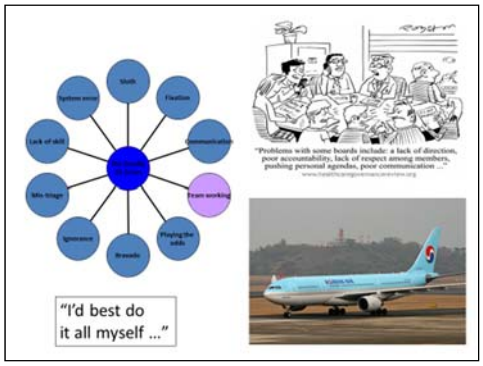

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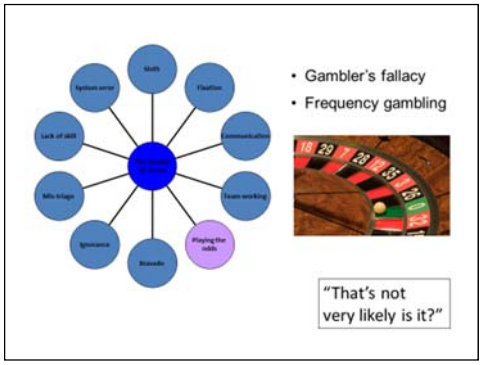

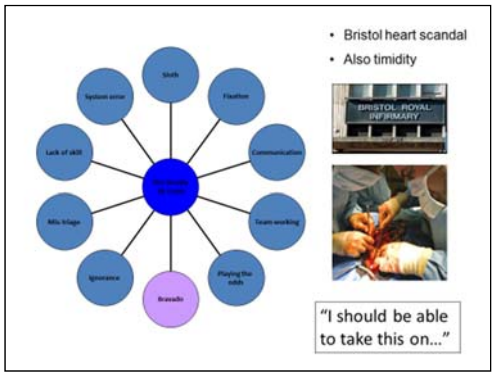

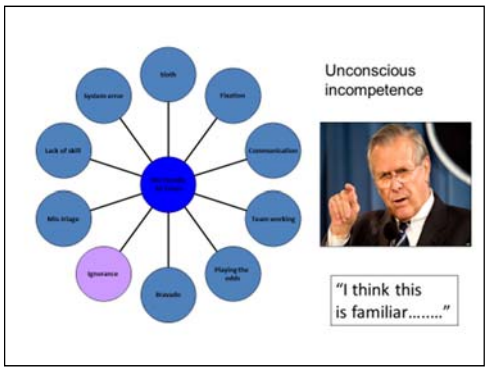

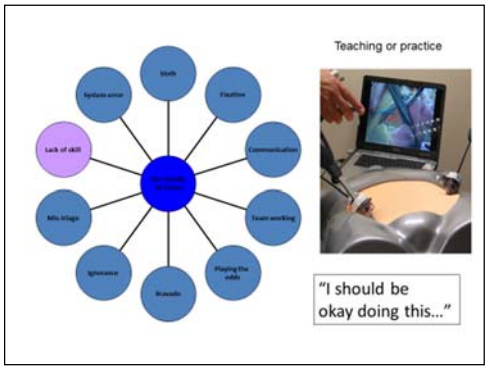

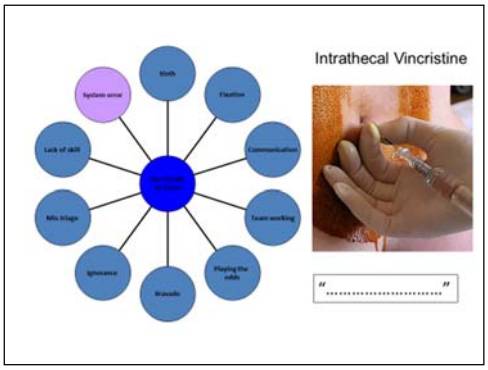

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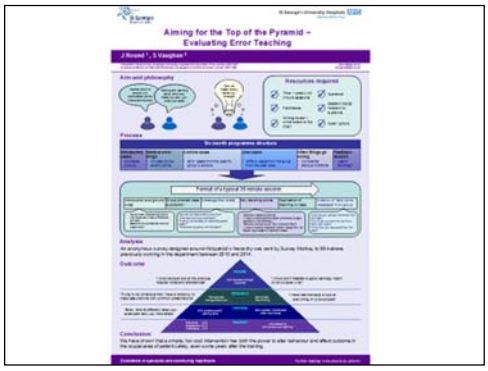

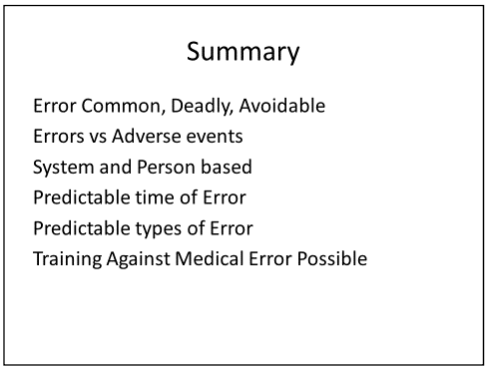

3.2. Paediatric case links

Below are links to the tutor (full) version of the cases:

Case 1 – Neonatology; Dominic Barton

https://openlabyrinth.sgul.ac.uk/renderLabyrinth/index/284

Case 2 – Difficulty in Breathing; Jack Horner

https://openlabyrinth.sgul.ac.uk/renderLabyrinth/index/296

Case 3 – Vomiting; Charlie

https://openlabyrinth.sgul.ac.uk/renderLabyrinth/index/309

Case 4 – Growth; Divina

https://openlabyrinth.sgul.ac.uk/renderLabyrinth/index/446

Case 5 – Seizures; Rory Gallagher

https://openlabyrinth.sgul.ac.uk/renderLabyrinth/index/279

Case 6 – Blue Baby; Bella

https://openlabyrinth.sgul.ac.uk/renderLabyrinth/index/364