Root Cause Analysis
An Introduction

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NPSA - London
Our objectives

• to increase understanding of the theory underpinning Root Cause Analysis

• to provide you with an overview of some of the RCA tools

• to provide a greater understanding of the advantage of using a ‘systems’ based approach to patient safety incidents
There is a need to learn from patient safety incidents – a systems view is needed

- Human errors are induced by system failures.

- Evidence from other ‘high reliability’ industries suggests that systematic investigation of adverse incidents is effective.

- Root Cause Analysis (RCA) is one approach
Why RCA?

• In depth analysis of a small number of incidents will bring greater dividends than a cursory examination of a large number.
  (Vincent and Adams 1999)

• RCA is a structured investigation that aims to identify the true cause(s) of a problem, and the actions necessary to eliminate it.
  (Anderson and Fagerhaug 2000)
Basic elements of a good RCA investigation

- WHAT happened
  - Unsafe Act (CDP/SDP)
- HOW it happened
  - Human Behaviour
- WHY it happened
  - Contributory Factors

Solution Development & Feedback
Exploring Incidents - Improving Safety

a guide to Root Cause Analysis from the NPSA

Introduction

Why things go wrong

Generating Solutions

Getting Started

Analysing Information

Gathering and mapping information

Exit

Resources

Help
Why do people get things wrong?

“Sorry boss I was doing my best”
## Understanding the causal factors of incidents

<table>
<thead>
<tr>
<th>Person centred approach</th>
<th>Systems approach</th>
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</thead>
<tbody>
<tr>
<td>• Individuals who make errors are ‘careless, at fault, reckless’</td>
<td>• Poor organisational design sets people up to fail</td>
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<tr>
<td>• Blame and punish</td>
<td>• Focus on the system rather than the individual</td>
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<tr>
<td>• Remove individual = improve safety</td>
<td>• Change the system = improve safety</td>
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</table>
Myths

• the perfection myth
  – if we try hard enough we will not make any errors

• the punishment myth
  – if we punish people when they make errors they will make fewer of them
ERROR TYPES

Basic error types

Intended actions
- Violations
- Mistakes
- Lapses
- Slips

Unintended actions
- Routine Reasoned
- Rule based
- Memory failures
- Attentional failures

Reckless & Malicious
- Reckless & Malicious
- Knowledge based
- Losing place
- Intrusions
- Misordering etc

Intended actions
- Mistakes
- Lapses
- Slips

Unsafe acts
- Mistakes
- Lapses
- Slips
Who has received any human factors training?

- Why errors occur
- The systems approach to errors
Exploring Incidents - Improving Safety

- Introduction
- Why things go wrong
- Generating Solutions
- Analysing Information
- Getting Started
- Gathering and mapping information

a guide to Root Cause Analysis from the NPSA
Getting Started

A Patient Safety Incident (PSI) is:

Any unintended or unexpected incident(s) that could have or did lead to harm for one or more persons receiving NHS funded healthcare

Which PSI requires an RCA?

- PSI causing death or severe harm
- Frequently occurring PSI / Prevented PSI
Classifying Incidents

• Use organisational procedure for PSI classification

• Classify according to
  - the degree of harm or damage caused at the time
  - its realistic future potential for harm if it occurred again
Select People for the RCA Investigation Team

Incidents causing death or severe harm

- Multidisciplinary group of 3-4 persons
- One of which should be fully trained in incident investigation and analysis
- Objective attitude
- Good organisational skills
- Use of experts
Who has been involved in any form of investigation following a patient safety incident?

What was your experience?
Gathering Information

- Information is the lifeblood of investigation

- 60% of your investigation time should be spent on data gathering
What Information to collect?
People

- Personnel directly involved in the incident & Other witnesses
  - Clinical staff
  - Patient/family
  - Porters
  - Health care assistants
  - Ward clerks
  - Members of the public, etc
What and how?

- Interviews
- “Brain Storming / Writing”
- Reflective practice documents
- Retrospective clinical records
Documentation

- Incident report(s)
- Prescription, dispensing and administration record
- Medical record
- Guidelines, policy and procedures (in operation at the time of the incident)
- Relevant audit data (clinical, risk management, H&S)
- Staff rota's
- Training and supervision records
- Medical equipment maintenance records
- etc
Any equipment involved in the incident

- Medicine pack, ampoules, pack information
- Infusion bag and administration set
- Infusion pimp
Consider the following

- Securing the site
- Take some photographs
- Sketch the layout
- What was the position of the equipment/people?
- Reconstruction
Mapping the information

Timeline & Tabular Timeline

Narrative Chronology

RCA Tools

Time/Person Grids

Cause and Effect Charts
Community Dentistry – failure of the chair

September 2000- Month 11 week 1.
Four weeks later the suction was found to be permanently on, on the dental chair and the Supplier was informed. It seemed that the motor was burnt out.

Month 11 week 2.
Seven days later the supplier came to repair the motor. The chair seemed to be working better again and disruption was minimal over the following three weeks.
08.24
Ambulance crew partly fill diesel vehicle with unleaded petrol at local garage

08.32
Emergency call received by ambulance crew to attend a serious RTA on local motorway

08.38
Ambulance breaks down whilst on Emergency call
## Tabular Timeline

<table>
<thead>
<tr>
<th>Date and Time of Event</th>
<th>18&lt;sup&gt;th&lt;/sup&gt; March 2002 – 19.15</th>
<th>18&lt;sup&gt;th&lt;/sup&gt; March 2002 – 20.00</th>
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</thead>
<tbody>
<tr>
<td><strong>Event</strong></td>
<td>The patient was seen on ward by the consultant anaesthetist</td>
<td>The patient was seen by the Senior House Officer (SHO) who applied the operation site mark</td>
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<tr>
<td><strong>Supplementary Information</strong></td>
<td>The patient declined a regional anaesthetic. Anaesthetic pre-assessment information is recorded in a log-book and the information then transferred to the anaesthetic record on the day of the procedure, although this transfer of information did not take place. This practice was adopted as the medical and anaesthetic record frequently got lost</td>
<td>SHO in her first SHO job and first rotation in orthopaedics. SHO applied the mark to an unusual part of the shin with a skin pencil, rather than the thigh or knee. Below knee anti-embolic stockings were then put on by the patient which covered the mark. No guidance or training is given to the SHOs on marking operative sites</td>
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<tr>
<td><strong>Good Practice</strong></td>
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<tr>
<td><strong>Care/Service Delivery Problem</strong></td>
<td>Failure to document planned procedure in the anaesthetic record</td>
<td>Operative site incorrectly marked</td>
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<tr>
<td>Staff</td>
<td>10.05</td>
<td>10.15</td>
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<td>Snr Nurse A</td>
<td>with pt 1</td>
<td>with pt 3</td>
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<tr>
<td>HCA 1</td>
<td>with pt 2</td>
<td>?</td>
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<tr>
<td>Social Wker</td>
<td>with pt 1</td>
<td>with pt 1</td>
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<td>Dr 1</td>
<td>?</td>
<td>?</td>
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Cause and Effect Diagrams

An investigation tool that displays an entire event:

• Follows a timeline

• Presents a summary diagram of a complex incident

• Charts the relationship of events, conditions, changes, barriers and causal factors using standard symbols
RCA Tools to help identify the problems

- Brainwriting
- Brainstorming
- RCA Tools
- Nominal Group Technique
- Change Analysis
Brainwriting Template

Incident/Issue/CDP/SDP, etc

Idea's
### NGT Ranking Template

<table>
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<tr>
<th>Problem:</th>
<th>Ideas</th>
<th>Points</th>
<th>Total</th>
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<td>A</td>
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Exploring Incidents - Improving Safety

Introduction

Why things go wrong

Generating Solutions

Getting Started

Analysing Information

Gathering and mapping information

Resources

Help
Analysing Information – Exploring the Problems

What are Contributory Factors?
- Contributory, influencing or causal factors are things that contributed to the incident.
- Contributory factors can vary in their significance of impact on the CDP/SDP.
- Contributory factors can have both a negative and positive impact.
How to identify the contributory factors and root causes

Five Whys Technique

Contributory Factors
Framework/
Fishbone
Diagrams

RCA Tools

Brainstorming/Brainwriting & NGT

Run Charts
NPSA Contributory Factor Taxonomy

- Patient Factors
- Individual Factors
- Task Factors
- Communication Factors
- Team and Social Factors
- Education and Training Factors
- Equipment and Resource Factors
- Working Conditions Factors
- Organisational & Strategic Factors
Patient factors

The key part of the analysis is to identify the contributory factors lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

## Patient factors

Patient factors are grouped into five types:

- Clinical condition
- **Social factors**
- Physical factors
- Mental and psychological factors
- Interpersonal relationships

Example: The patient did not understand the risks of treatment due to his poor understanding of the English language and no interpreters were available.
Contributory factors - NPSA framework

The key part of the analysis is to identify the contributory factors lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

Individual factors

Individual factors are grouped into three types:

- Physical Issues
- Psychological Issues
- Personality.

Example: A staff nurse experiencing problems with hearing and mishearing handover instructions to patient.
Contributory factors - NPSA framework

The key part of the analysis is to identify the **contributory factors** lying behind each problem. The NPSA's CFF has categories and components relating to exploring incidents. Click each category to find out more.

Task factors are grouped into three types:

- Guidelines and Policies
- Decision making aids
- Task design

Example: The algorithm for managing respiratory arrest had a vital component missing.
Communication factors

The key part of the analysis is to identify the contributory factors lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

Communications factors are grouped into three types:

- Verbal
- Written
- Non-verbal.

Example: Relatives interpret GP’s instructions to patient wrongly due to limited understanding of language.
Team & Social factors

Contributory factors - NPSA framework

The key part of the analysis is to identify the **contributory factors** lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

Team and social factors are grouped into three types:

- Role congruence
- Leadership
- **Support and cultural factors.**

Example: *multi-disciplinary team rarely met and the weekly Directorate meeting was for doctors only.*
Contributory factors - NPSA framework
The key part of the analysis is to identify the contributory factors lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

Education & Training factors

These factors are grouped into four types:

- Education/training
- Appropriateness
- Supervision
- Availability

Example: Standards of care were not met as new care assistants at ward level were trained by someone who was competent as a practitioner but had no training expertise or experience.
Contributory factors - NPSA framework

The key part of the analysis is to identify the contributory factors lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

Equipment & Resources factors are grouped into five types:

- Equipment and supplies
- Visual Display
- Integrity
- Positioning
- Usability

Example: A patient’s oxygen levels dropped causing respiratory arrest. The alarm on the monitor was faulty.
Contributory factors - NPSA framework
The key part of the analysis is to identify the contributory factors lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

Working conditions factors are grouped into four types:

- Administrative
- Design of physical equipment
- Staffing
- Time

Example: Previous medical records were not available for clinical staff to plan treatment and care for an emergency admission, therefore delaying clinical decisions and treatment.
Organisational & Strategic factors

The key part of the analysis is to identify the contributory factors lying behind each problem. The NPSA’s CFF has categories and components relating to exploring incidents. Click each category to find out more.

These factors are grouped into five types:

- Organisational structure
- Policy, standards, goals
- Externally imported risks
- Safety culture
- Priorities

Example: The ambulance crew would not lift 20 stone cardiac patient as it would put them at risk.
Wrong site surgery

The team now begin taking these factors and plotting them on to a fishbone diagram.
Site Marking not visible

Task Factors
- No guidance on site marking
- Pt helpfully removed and replaced TED to show mark
- Patients admitted too late for Cons ward round
- Ward busy

Individual (staff) Factors
- Inexperienced SHO marked site, Unaware of correct procedure
- No check of procedure within multi-disciplinary team

Team Factors
- Concern around meeting, cancelled operation targets

Patient Factors
- Pt helpfully removed and replaced TED to show mark

Work Environmental Factors
- Patients admitted too late for Cons ward round
- Ward busy

Institutional Context Factors
- Patients admitted too late for Cons ward round
- Delay in pts admission
- Lack of formal local orientation & training prog for junior Drs

Organisational & Management Factors
- Lack of formal local orientation & training prog for junior Drs
Five Whys

- Tool that enables investigator(s) to identify the causes for each problem (CDP/SDP).
- Best suited to simple and non-complex problems.
- Quick and easy to teach
- 3 – 5 – 7 whys?
Pt informed nurse no change since recovery

Pt had neurosurgery

Care handed over to ward staff

Care handed over to night staff

Deterioration in condition

Deteriorating neuro observations not reported or acted upon

Agency Nurse orientation sheet not completed

Ward busy and acute

Only 2 of 6 staff permanent

Delayed Procedure for removal of haematoma

Nurse inexperienced and unfamiliar with obs sheet and terminology therefore did not alert anyone to deterioration

5 Whys
Nurse did not alert Senior staff of Patients deterioration post op

WHY?

He thought that the day staff had been aware of condition since return from theatre

WHY?

Because on obs chart “N” had been recorded throughout

WHY?

Because “N” is the letter for “normal” but he assumed it meant “Numb”

WHY?

Because there was no key on the neurological observation chart

Root Cause
Run Charts

Purpose
• To identify trends and patterns in a process, over a specific period of time.

How to Construct Run Charts
• Decide what the chart will measure (what data over what period of time).
• Draw graph
Run Chart Example: Frequency of Violence and Aggression

Months

Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

2
4
6
8
10

Violence and Aggression
Nurse delivers Vincristine to ward

- Vincristine put in wrong fridge

- SHO unfamiliar with ward and IT policy & procedure

- SP and SN check pt details and commence procedure

- SN called away from procedure to attend emergency

- SP did not refer to drug to be collected by name - "chemo"

- Drug Route not checked

- Drug checking process interrupted by Sr 2

- Sr 2 did not query procedure without nurse

- SHO takes only drug in fridge which is the wrong one

- Locum SpR sleeps, continues to sound interrupting procedures

- Pt listening to walkman, not included in process

- Lack of Team work and understanding of procedure/policy

- SHO not on IT Register to check Methotrexate

- Premature end to procedure

- Locum SpR & SHO didn’t know each other or the patient

- Procedure continues with Locum SpR and SHO

- SHO asked by SP to collect drug from fridge

- Failure to identify incorrect drug & route during checking process

- SHO administered IT instead of methotrexate

- Vincristine medication checking policy, drug route not checked against prescription chart

- Failed barrier - separate fridge for IT meds & visual difference

- No check to ensure that IV had already been given

- Intraoperative Procedure continues with Locum SpR and SHO

- S5 Why's

- Delivering nurse given keys by Sr 2 with no check that she knows where to put it

- Check policy / guidelines re IT administration without nurse present

- Failure to check team knowledge and understanding of procedure/processes
Identifying the Root Causes

- Identify the contributory factors having the biggest impact on system failure = ROOT CAUSEs

- A Root Cause is a fundamental cause which if resolved will eradicate, or significantly contribute to the resolution, of the identified problem to which it is attached both within the local department and more widely across the organisation
Generating Solutions
The key principles

- Keep it Simple
- List all recommendations for change and prioritise for effective implementation
- Draw up an Action Plan
- Involve Patients and Staff
Key Principles for Solution Design

- Design tasks and processes to minimise dependency on short-term memory and attention span
- Avoid fatigue: review working hours and workloads
- Retraining is not always the right solution
- Simplify tasks, processes, protocols, equipment
- Standardise processes and equipment
- Use protocols and checklists wisely
How to Develop Failsafe Solutions

Barrier Analysis

Hazard

Barriers

Controls

Defences

Unsuspecting target
What is a barrier:

A control measure designed to prevent harm to

- People
- Buildings
- Organisations
- Products
- Communities
Types of Barrier

**Human Action**
- Checking a drug dose before administering

**Administrative**
- Training, Supervision and Procedures

**Physical**
- Redesign product

**Natural**
- Place, Time or Distance
When can Barrier Analysis be used?

Prospectively to identify possible ‘Hazards’ their ‘Targets’ and potential solutions

Reactively following a patient safety incident to identify the ‘Barriers’ that should have been in place to have prevented or mitigated against an incident
Performing a Proactive barrier analysis

- Choose an activity to be analysed (e.g. preparing a patient for theatre, giving blood)
- List, using Brainstorming techniques with relevant experts / others

<table>
<thead>
<tr>
<th>TARGETS</th>
<th>HAZARDS</th>
<th>BARRIERS</th>
</tr>
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<tbody>
<tr>
<td>Giving blood to patient</td>
<td>• wrong pt</td>
<td>• checks</td>
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<tr>
<td></td>
<td>• wrong blood</td>
<td>• protocols</td>
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</table>
Barrier Analysis Cont’d

• Evaluate the list of barriers as strong, average or weak - any barrier involving human action is marked down

• Record the findings

• Remember barrier analysis can be used proactively or reactively!
Performing a Proactive Barrier Analysis

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Performing a REACTIVE Barrier Analysis

Event:

<table>
<thead>
<tr>
<th>Prevention Barriers in Place</th>
<th>Did the Barrier Fail?</th>
<th>Why?</th>
<th>How Barrier affect the outcome of event?</th>
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<tr>
<td>Root Cause</td>
<td>Actions to Address Root Cause</td>
<td>Level of Recommendation (Individual Team, Directorate, Organisation)</td>
<td>By Whom</td>
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Evidence of change (however small) starts to move the culture from one of fear to one of participation
NPSA – RCA Tool Kit

http://www.nrls.npsa.nhs.uk/resources/?entryid45=59847