Resilience Health Care

From Safety I

To Safety II

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Overview of minicourse

From Safety-I
There is something rotten ...

10 percent of patients admitted to hospital experience iatrogenic harm. More than half of this harm could have been prevented if staff had followed established good practice (Vincent et al. BMJ, 2001).

Nearly 60% of patients are not told about the potential side-effects of their prescribed medications (Source: Commonwealth Fund, 2005).

45% of patients fail to receive recommended care (McGlynn et al., NEJM, 2003).
Safety is defined as ‘freedom from accidental injury,’ which can be achieved by ‘Avoiding injuries or harm to patients from care that is intended to help them.’

Industrial safety can be defined as the ability to manage the risks inherent to operations or related to the environment. Industrial safety is not a dislike of risks; rather it is a commitment to clearly identify them in relation to production operations, assess them in terms of quality and quantity, and manage them.
Safety-I: Focus on what goes wrong

Safety-I looks at what happens from the side of unsafe functioning.

When the focus is on that which goes wrong (accidents, incidents, etc.), then it is difficult to see that which goes right.
Patient safety

Measuring harm
Measuring what goes wrong in health care involves counting how many patients are harmed or killed and from what type of adverse events.

Understanding the causes
The next step is to understand the underlying causes that lead to patient harm. Because of the complex nature of health care, there is no single reason why things go wrong.

Developing solutions
Learning from implementation
Evaluating impact
Translating improvement into policy and practice
Three types of accident models

Simple linear model
Independent causes, Failures, malfunctions

Complex linear model
Interdependent causes (active + latent)

Non-linear model
Tight couplings, coincidences, resonance, emergence

Sequential
Epidemiological
Systemic
Adverse outcomes (accidents, incidents) happen when something goes wrong. Adverse outcomes therefore have causes, which can be found and treated.

Find the component that failed by reasoning backwards from the final consequence.

Accidents result from a combination of active failures (unsafe acts) and latent conditions (hazards).

Find the probability that something “breaks”, either alone or by simple, logical and fixed combinations.

Look for single failures combined with latent conditions that may degrade barriers and defences.
Simple linear model

Heinrich’s ‘domino’ model (1931). ‘Fault of person’ as an unspecified cause.

Humans as ‘accident-prone’ or ‘error prone,’ meaning that a person has a greater number of accidents than normal.

Complex linear model

Multiple layers of defences, barriers, and safeguards.

The holes represent weaknesses or failures of defences, barriers, and safeguards.

Some holes are due to active failures

Other holes are due to latent conditions

Hazard

Loss
The Code of Hammurabi (1792-1750)

If a physician heal the broken bone or diseased soft part of a man, the patient shall pay the physician five shekels in money. If he were a freed man he shall pay three shekels. If he were a slave his owner shall pay the physician two shekels.

If a physician make a large incision with an operating knife and cure it, or if he open a tumor (over the eye) with an operating knife, and saves the eye, he shall receive ten shekels in money. If the patient be a freed man, he receives five shekels. If he be the slave of some one, his owner shall give the physician two shekels.

If a physician make a large incision with the operating knife, and kill him, or open a tumor with the operating knife, and cut out the eye, his hands shall be cut off. If a physician make a large incision in the slave of a freed man, and kill him, he shall replace the slave with another slave. If he had opened a tumor with the operating knife, and put out his eye, he shall pay half his value.
The causality dilemma

Historically, the physician-patient relation was one-to-one. The first modern hospital (The Charité, Berlin) is from 1710. In a one-to-one relation, it makes sense to assign praise – and blame – directly to the physician.

Staff: ~ 8.000 (Rigshospitalet, 2008)
Number of bed days 322,033
Number of surgical operations 43,344
Number of outpatients 383,609
Average duration of stay 5.2 days

Does it still make sense to think of direct responsibility?
Safety-I – when nothing goes wrong

Safety-I: Safety is defined as a condition where the number of adverse outcomes (accidents / incidents / near misses) is as low as possible.

Safety has traditionally been defined by its opposite – the lack of safety.

The lack of safety means that something goes wrong or can go wrong.

Safety-I requires the ability to prevent that something goes wrong. This is achieved by:

1. Find the causes of what goes wrong (RCA).
2. Eliminate causes, disable possible cause-effect links.
3. Measure results by how many fewer things go wrong.
Overview of minicourse

From Safety-I

To Safety-II

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Why only look at what goes wrong?

**Safety-I** = Reduced number of adverse events.
Focus is on what goes wrong. Look for failures and malfunctions. Try to eliminate causes and improve barriers.

Safety and core business compete for resources. Learning only uses a fraction of the data available.

\[ 10^{-4} := 1 \text{ failure in 10,000 events} \]

\[ 1 - 10^{-4} := 9.999 \text{ non-failures in 10,000 events} \]

**Safety-II** = Ability to succeed under varying conditions.
Focus is on what goes right. Use that to understand everyday performance, to do better and to be safer.

Safety and core business help each other. Learning uses most of the data available.
Noticing the unnoticeable

Inspector  “Is there any point to which you would wish to draw my attention?”
Gregory  “To the curious incident of the dog in the night-time.”
SH  “The dog did nothing in the night-time.”
IG  “That was the curious incident,” remarked Sherlock Holmes.

Perceive those things which cannot be seen
Miyamoto Musashi  (c. 1584-1645)
What should we notice?

- Unexamined events
- Big surprises
- Small surprises
- No surprises

Everyday performance

Things that go right
The system functions can range from being easy to understand to being difficult to understand – either in part or in whole.

The instability of system functions can range from low to high – from being regular and orderly (‘clockwork’) to being irregular and disorderly.

Descriptions can either be simple (few elements and relations) or elaborate (many elements and relations).
Tractable systems

Homogeneous processes

Standardized industrial production is stable, relatively simple to describe, and well understood.

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Intractable systems

Services for unscheduled demands, such as an emergency room, are irregular, difficult to describe and not always completely understood.
Performance variability is necessary

Most socio-technical systems are intractable. Conditions of work are therefore underspecified.

Resources (time, manpower, materials, information, etc.) may be limited or unavailable

People (individually and collectively) must adjust what they do to match the conditions.

For the very same reasons, the adjustments will always be approximate.

The approximate adjustments are the reason why everyday work is safe and effective.

But the approximate adjustments are also the reason why things sometimes go wrong.

Acceptable outcomes

Unacceptable outcomes
Safety II – when everything goes right

Safety is the ability to succeed under varying conditions.
(Risk is the likelihood that this does not happen, that people do not succeed.)
The emphasis is on how things go right, how they work in the first place.
Different outcomes (“normal” results vs. failures) are not distinct binary categories,
but rather judgements of value.
Unexpected outcomes are not necessarily a consequence of unexpected processes.

Individuals and organisations must adjust everything they do to match the current conditions. Everyday performance must be variable in order for things to work.
Overview of minicourse

To Resilient Health Care

From Safety-I

To Safety-II

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Work as imagined – work as done

Work-as-imagined is what designers, managers, regulators, and authorities believe happens or should happen.

Work-as-done is what actually happens.

Safety I: Failure is explained as a breakdown or malfunctioning of a system and/or its components (non-compliance, violations).

Safety II: Individuals and organisations must adjust to the current conditions in everything they do. Performance must be variable in order for things to work.

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Emergency surgery on a fractured neck of femur involves app. 75 clinical guidelines and policies.

UK Government guideline on “Working Together to Safeguard Children” is 390 pages long!

Typical patient journey

Unintended Understanding failure – when people have a different understanding of what the procedure is and what they have to do.

Unintended Awareness failure – when people are not aware of the existence of a rule or procedure and therefore operate with any reference to it.

Situational non-compliance – when the situation makes it impossible to do the job and be compliant, e.g., because of insufficient time or resources.

Optimizing non-compliance for company benefit – individuals take short-cuts believing that this will achieve what they believe the company, and their superiors, really want;

Optimizing non-compliance for personal benefit – short-cuts taken to achieve purely personal goals;

Exceptional non-compliance – deviations from the official procedures that may be difficult to follow under specific, and usually novel, circumstances.
Work-as-done: The ETTO view

<table>
<thead>
<tr>
<th>ASPECT OR CONDITION</th>
<th>TYPE OF PERFORMANCE ADJUSTMENT (ETTO)</th>
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<tbody>
<tr>
<td></td>
<td>Avoid</td>
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<tr>
<td>Time</td>
<td>Waste of time</td>
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<tr>
<td>Human effort</td>
<td>Waste of effort</td>
</tr>
<tr>
<td>Workplace (HF)</td>
<td>Inadequate work conditions</td>
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<tr>
<td></td>
<td>Work overload</td>
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<tr>
<td></td>
<td>Waste of material &amp; resources</td>
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<tr>
<td></td>
<td>Improper use</td>
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<tr>
<td></td>
<td>Waste of money</td>
</tr>
<tr>
<td>Equipment / tools</td>
<td>Data overload</td>
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<tr>
<td>Finance (cost)</td>
<td></td>
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<tr>
<td>Data</td>
<td></td>
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</tbody>
</table>
Why do people vary in their work?

- **AVOID**
  anything that may have negative consequences for yourself, your group, or organisation

- **MAINTAIN/CREATE**
  conditions that may be of use in case of future problems.

- **COMPENSATE FOR**
  unacceptable conditions so that it becomes possible to do your work.
Efficiency-Thoroughness Trade-Off

Thoroughness: Work Safely
Recognising situation.
Choosing and planning.

If thoroughness dominates, there may be too little time to carry out the actions.
Neglect pending actions
Miss new events

Efficiency: Get work done
Implementing plans.
Executing actions.

If efficiency dominates, actions may be badly prepared or wrong
Miss pre-conditions
Look for expected results

The dilemma is that people are expected to be efficient and thorough at the same time – or rather to be thorough, when with hindsight it was wrong to be efficient.
Some ETTO heuristics

Cognitive (individual)
- Judgement under uncertainty
- Cognitive primitives (SM – FG)
- Reactions to information input over- and underload
- Cognitive style
- Confirmation bias

Idiosyncratic (work related)
- Looks fine
- Not really important
- Normally OK, no need to check
- I’ve done it millions of time before
- Will be checked by someone else
- Has been checked by someone else
- This way is much quicker
- No time (or resources) to do it now
- Can’t remember how to do it
- We always do it this way
- It looks like X (so it probably is X)
- We must get this done
- Must be ready in time
- Must not use too much of X

Collective (organisation)
- Negative reporting
- Reduce redundancy
- Meet “production” targets
- Reduce unnecessary cost
- Double-bind
- Reject conflicting information

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Handling a drug prescription

On a cold January afternoon, a customer handed in a prescription at a drug store. Workload was high due to illness among staff, many customers (20-30) were waiting (30-40 minutes), and there was only one computer terminal available.

**Thoroughness**
- Register prescription in computer system by drug name before fetching drug from supply.
- Verify drug and dose via customer dialogue.

**Efficiency**
- Avoid letting customer wait by fetching drug from supply, and registering it later.
- Customer was irritated because of long wait and declined.

Customer received the wrong drug (Estradiol instead of Efedrin), but the mistake was realised before drug was used … and the pharmacist was blamed for not following procedures.
How did people adjust their work?

**AVOID**

- Waste of time (many customers waiting for 30-40 minutes)

**MAINTAIN/CREATE**

- Manageable workload (busy period, high pressure)

**COMPENSATE FOR**

- Manpower shortage (illness among staff)
- Unavailability of tools (only one computer terminal available)
What is resilience?

Resilience is the intrinsic ability of an organisation to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.

In order to be resilient, the organisation must have four basic abilities.

- **Learn from past events**, understand correctly what happened and why
- **Monitor** short-term developments and threats; revise risk models
- **Anticipate** long-term threats and opportunities
- **Respond** to regular and irregular conditions in an effective, flexible manner,
The ability to respond (actual)

What: For which events is there a response ready? How was the list of events created? When – and why – is the list revised?

When: What is the threshold of response? How soon can a response been given? How long can it be sustained?

How: How was the type of response determined? How many resources are allocated to response readiness? How is the readiness verified or maintained?
On April 20, 2010, an explosion occurred on the rig and she caught fire. The rig was in the final phases of drilling a well in which casing is cemented in place, reinforcing the well. 7 workers were taken to the hospital, but 11 people are missing.

The Blowout Preventers or BOPs are controlled with redundant systems from the rig. In the event of a serious emergency, they should be engaged manually or automatically when something of this proportion breaks out. None of them were apparently activated. Deepwater Horizon sank on April 22, 2010, in water approximately 5,000 feet deep, and has been located on the seafloor about 1/4 mile NW of the well.
The ability to monitor (Critical)

- Meaningfulness (desirability)
  - Relevant – but are they cost-effective?
  - Ideal
  - Irrelevant

- Ease of measurement (availability)
  - LO
  - HI

- Factual
- Critical
- Potential
The ‘real’ indicators

Safety is defined as that which is ‘measured’ by the indicators. Availability is more important than meaningfulness.

Indicators are based on an articulated description (model) of the system and of safety. Meaningfulness is more important than availability.

Proxy indicator: Indirect measure or sign that represents a phenomenon in the absence of a direct measure or sign.
The ability to learn (factual)

- What is the learning based on (successes – failures)?
- When does learning take place (continuously or event-driven)?
- What is the nature of learning (qualitative, quantitative)?
- What is the target of learning (individuals, organisation)?
- How are the effects of learning verified and maintained?
What does it take to learn?

Opportunity (to learn): Learning situations (cases) must be frequent enough for a learning practice to develop.

Comparable /similar: Learning situations must have enough in common to allow for generalisation.

Opportunity (to verify): It must be possible to verify that the learning was ‘correct’ (feedback).

The purpose of learning (from accidents, etc.) is to change behaviour so that certain outcomes become more likely and other outcomes less likely.
The ability to look ahead (potential)

The future is a “mirror” image of the past (repetition, extrapolation)

The future is described as a (re)combination of past events and conditions.

The future has not been seen before. It involves a combination of known performance variability, that usually is seen as irrelevant for safety.

Mechanistic view

Probabilistic view

Realistic view
Financial crisis of 2008

Partially … I made the mistake in presuming that the self-interest of organisations, specifically banks, is such that they were best capable of protecting shareholders and equity in the firms … I discovered a flaw in the model that I perceived is the critical functioning structure that defines how the world works. I had been going for 40 years with considerable evidence that it was working exceptionally well.

.. once-in-a-century credit tsunami, … that … turned out to be much broader than anything I could have imagined.

Alan Greenspan, Guardian, October 24, 2008
### Achieving Safety-II in practice

<table>
<thead>
<tr>
<th>Resilient Marker Level</th>
<th>Monitoring / preparing / scheduling work / ‘sense of unease’ / compensating</th>
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<tbody>
<tr>
<td><strong>Strategy Level</strong></td>
<td>1) Resilience repertoire</td>
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<tr>
<td></td>
<td>2) Mode of operation</td>
</tr>
<tr>
<td></td>
<td>3) Resources and enabling conditions</td>
</tr>
<tr>
<td></td>
<td>4) Threats &amp; opportunities</td>
</tr>
<tr>
<td><strong>Observation Level</strong></td>
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The trolley as a unit of work

The **purpose** of the Day Care Unit is to administer the right treatment to the right patient.

One **threat** is that the details of the treatment may be incomplete so that incorrect treatment may be given to a patient in this busy environment.

**Observation:** a new member of staff failed to tidy the trolley after administering treatment. An experienced member of staff pointed out that keeping the trolleys tidy was important for the treatment routine: the trolley should be fully prepared before a patient’s treatment, the treatment should be administered, and then the trolley should be tidy to return it to its resting state.

The **resilience strategy** of ‘preparation’ reduces the likelihood of error, and the tidying allows for better ‘monitoring’ of activities and errors, e.g. only those things needed for treatment should be on a properly prepared trolley and nothing should be unused after.
How can we learn from what goes right?

**Notice the unnoticeable.** Learn from situations where nothing out of the ordinary seemed to happen, by understanding what actually took place. Things go well because people make sensible adjustments according to the demands of the situation. Recognise these adjustments and try to learn from them!

**Select what to look at based on frequency rather than severity.** It is easier to learn from that which is frequent (and regular) than for that which is infrequent and irregular. Small improvements of everyday performance may count for more than large improvements of exceptional performance.

**Allow time to reflect, to learn, and to communicate.** If you are always trying to make ends meet, there will never be time to consolidate experiences or replenish resources – including your own understanding. It must be legitimate in the culture to allocate resources – especially time – to reflect, to share experiences, and to learn.
Safety-I: Eliminate the negative

Reduce the number of things that go wrong

Negative outcomes are caused by failures and malfunctions.

Safety = Reduced number of adverse events.

Eliminate failures and malfunctions as far as possible.

Negative outcomes (accidents, incidents) are relatively rare.

Their size (cost) is variable, but often large.

Adverse events are unusual and therefore attract attention.
Safety-II: Accentuate the positive

Things that go right are the norm rather than the exception.

Improve resilience (respond, monitor, learn, anticipate).

Increase the number of things that go right.

Their size (benefit) is small, but known and predictable.

Safety = Ability to succeed under varying conditions.

Because things go right all the time they are routinely ignored.

All outcomes due to performance adjustments.

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Thank you for your attention

For more information visit www.resilienthealthcare.net

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