Resilient health care: re-conceptualising patient safety

Professor Jeffrey Braithwaite, PhD
Professor of Health Systems Research
Director, Australian Institute of Health Innovation

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Australian Institute of Health Innovation’s mission

Our mission is to enhance local, institutional and international health system decision-making through evidence; and use systems sciences and translational approaches to provide innovative, evidence-based solutions to specified health care delivery problems.

http://www.med.unsw.edu.au/medweb.nsf/page/ihi
Australian Institute of Health Innovation

- Professor Jeffrey Braithwaite
  Professor and Foundation Director, AIHI; Director, Centre for Clinical Governance Research
- Professor Enrico Coiera
  Professor of Health Informatics, Centre for Health Informatics, AIHI, UNSW
- Professor Ken Hillman
  Professor of Intensive Care, Simpson Centre for Health Services Research, AIHI, UNSW
- Professor Johanna Westbrook
  Professor of Health Information Centre for Health Systems and Safety Research, AIHI, UNSW

Background - the Centre

The Centre for Clinical Governance Research undertakes strategic research, evaluations and research-based projects of national and international standing with a core interest to investigate health sector issues of policy, culture, systems, governance and leadership.

## A statistical comparison 2013-2014

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>Sweden</th>
<th>UK</th>
<th>Netherlands</th>
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</thead>
<tbody>
<tr>
<td>Population</td>
<td>22,507,617 (56th)</td>
<td>9,723,809 (91st)</td>
<td>63,742,977 (23rd)</td>
<td>15,569,077 (66th)</td>
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<tr>
<td>P’n growth rate</td>
<td>1.09% (112th)</td>
<td>0.79% (140th)</td>
<td>0.54% (152nd)</td>
<td>0.22% (178th)</td>
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<tr>
<td>Area (sq km)</td>
<td>7,741,220 (6th)</td>
<td>450,295 (56th)</td>
<td>243,610 (80th)</td>
<td>43,094 (134th)</td>
</tr>
<tr>
<td>GDP PPP, $US</td>
<td>998.3 billion (18th)</td>
<td>393.8 billion (35th)</td>
<td>2.378 trillion (9th)</td>
<td>211.3 billion (55th)</td>
</tr>
<tr>
<td>GDP per capita $US</td>
<td>43,000 (19th)</td>
<td>40,900 (26th)</td>
<td>37,300 (34th)</td>
<td>37,800 (31st)</td>
</tr>
<tr>
<td>Imports $US</td>
<td>245 billion (22nd)</td>
<td>158 billion (30th)</td>
<td>646 billion (6th)</td>
<td>98 billion (35th)</td>
</tr>
<tr>
<td>Exports $US</td>
<td>252 billion (23rd)</td>
<td>182 billion (28th)</td>
<td>476 billion (11th)</td>
<td>106 billion (37th)</td>
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Safety in Patient Care

“After decades of improving the health care system, patients still receive care that is highly variable, frequently inappropriate, and too often, unsafe.”¹


How do organisations work?
If your mental model is this …

Then this is how you will deal with error …
A Medication Error Story

Nurse gives the patient a medication to which he is allergic.

Patient arrests and dies.

Nurse borrows medication from another patient.

Tube system for obtaining medications is broken.

Nurse staffing.

Fax system for ordering medications is broken.


But healthcare really looks like this …
And this …

- Problem solving networks in an ED

Nurses
Doctors
Allied health
Admin and support

[Creswick, Westbrook and Braithwaite, 2009]

And this …

- Medication advice-seeking networks in an ED

Nurses
Doctors
Allied health
Admin and support

[Creswick, Westbrook and Braithwaite, 2009]
And this …

- Socialising networks in an ED

Nurses
Doctors
Allied health
Admin and support

[Creswick, Westbrook and Braithwaite, 2009]

So we need new ways of thinking
Beyond linear reductionism

Health care as a complex adaptive system

- Agents
- Inter-relating
- Rich relationships
- Non-linearity
- Self-organising
- Hierarchical
- Path-dependent

- Emergent behaviours
- Feedback occurs
- Fractal, nested
- Heterarchical
- Individuals may only know local elements

[Braithwaite et al, 2014]
Health care as a complex adaptive system

1. Complex systems are intrinsically **hazardous** systems
2. Complex systems are heavily and successfully **defended against failure**
3. **Catastrophe requires multiple failures** - single point failures are not enough
4. Complex systems contain changing mixtures of **failures latent** within them

[Cook, 1998 and later]

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Health care as a complex adaptive system

5. Complex systems run in **degraded** mode
6. Catastrophe is always **just around the corner**
7. **Post-accident attribution** of accident to a ‘root cause’ **is fundamentally wrong**
8. **Hindsight biases** post-accident assessments of human performance

[Cook, 1998 and later]
Health care as a complex adaptive system

9. Humans have dual roles: as **producers** and **defenders** against failure
10. All practitioner actions are **gambles**
11. Actions at the **sharp end** resolve all ambiguity
12. **Human practitioners are the adaptable element** of complex systems

[Cook, 1998 and later]

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Health care as a complex adaptive system

13. **Human expertise** in complex systems is constantly changing
14. Change introduces **new forms of failure**
15. Views of ‘cause’ limit the effectiveness of **defences** against future events
16. **Safety is a characteristic of systems** and not of their components

[Cook, 1998 and later]
Health care as a complex adaptive system

17. People **continuously create safety**

18. Failure free operations require experience with failure

[Cook, 1998 and later]

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**Safety I and Safety II thinking**

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.

$10^{-4} = 1$ failure 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.

$1 - 10^{-4} = 9,999$ non-failures in $10,000$ events

© Eike Hofhage, 2012
Safety Perspectives in RHC

Safety I

• The (relative) absence of adverse events

• Reactive

• Assumes safety can be achieved by finding, and eliminating the causes of adverse events

Safety II

• The ability to succeed under varying conditions

• Proactive

• Focuses on what goes right, so that the number of intended and acceptable outcomes is as high as possible every day

Typical understanding of Safety

The ‘find and fix’ principle

Let’s tackle *things that go wrong*

A focus on what goes right receives little encouragement

There is little demand from authorities and regulators to look at what works well, and if someone should, there is little help to be found
A Swedish example
Why did the Vasa sink on 10 August 1628?

The Vasa is so huge it can be viewed from seven floors in the museum.

[http://www.vasamuseet.se/en/The-Ship/The-sinking/]

A Swedish example
WHY DID VASA SINK?

“The news of the sinking reached the Swedish king, who was in Prussia, after two weeks. The disaster had to be the result of “foolishness and incompetence,” and the guilty must be punished, he wrote to the Royal Council in Stockholm.”

[http://www.vasamuseet.se/en/The-Ship/The-sinking/]
A Swedish example

WHY DID VASA SINK?

“What exactly lay behind the loss could not be determined with certainty in the inquest held in the palace, but the ship’s lack of stability was a fact: the underwater part of the hull was too small and the ballast insufficient in relation to the rig and cannon. The leaders of the inquest believed that the ship was well built but incorrectly proportioned.”

[http://www.vasamuseet.se/en/The-Ship/The-sinking/]

A Swedish example

WHY DID VASA SINK?

“After Vasa, many successful ships with two or even three gundecks were built, so something must have been learned from the disaster.”

[http://www.vasamuseet.se/en/The-Ship/The-sinking/]
Reactive Safety Management

Highly technocratic and largely retrospective model of learning

Reactive, not proactive, forms of foresight and problem-solving

Focuses on the 10-20% of breaches vs the 80-90% of instances that maintain day to day safety

Poor understanding of everyday work including organisational culture and politics

Hollnagel et al, Resilient Health Care, 2013

Critical Analysis of Safety I
A Different Perspective – Safety II

A different way of looking at safety

A different way of applying many familiar methods and techniques

Asks us to identify *things that go right* and analyse why they work well

Requires proactive management of performance variability, not just constraints and avoidance

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Safety II: When Things Go Right

What if we changed the definition of safety from ‘avoiding something that goes wrong’ to ‘ensuring that everything goes right’?

More precisely ‘ensuring that the number of intended and acceptable outcomes is as high as possible’

This requires a deep understanding of **everyday activities**

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The 10% or the 90%?

When things go right

90%

When things go wrong

10%

Inquiries
Incident monitoring
RCAs
Hand hygiene
Handover
Checklists
Etcetera ...
Etcetera ...

What on earth were we thinking

• We know a lot about when things go wrong
• But have made little progress
• We know little about when things go right
• And this everyday clinical behaviour, relying on expertise and tacit knowledge, creates safe effective care
• We call this Resilient Health Care
So … we need to develop more system resilience

Resilience is...

…Bouncing back faster after stress, enduring greater stresses, and being disturbed less by a given amount of stress…

…Maintaining system function in the event of a disturbance…

…The ability to withstand, recover from, and reorganize in response to crises…

For an Individual  
For a System  
For an Adaptive System

Resilient Health Care

Another way of thinking about resilience:

“resilience is the intrinsic ability of a system to adjust its functioning prior to, during or following changes/disturbances in order to sustain required operations under expected or unexpected conditions”

Here are some ideas from RHC thinking...

[Holmage et al, Resilient Health Care, 2013]
We tend to figure out solutions and ‘fix’ work as imagined rather than work as enacted

First story, second story
First story: linear thinking

Things have gone wrong
Find out what happened
Attribute actions to people
Uncover the root causes
Fix the systems so this doesn’t happen again


But healthcare really looks like this …
Second story: complexity thinking

It’s more complex than the first story
It’s not linear at all
Multiple interacting variables
Uncover how come we did this many times previously and things went right
Strengthen the systems so we do more things well

Productive Insights into Safety

Productive insights are generated from the ‘second story’ that lies behind the ‘first story’ of incidents and accidents

First stories are accounts of the ‘celebrated’ accidents which categorise them as both catastrophes and blunders

Second stories tell how, ‘multiple interacting factors in complex systems can combine to produce systemic vulnerabilities to failure … the system usually … manages risk but sometimes fails.’

[Cook, Woods and Miller, 1998:2-3]
Resilience and the Second Story

Resilience:
– is a property of systems
– confers on systems the ability to remain intact and functional despite the presence of threats to their integrity and function
– is the opposite of brittleness and aspires to be a theory of systemic function

How does complexity fit in?
The natural properties of complex systems
Many complex systems have similar natural properties and behaviours

Common network features have been identified by researchers in fields as diverse as mathematics, sociology, marketing science, psychology

We need to understand these features to understand resilience

Boards of Directors in business

http://images.businessweek.com/ss/06/09/ceo_socnet/image/intro.jpg&imgrefurl=
First two principal components of the editorial adjacency graph for the years (A) 2000, (B) 2002, and (C) 2005. Nodes correspond to members, and lines correspond to existing edges in the editorial adjacency graph. These represent the editorial boards of journals in medical informatics and bioinformatics.

Network map of the Forensic Science Laboratory, Ireland, recording advice given from scientist to scientist over a 3-day period where forensic scientists have formed four CoPs. Biology (green), Chemistry (blue), DNA (red), Drugs (pink), Executive management (yellow). Management (gold stars).


Prestige of scientists proportional to diameter of vertices—sixteen scientists within a laboratory network give advice.
Natural properties of complex systems

<table>
<thead>
<tr>
<th>Properties of complex systems</th>
<th>Health care manifestations</th>
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<tbody>
<tr>
<td>Natural networks</td>
<td>Groups of clinicians who interact professionally to share information, support, consult, refer, and jointly manage patients</td>
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<tr>
<td>Natural hubs and scale-free behaviour</td>
<td>Opinion leaders in networks who disproportionately influence policies, events or practices</td>
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<tr>
<td>Natural pathways, connectivity and small-worlds</td>
<td>Communication channels facilitating the rapid dissemination of information via “grapevines” and communities of practice</td>
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<tr>
<td>Natural appeal and stickiness</td>
<td>Messages and communications that are convincing, and are absorbed amongst clinical cohorts</td>
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<tr>
<td>Natural propagation and tipping points</td>
<td>The point at which a message, idea or practice whose time has come is readily adopted by a critical mass of clinicians</td>
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<tr>
<td>Natural categories and natural mapping</td>
<td>The identification of clinically relevant problems grouped as accessible data, to facilitate decision-making and solutions to health care problems</td>
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<tr>
<td>Natural interest and self-selection</td>
<td>Clinicians with common concerns and complementary expertise voluntarily grouped together to collectively resolve coal-face clinical problems</td>
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Articulating these natural properties
Two types of networks

**Type A**: purpose-designed, funded or imposed by authority, in structured organisational or institutional forms [designed, mandated networks]

**Type B**: those composed of the relationships amongst clinicians, via professional interests, referrals, supports, friendships, communications and advice [natural networks]

[Braithwaite et al 2009]

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Natural networks

Natural networks do not respond well to conventional management or control measures

They emerge spontaneously and propagate or function with little or no externally imposed structure or resources

They can exert powerful and pervasive influences on how systems function

[Braithwaite et al 2009]
Example A: friendship clusters in a school

[Moody, 2001]

Example B: the internet

[Cheswick, 2007]
Example C: clinicians networked in GMT\textsuperscript{2}

[Braithwaite and Goulston, 2004]

Example D: obesity ties in the Framingham Health Study

[Christakis and Fowler, 2007]
Clinician-researcher alliance study: central actors

Figure 1 Current Collaboration network. Central actor LC64 shown in blue, brokers BB28, EB31, DB30, CC55, MA13 and KA11 in yellow and JA10 who is both a central actor and a broker is shown in red.

[Long et al 2013]

Clinician-researcher alliance study: governing body before

Figure 2 Social network diagram of Governing Body members: “Which people did you know before the TRN started?”
Figure 3 Social network diagram of Whole TRN: “Which people did you know before the TRN started?” Governing body members are black circles; rank and file members are grey triangles.

Figure 4 Past collaboration network. Each node represents a survey respondent and each line a tie defined by the questions: “I know this person through collaboration on a research project before the translational research network began (e.g. through clinical trials, NHMRC funded projects, quality improvement projects, audits)” or “I have worked with this person in another way, including current work colleagues (e.g. shared care of patients, worked in the same lab, shared resources).” TRN director is LC64; JA10 is the TRN manager. Square nodes are clinicians, circles are researchers and triangles are clinician-researchers. Blue are members from a Central Site, red are from a Satellite site and black from a peripheral site.
Figure 5 Current Collaboration network.
Links defined by the question: “I have consulted or collaborated with this person regarding a translational research network project or regarding dissemination of its objectives or findings.” Four respondents are not currently collaborating. JA10 is the TRN manager.

Figure 6 Future Collaboration network.
Links defined by the question: “I would consider collaborating with this person on a translational research network project in the future.”

Clinician-researcher alliance study: key players currently

Clinician-researcher alliance study: future collaborations
Natural hubs and scale-free behaviour

Nodes [hubs] are not randomly distributed [scalable] but are scale-free [i.e., they are unequally distributed]

Many nodes are relatively isolated, with one or two links

Some nodes have a moderate number of links

Natural hubs, scale-free behaviour

Others are the distributed force field of the network, with many links. These are the:

– Google search engine
– King’s Cross St Pancras railway station
– Prominent clinicians at the centre of nests of referral, consultation or collegial patterns
Natural hubs, scale-free behaviour

Counter-intuitively, scale-free networks resist jamming

They concentrate effort efficiently

The hubs are the key to this efficiency

We have a surprising number of nouns for these kinds of people:

– Mavens
– Boundary-riders
– Cosmopolites
– Brokers
– Liaisons
– Translators
– Socialites
– Cross-cultural communicators
– Bridges
– Opinion-leaders
– Reticulists
Natural pathways, connectivity and small worlds

The sociology of networks is that they can be highly efficient

The term for this is ‘small worlds’

These are fast, navigable routes through the complex montage of connections

Natural pathways, connectivity and small worlds

The ties between any two of us can be mapped through no more than ‘six degrees of separation’

You do not have to know everyone in a chain across the six degrees – just the next person, who knows someone else, and so on
Natural stickiness

So the system is resilient without everyone understanding what everyone else does

Methods for the study of Resilient Health Care

How do you study the multiplicity of organisational, economic, technical, informational, clinical and human aspects of routine care delivery?

How much local effort and shared interactive expertise are involved in overcoming, rescuing, avoiding, adjusting, anticipating and repairing that which could have gone wrong but did not?
Methods for the study of Resilient Health Care

• Social Network Analysis (SNA) in one way
• What is it that people hope to learn by applying SNA?
  • uncovering patterns of connections between people in order to predict or change behaviour
  • Cunningham et al. (2012) review highlighted the importance of network brokers and bridges – typically clinicians, who are prominent in networks

What SNA reveals

• People working at the boundaries are important – since innovation comes from not only interactions *within* silos but *across* them
  • Long et al. (2013) found high degrees of homophily and clustering of professional groups which can be a major barrier to multidisciplinary team work.
  • SNA allows us to see connections between healthcare agents as they *actually operate*, rather than as they are *expected to operate*
Methods for the study of Resilient Health Care

• Actor Network Theory (ANT)
• ANT adds to the analytic mix the dimensions of time, space, ideas and material ‘stuff’
  • ANT’s power is its attention to links - including objects, technologies, information and ideas
  • ANT is not a snapshot but views all links as entirely contingent and local, fragile and temporary, constantly shifting moment-to-moment

What ANT reveals

• Exposing the nuances, dynamics, non-linearity, and complexity of resilient clinical work.
Benefits of SNA and ANT

- SNA is a sweeping bird’s eye view of the action on the ground

- ANT provides a detailed grasp of socio-technical-temporal dynamics from an ant’s-eye view.

- Networks do not treat any one individual or professional group as foundational – force us to look at the collective enactment of safe care

- Strong methodological power

Implications of these alternative ways of thinking
Discussion: comments, questions, observations?

Contact details

Jeffrey Braithwaite, PhD
Australian Institute of Health Innovation
Faculty of Medicine
University of New South Wales
Email: j.braithwaite@unsw.edu.au
Web: http://clingov.med.unsw.edu.au
Workarounds: what they look like

Workaround in a hospital ward to solve the problem of the smoke alarm that kept going off because of nebulisers in a patient’s room.
Example 1: patients with difficulty swallowing

- Elderly patients with difficulty swallowing restricted to **thickened fluids to prevent aspiration**
- Patients also require medication to ensure bowel regularity
- Popular medication comes as powder, but when mixed forms **thin fluid**
- Implementing policy about medication means giving patient this fluid

**Following the policy may result in unsafe practice**

- Management offered two solutions:
  - equipment to make solution thicker (**wait of months for it to arrive**)
  - Implementing mixing method from another hospital (**doesn’t work with processes in this hospital**)

- **Nurse works around the problem** by banning brand of medication that forms thin fluid

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Example 2: Electronic Medication Records

- Medication administration policy states that EMRs must be taken to bedside to be checked against patient’s identification band **before** administration
- Medical record in EMR must be signed off **after** medication administration
- IT ‘black spots’ mean EMR often does not work at bedside

**Following policy is simply not possible in practice**

- Nurse works around the problem by leaving EMR outside patient’s room, signing off medication **before** administering and memorising patient ID from the EMR