



20th International Conference
The International Society for Quality in Health Care
The Burlington Hotel, Dublin
11th - 14th October 2009

Reverse engineering disasters: what can healthcare learn from other industries?

Dublin 2009 - Designing for Quality

11- 14 October 2009, Dublin, Ireland



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Background - research team

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Background - the Institute

The 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.

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Objectives

1. Examine disasters in several industries, reverse-engineering the human and technological factors which contributed to their occurrence;
2. Test these factors against examples of major breaches of patient safety; and
3. Identify the ways in which healthcare can be redesigned to prevent major disasters occurring. This is a key issue in designing patient safety with built-in quality.



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Definition

Reverse engineering is the process of identifying the principles of a device or system, by taking it apart and identifying the underlying design. It involves:

- Identifying the system's components and the relationships between them;
- Producing different or abstract representations of the system in another form;
- Creating a (physical) representation of that system.



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Method

- We analysed disaster events in six industries:



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Method

- Theoretically informed by Normal Accident and High Reliability Theory;
- Commonalities and differences in the causes, pathways and consequences of these disasters were identified;
- These core elements were mapped in each disaster.



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Method

- This disaster arc was applied to:
 - Three individual cases of healthcare (involving technical, design and procedural errors);
 - Ten patient safety inquiries from around the world (Australia, Canada, Slovenia and New Zealand, United Kingdom) including paediatric, acute care, pathology, infection control, maternal and child health, long term care and mental health services.



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Results

Disasters across all industries follow a predictable arc over time.

1. Disasters emerge from a relatively stable system, but which contains the latent conditions for disasters (or errors) (phase 1).

A destabilising agent (individual, action or event) is then introduced.



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Results

2. The disaster then proceeds along four pathways which contain various tipping points where the disaster could have been ameliorated or halted (phase two).

If the pathway is not halted it leads to its culmination where the greatest amount of damage occurred.



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Results

3. The disaster then proceeds along four pathways which contain various tipping points where the disaster could have been ameliorated or halted (phase three):

- Abatement of the disaster or error;
- Stabilisation;
- Continuance;
- Further exacerbation.



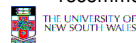
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Results

4. The final phase, the post-disaster, is marked by the:

- Use of standing or specially convened public, private, professional or organisational inquiry processes (or some combination of all of these);
- Development of regulatory frameworks;
- Production of recommendations;
- Implementation or not, of all or some of these recommendations;
- Ongoing monitoring and investigation to ensure system feedback and the institutionalisation of recommendations.



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Discussion

Common elements in the conditions which preceded disasters were identified:

- Organisational
 - History and culture of low or variable standards
 - Deficient quality and monitoring processes
 - Constraints to the discovery and rectification of errors
 - Ineffectual organisational and personal communication and documentation

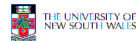


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Discussion

- Teams and individuals
 - Over worked and under-experienced staff
 - Deficient teamwork, including lack of understanding and respect for other professions
 - Inadequate professional training and supervision
 - Lack of balance between professional autonomy and individual, team or professional responsibility



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Discussion

- Patients and families
 - Inadequately involved in care planning;
 - Not able to give informed consent;
 - Unsure of their rights;
 - Afraid of exercising the rights they knew about;
 - Not respected, treated with consideration or compassion;
 - Rarely given sympathetic or helpful support when they made complaints.



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Discussion

- Environmental
 - Poor design of facilities, processes and 'tools'



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Discussion

This environment was easily destabilised, allowing small actions to become catalysts for large scale disasters.

Yet healthcare, like other systems, are marked by cultural, social and technical warning signs prior to disasters, including the active concerns of patients, families and clinicians.



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Discussion

In the cases reviewed, the disaster pathway continues in an upward trajectory when the conditions for error were further enabled by organisational and procedural factors such as the:

- Denial or suppression of early warning signs;
- Dismissal of patient and clinician concerns;
- Failure of timely transmission of vital information to responsible individuals;



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Discussion

- Suppression and abuse of whistleblowers;
- Reaching the point of no return;
- Routine circumventing of existing procedures and protocols.

As a result, corrective actions are either not attempted or ineffective and the implications of the disaster continue, sometimes for decades after the original error or event.



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Discussion

The final stage, the inquiry process is vitally important to our understanding both of disasters per se, and of patient safety issues.

- Inquiry processes are largely impartial and objective;
- Each inquiry has a different emphasis and remit as directed by the regulatory framework under which they operate;
- Since the Bristol Royal Infirmary Inquiry, most patient safety inquiries are seeking to find a balance between a systems approach to errors and the role of individual clinician(s);



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Discussion

- Inquiry recommendations range up to several hundred. Most suggest variations on three strategies:
 - Organisational or team restructuring;
 - Policy and guideline development;
 - Staff training.



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Conclusion

- Differences in industries, countries, and disaster or error events did not preclude the identification of contributing factors.
- Major cases of error in healthcare systems follow similar and predictable arcs.
- The design of healthcare systems must address the cultural, social and structural conditions and organisational and procedural factors which enable small, seemingly unimportant events, to lead to major disasters.



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Selected references

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