LOUGHBOROUGH
DESIGN
SCHOOL

Loughborough University

Human Factors and Healthcare: An Overview

Dr Patrick Waterson

Human Factors and Complex Systems Group

Loughborough University UK

(Durham, 'Mind Over Splatter', October 17th, 2019)

My background

- At Loughborough since 2007, Fellow of CIEHF, Trustee CHFG
- Day job: Teaching undergrad (BSc) and postgrad (MSc) Human Factors and Ergonomics (HFE)
- Supervised 15 PhD students through to completion (Alison will no. 16 ☺)
- Research
  - Human error, accident and incident investigation (across a range of safety critical industries including healthcare)
  - Patient safety culture and its assessment, interventions (e.g., new technologies, WHO checklist, acute-community care transitions)

How far have we come with human factors/ergonomics (HFE) and healthcare?

Human Factors and healthcare: reasons to be cheerful ...

HSIB
HEALTHCARE SAFETY INVESTIGATION BRANCH

Human Factors in Healthcare
A Concordat from the National Quality Board

Loughborough University

https://vimeo.com/196716703

Human Factors and healthcare: reasons to be cheerful

NHS
Nottingham University Hospitals
NHS Trust

NHS
University Hospitals Birmingham
NHS Foundation Trust

Trent Simulation and Clinical Skills Centre

- The Centre
- Courses
- Faculty and Teaching

Human Factors and Patient Safety

At the Trent Simulation and Clinical Skills centre we do far more than 'just' simulation. Our overarching goal is to improve the quality of care for patients through providing education and interventions in patient safety and ergonomics/ human factors. Understanding how the systems we work in influence performance is fundamental to identify how we can improve to make care safer.

NUFFIELD DEPARTMENT OF SURGICAL SCIENCES
Medical Sciences Division

Staff Intranet

HOME ABOUT US NEWS EVENTS RESEARCH PUBLICATIONS STUDY WITH US OUR TEAM PUBL

Study with us / Graduate studies / Degrees / Postgraduate Certificate in Patient Safety

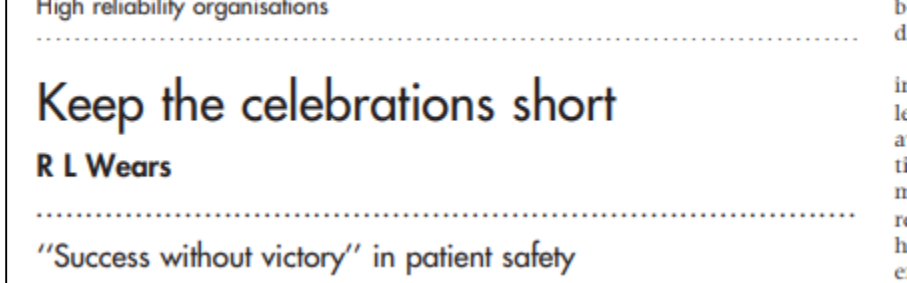
Postgraduate Certificate in Patient Safety

UNIVERSITY OF OXFORD

chfg clinical human factors group
working to make healthcare safer

Human Factors and healthcare: keep the celebrations short – Wears (2005)

- Criticised an overly 'rosy' view of patient safety progress
- 'Safety champions' everywhere
- Contrast with other safety domains:
  - "Striving for safety in this world is analogous to fighting a long guerrilla war… occasional losses, invisible enemies … with no end in sight"
  - The dangers of complacency and the value of 'chronic unease' (James Reason)


High reliability organisations

Keep the celebrations short

R L Wears

"Success without victory" in patient safety

Patient safety - progress

- **Last 20 years progress, but 'science' is still immature**
- **Measurement and evaluation is problematic**
- **Even when we think we are improving, it is hard to show why and how**

By Robert M. Wachter

Patient Safety At Ten: Unmistakable Progress, Troubling Gaps

doi: 10.1377/hlthaff.2009.0785
HEALTH AFFAIRS 29, NO. 1 (2010):

ABSTRACT December 1, 2009, marks the tenth anniversary of the Institute of Medicine report on medical errors, *To Err Is Human*, which arguably launched the modern patient-safety movement. Over the past decade, a variety of pressures (such as more robust accreditation standards and increasing error-reporting requirements) have created a stronger business case for hospitals to focus on patient safety. Relatively few health care systems have fully implemented information technology, and we are finally grappling with balancing "no blame" and accountability. The research pipeline is maturing, but funding remains inadequate. Our limited ability to measure progress in safety is a substantial impediment. Overall, I give our safety efforts a grade of B–, a modest improvement since 2004.

Robert M. Wachter (bobw@medicine.ucsf.edu) is professor and associate chair of the Department of Medicine at the University of California, San Francisco.

Editorials represent the opinions of the authors and not necessarily those of the *BMJ* or BMA

For the full versions of these articles see bmj.com

EDITORIALS

Is quality of care improving in the UK?

Yes, but we do not know why

RESEARCH, pp 369, 370

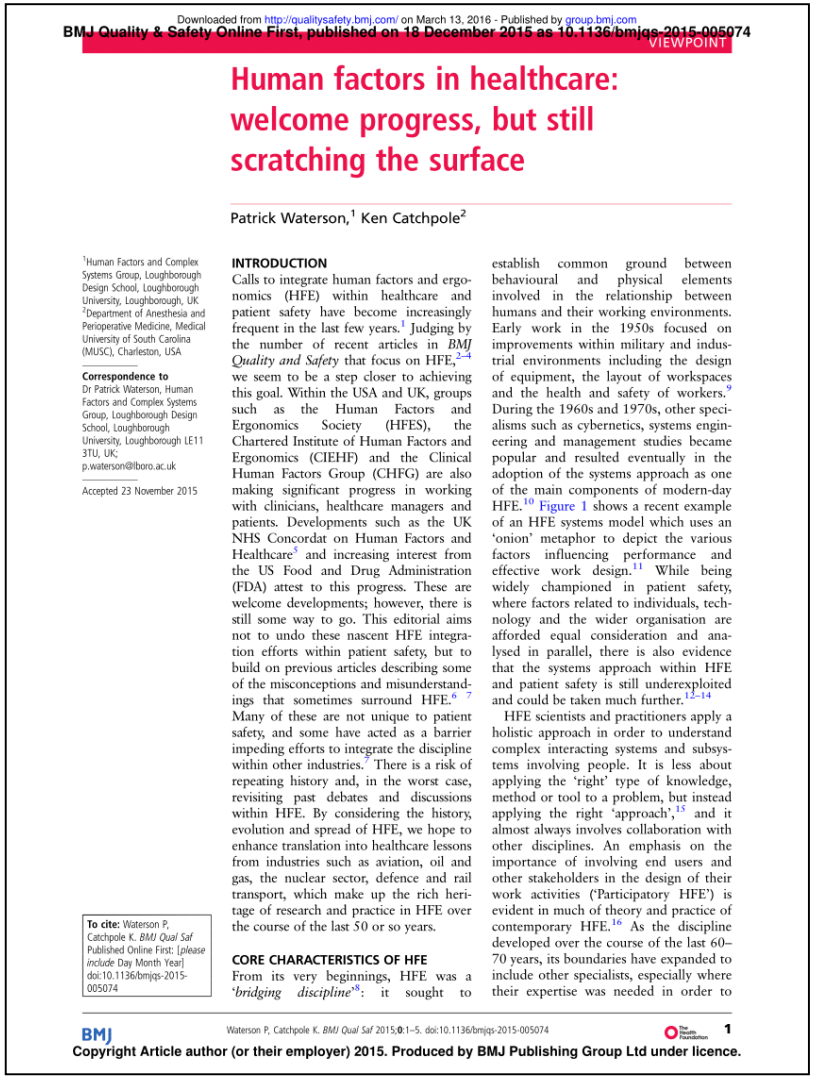
Peter J Pronovost professor
Sean M Berenholtz associate professor, Department of Anesthesiology and Critical

The need to improve the quality of care is well recognised. Yet accomplishing this is complicated, messy, and uncertain, requiring that researchers tackle technical (science) and adaptive (emotional, social, cultural, and political) challenges.[1] Tension exists between those who say "just do

harm. The quality improvement field needs to embrace science, favour evidence over anecdote, and move beyond using only one generic framework for improvement (the plan, do, study, act cycle).[5] Different types of patient safety challenges exist, such as translating evidence into practice, improving

Human Factors and healthcare: the dangers of repeating the past

- Brief overview of the history and development of Human Factors
- 'Bridging discipline' – seeking common ground with other disciplines
- Way forward not just about education and training – too much emphasis on healthcare staff to 'get up to speed'
- More about 'mutual adjustment', learning together, demonstrating value
- Human factors experts shouldn't be knowledge 'gatekeepers' - 'Giving human factors away'



BMJ Quality & Safety Online First, published on 18 December 2015 as 10.1136/bmjqs-2015-005074

VIEWPOINT

Human factors in healthcare: welcome progress, but still scratching the surface

Patrick Waterson,[1] Ken Catchpole[2]

[1]Human Factors and Complex Systems Group, Loughborough Design School, Loughborough University, Loughborough, UK
[2]Department of Anesthesia and Perioperative Medicine, Medical University of South Carolina (MUSC), Charleston, USA

Correspondence to
Dr Patrick Waterson, Human Factors and Complex Systems Group, Loughborough Design School, Loughborough University, Loughborough LE11 3TU, UK;
p.waterson@lboro.ac.uk

Accepted 23 November 2015

INTRODUCTION

Calls to integrate human factors and ergonomics (HFE) within healthcare and patient safety have become increasingly frequent in the last few years.[1] Judging by the number of recent articles in *BMJ Quality and Safety* that focus on HFE,[2–4] we seem to be a step closer to achieving this goal. Within the USA and UK, groups such as the Human Factors and Ergonomics Society (HFES), the Chartered Institute of Human Factors and Ergonomics (CIEHF) and the Clinical Human Factors Group (CHFG) are also making significant progress in working with clinicians, healthcare managers and patients. Developments such as the UK NHS Concordat on Human Factors and Healthcare[5] and increasing interest from the US Food and Drug Administration (FDA) attest to this progress. These are welcome developments; however, there is still some way to go. This editorial aims not to undo these nascent HFE integration efforts within patient safety, but to build on previous articles describing some of the misconceptions and misunderstandings that sometimes surround HFE.[6 7] Many of these are not unique to patient safety, and some have acted as a barrier impeding efforts to integrate the discipline within other industries.[8] There is a risk of repeating history and, in the worst case, revisiting past debates and discussions within HFE. By considering the history, evolution and spread of HFE, we hope to enhance translation into healthcare lessons from industries such as aviation, oil and gas, the nuclear sector, defence and rail transport, which make up the rich heritage of research and practice in HFE over the course of the last 50 or so years.

CORE CHARACTERISTICS OF HFE

From its very beginnings, HFE was a '*bridging discipline*'[8]: it sought to establish common ground between behavioural and physical elements involved in the relationship between humans and their working environments. Early work in the 1950s focused on improvements within military and industrial environments including the design of equipment, the layout of workspaces and the health and safety of workers.[9] During the 1960s and 1970s, other specialisms such as cybernetics, systems engineering and management studies became popular and resulted eventually in the adoption of the systems approach as one of the main components of modern-day HFE.[10] Figure 1 shows a recent example of an HFE systems model which uses an 'onion' metaphor to depict the various factors influencing performance and effective work design.[11] While being widely championed in patient safety, where factors related to individuals, technology and the wider organisation are afforded equal consideration and analysed in parallel, there is also evidence that the systems approach within HFE and patient safety is still underexploited and could be taken much further.[12–14]

HFE scientists and practitioners apply a holistic approach in order to understand complex interacting systems and subsystems involving people. It is less about applying the 'right' type of knowledge, method or tool to a problem, but instead applying the right 'approach',[15] and it almost always involves collaboration with other disciplines. An emphasis on the importance of involving end users and other stakeholders in the design of their work activities ('Participatory HFE') is evident in much of theory and practice of contemporary HFE.[16] As the discipline developed over the course of the last 60–70 years, its boundaries have expanded to include other specialists, especially where their expertise was needed in order to

To cite: Waterson P, Catchpole K. *BMJ Qual Saf* Published Online First: [*please include* Day Month Year] doi:10.1136/bmjqs-2015-005074

Loughborough University

Some challenges – Some lip service, persistance of blame culture (2009)?

Ergonomics
Vol. 52, No. 10, October 2009, 1185–1195

Taylor & Francis
Taylor & Francis Group

A critical review of the systems approach within patient safety research

Patrick Waterson*

Department of Human Sciences, Loughborough University, Loughborough LE11 3TU, UK

The application of concepts, theories and methods from systems ergonomics within patient safety has proved to be an expanding area of research and application in the last decade. This paper aims to take a step back and examine what types of research have been conducted so far and use the results to suggest new ways forward. An analysis of a selection of the patient safety literature suggests that research has so far focused on human error, frameworks for safety and risk and incident reporting. The majority of studies have addressed system concerns at an individual level of analysis with only a few analysing systems across multiple system boundaries. Based on the findings, it is argued that future research needs to move away from a concentration on errors and towards an examination of the connections between systems levels. Examples of how this could be achieved are described in the paper. The outcomes from the review of the systems approach within patient safety provide practitioners and researchers within health care (e.g. the UK National Health Service) with a picture of what types of research are currently being investigated, gaps in understanding and possible future ways forward.

Keywords: complex systems; socio-technical systems; patient safety; health care ergonomics; work organisation

Some challenges – Lip service, persistance of blame (2009)?

Ergonomics
Vol. 52, No. 10, October 2009, 1185–1195

Taylor & Francis
Taylor & Francis Group

A critical review of the systems approach within patient safety research

Patrick Waterson*

Department of Human Sciences, Loughborough University, Loughborough LE11 3TU, UK

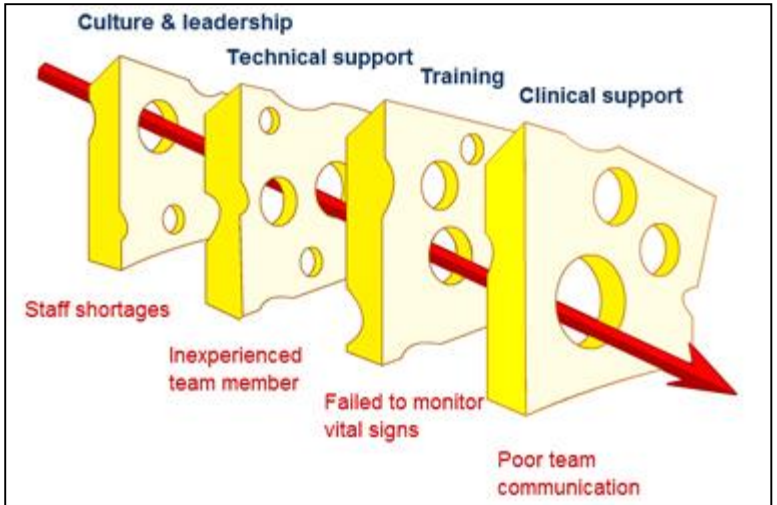
The application of concepts, theories and methods from systems ergonomics within patient safety has proved to be an expanding area of research and application in the last decade. This paper aims to take a step back and examine what types of research have been conducted so far and use the results to suggest new ways forward. An analysis of a selection of the patient safety literature suggests that research has so far focused on human error, frameworks for safety and risk and incident reporting. The majority of studies have addressed system concerns at an individual level of analysis with only a few analysing systems across multiple system boundaries. Based on the findings, it is argued that future research needs to move away from a concentration on errors and towards an examination of the connections between systems levels. Examples of how this could be achieved are described in the paper. The outcomes from the review of the systems approach within patient safety provide practitioners and researchers within health care (e.g. the UK National Health Service) with a picture of what types of research are currently being investigated, gaps in understanding and possible future ways forward.

Keywords: complex systems; socio-technical systems; patient safety; health care ergonomics; work organisation

"The majority of studies have addressed system concerns at an individual level of analysis with only a few analysing systems across multiple system boundaries".

2015 NHS Morecambe Bay Investigation (Kirkup, 2015)*

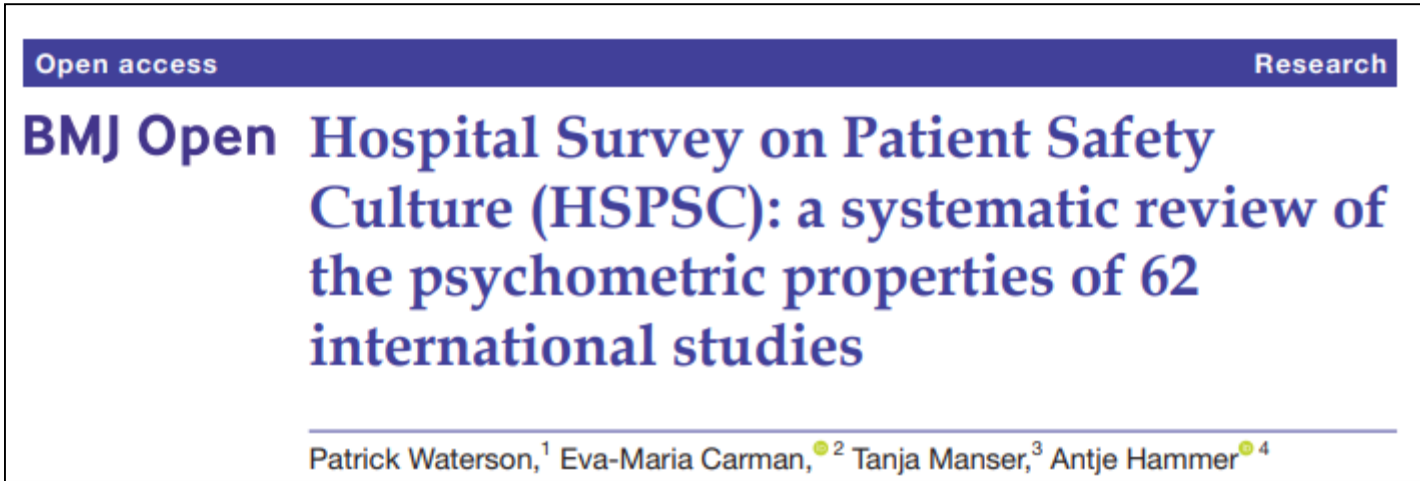
- Dysfunctional working relationships (midwives, obstetricians, paediatricians …)
- Poor investigation of fatalities, collusion, cover-up, CQC failings, 'musketeer midwives'
- **'What happened at the Trust represents the simultaneous failure of a great many systems at almost every level from the labour ward to the headquarters of the national bodies. In terms of James Reason's 'Swiss Cheese' model of accident causation, there were a large number of slices of cheese, and in the case of the Trust every one of them was aligned so that one set of holes aligned perfectly.' (Kirkup, 2015, p. 185).**



*Waterson, P.E. (in press). Causation, levels of analysis and explanation in systems ergonomics – A closer look at the UK NHS Morecambe Bay Investigation. Applied Ergonomics

Some challenges - Poor science, weak evidence

- Psychometric properties (reliability, validity) of 62 international studies that have used the Hospital Survey on Patient Safety Culture
- Hospitals and other healthcare settings across the World
- 62% of studies reported reliabilities which were unacceptably low
- 40% of studies did not report any data on validity
- Patient safety culture(s)
- Need for caution in using this instrument!



Some challenges – time, complexity

Vincent, Charles A
@VincentCharlesA

Follow

126 organisations with regulatory influence on the NHS. No wonder finding time for improvement is so hard. Our new paper BMJ Open bmjopen.bmj.com/content/9/7/e0…

5:49 AM - 30 Jul 2019

Some challenges – methods (e.g., Root Cause Analysis)

ORIGINAL RESEARCH

Our current approach to root cause analysis: is it contributing to our failure to improve patient safety?

Kathryn M Kellogg,[1] Zach Hettinger,[1] Manish Shah,[2] Robert L Wears,[3] Craig R Sellers,[4] Melissa Squires,[5] Rollin J Fairbanks[1]

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/bmjqs-2016-005991).

For numbered affiliations see end of article.

Correspondence to
Dr Kathryn M Kellogg, MedStar Health, MedStar Institute for Innovation, Washington, DC 20008, USA; kate.kellogg@medicalhfe.org

Received 10 August 2016
Revised 29 September 2016
Accepted 21 October 2016
Published Online First 2 February 2017

ABSTRACT

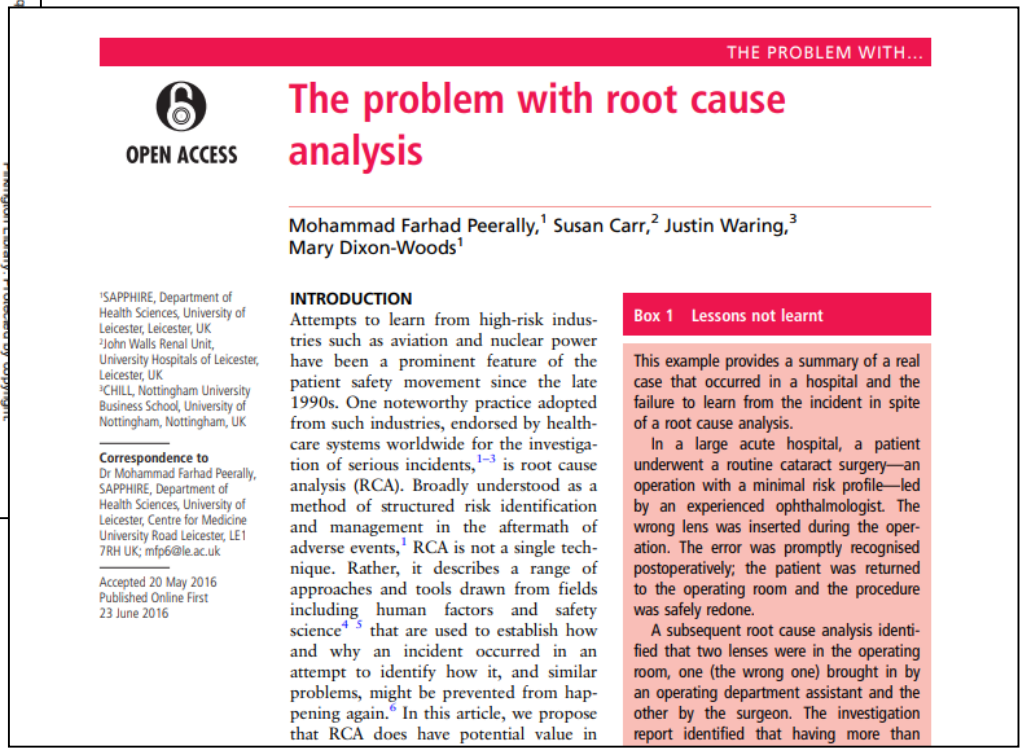
Background Despite over a decade of efforts to reduce the adverse event rate in healthcare, the rate has remained relatively unchanged. Root cause analysis (RCA) is a process used by hospitals in an attempt to reduce adverse event rates; however, the outputs of this process have not been well studied in healthcare. This study aimed to examine the types of solutions proposed in RCAs over an 8-year period at a major academic medical institution.

Methods All state-reportable adverse events were gathered, and those for which an RCA was performed were analysed. A consensus rating process was used to determine a severity rating for each case. A qualitative approach was used to categorise the types of solutions proposed by the RCA team in each case and descriptive statistics were calculated.

Results 302 RCAs were reviewed. The most common event types involved a procedure complication, followed by cardiopulmonary arrest, neurological deficit and retained foreign body. In 106 RCAs, solutions were proposed. A large proportion (38.7%) of RCAs with solutions proposed involved a patient death. Of the 731 proposed solutions, the most common

undergone over 15 years of intense scrutiny, funding, regulation and research worldwide. Despite dramatically intensified efforts to increase the safety of the healthcare system, reports have suggested that safety has not improved. The adverse event rate has remained essentially the same, suggesting that our current solutions to the problem are not working.[1–10] This lack of progress persists despite the devotion of a tremendous amount of financial and human resources at the local, state and national levels in an effort to reduce errors and patient harm.[11]

One common, resource-intensive, practice is the root cause analysis (RCA) process, which is used by most hospitals in the USA.[12–15] The RCA process has been mandated in response to sentinel events by the Joint Commission since 1997.[16] Although the RCA process has been presumed to induce change, its effectiveness has been questioned and there is not robust literature to support its efficacy.[17 18] In healthcare, there are reports of difficulty in both determining the causes (more accurately termed the



THE PROBLEM WITH...

OPEN ACCESS

The problem with root cause analysis

Mohammad Farhad Peerally,[1] Susan Carr,[2] Justin Waring,[3] Mary Dixon-Woods[1]

[1]SAPPHIRE, Department of Health Sciences, University of Leicester, Leicester, UK
[2]John Walls Renal Unit, University Hospitals of Leicester, Leicester, UK
[3]CHILL, Nottingham University Business School, University of Nottingham, Nottingham, UK

Correspondence to
Dr Mohammad Farhad Peerally, SAPPHIRE, Department of Health Sciences, University of Leicester, Centre for Medicine University Road Leicester, LE1 7RH UK; mfp6@le.ac.uk

Accepted 20 May 2016
Published Online First 23 June 2016

INTRODUCTION

Attempts to learn from high-risk industries such as aviation and nuclear power have been a prominent feature of the patient safety movement since the late 1990s. One noteworthy practice adopted from such industries, endorsed by healthcare systems worldwide for the investigation of serious incidents,[1–3] is root cause analysis (RCA). Broadly understood as a method of structured risk identification and management in the aftermath of adverse events,[1] RCA is not a single technique. Rather, it describes a range of approaches and tools drawn from fields including human factors and safety science[4 5] that are used to establish how and why an incident occurred in an attempt to identify how it, and similar problems, might be prevented from happening again.[6] In this article, we propose that RCA does have potential value in

Box 1 Lessons not learnt

This example provides a summary of a real case that occurred in a hospital and the failure to learn from the incident in spite of a root cause analysis.

In a large acute hospital, a patient underwent a routine cataract surgery—an operation with a minimal risk profile—led by an experienced ophthalmologist. The wrong lens was inserted during the operation. The error was promptly recognised postoperatively; the patient was returned to the operating room and the procedure was safely redone.

A subsequent root cause analysis identified that two lenses were in the operating room, one (the wrong one) brought in by an operating department assistant and the other by the surgeon. The investigation report identified that having more than

Big Gap Between Research and Practice, What is Possible in NHS Trusts

Some challenges – methods (e.g., Root Cause Analysis)

ORIGINAL RESEARCH

Our current approach to root cause analysis: is it contributing to our failure to improve patient safety?

Kathryn M Kellogg,[1] Zach Hettinger,[1] Manish Shah,[2] Robert L Wears,[3] Craig R Sellers,[4] Melissa Squires,[5] Rollin J Fairbanks[1]

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/bmjqs-2016-005991).

For numbered affiliations see end of article.

Correspondence to
Dr Kathryn M Kellogg, MedStar Health, MedStar Institute for Innovation, Washington, DC 20008, USA; kate.kellogg@medicalhfe.org

Received 10 August 2016
Revised 29 September 2016
Accepted 21 October 2016
Published Online First 2 February 2017

ABSTRACT

Background Despite over a decade of efforts to reduce the adverse event rate in healthcare, the rate has remained relatively unchanged. Root cause analysis (RCA) is a process used by hospitals in an attempt to reduce adverse event rates; however, the outputs of this process have not been well studied in healthcare. This study aimed to examine the types of solutions proposed in RCAs over an 8-year period at a major academic medical institution.

Methods All state-reportable adverse events were gathered, and those for which an RCA was performed were analysed. A consensus rating process was used to determine a severity rating for each case. A qualitative approach was used to categorise the types of solutions proposed by the RCA team in each case and descriptive statistics were calculated.

Results 302 RCAs were reviewed. The most common event types involved a procedure complication, followed by cardiopulmonary arrest, neurological deficit and retained foreign body. In 106 RCAs, solutions were proposed. A large proportion (38.7%) of RCAs with solutions proposed involved a patient death. Of the 731 proposed solutions, the most common

undergone over 15 years of intense scrutiny, funding, regulation and research worldwide. Despite dramatically intensified efforts to increase the safety of the healthcare system, reports have suggested that safety has not improved. The adverse event rate has remained essentially the same, suggesting that our current solutions to the problem are not working.[1–10] This lack of progress persists despite the devotion of a tremendous amount of financial and human resources at the local, state and national levels in an effort to reduce errors and patient harm.[11]

One common, resource-intensive, practice is the root cause analysis (RCA) process, which is used by most hospitals in the USA.[12–15] The RCA process has been mandated in response to sentinel events by the Joint Commission since 1997.[16] Although the RCA process has been presumed to induce change, its effectiveness has been questioned and there is not robust literature to support its efficacy.[17 18] In healthcare, there are reports of difficulty in both determining the causes (more accurately termed

THE PROBLEM WITH...

OPEN ACCESS

The problem with root cause analysis

Mohammad Farhad Peerally,[1] Susan Carr,[2] Justin Waring,[3] Mary Dixon-Woods[1]

[1]SAPPHIRE, Department of Health Sciences, University of Leicester, Leicester, UK
[2]John Walls Renal Unit, University Hospitals of Leicester, Leicester, UK
[3]CHILL, Nottingham University Business School, University of Nottingham, Nottingham, UK

Correspondence to
Dr Mohammad Farhad Peerally, SAPPHIRE, Department of Health Sciences, University of Leicester, Centre for Medicine University Road Leicester, LE1 7RH UK; mfp6@le.ac.uk

Accepted 20 May 2016
Published Online First 23 June 2016

INTRODUCTION

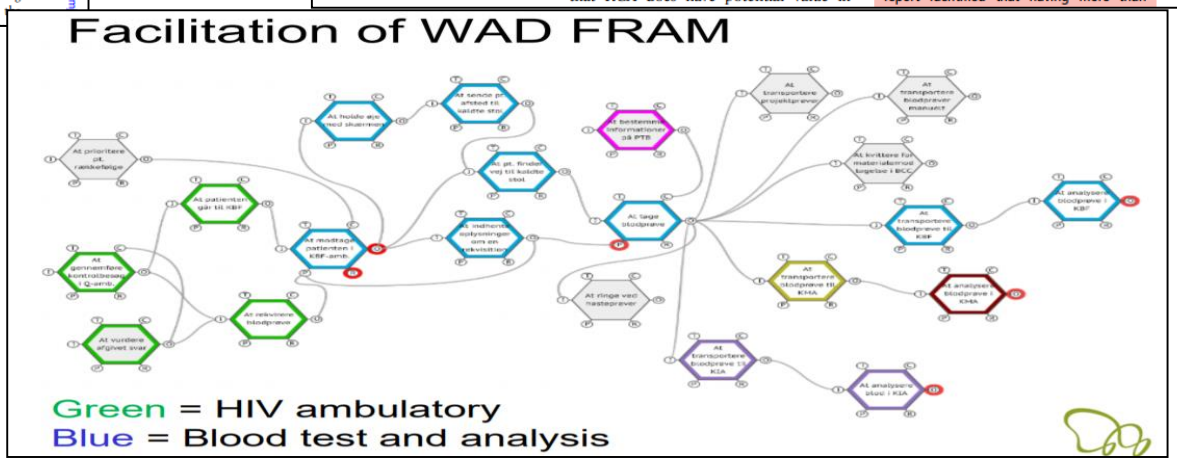
Attempts to learn from high-risk industries such as aviation and nuclear power have been a prominent feature of the patient safety movement since the late 1990s. One noteworthy practice adopted from such industries, endorsed by healthcare systems worldwide for the investigation of serious incidents,[1–3] is root cause analysis (RCA). Broadly understood as a method of structured risk identification and management in the aftermath of adverse events,[1] RCA is not a single technique. Rather, it describes a range of approaches and tools drawn from fields including human factors and safety science[4 5] that are used to establish how and why an incident occurred in an attempt to identify how it, and similar problems, might be prevented from happening again.[6] In this article, we propose that RCA does have potential value in

Box 1 Lessons not learnt

This example provides a summary of a real case that occurred in a hospital and the failure to learn from the incident in spite of a root cause analysis.

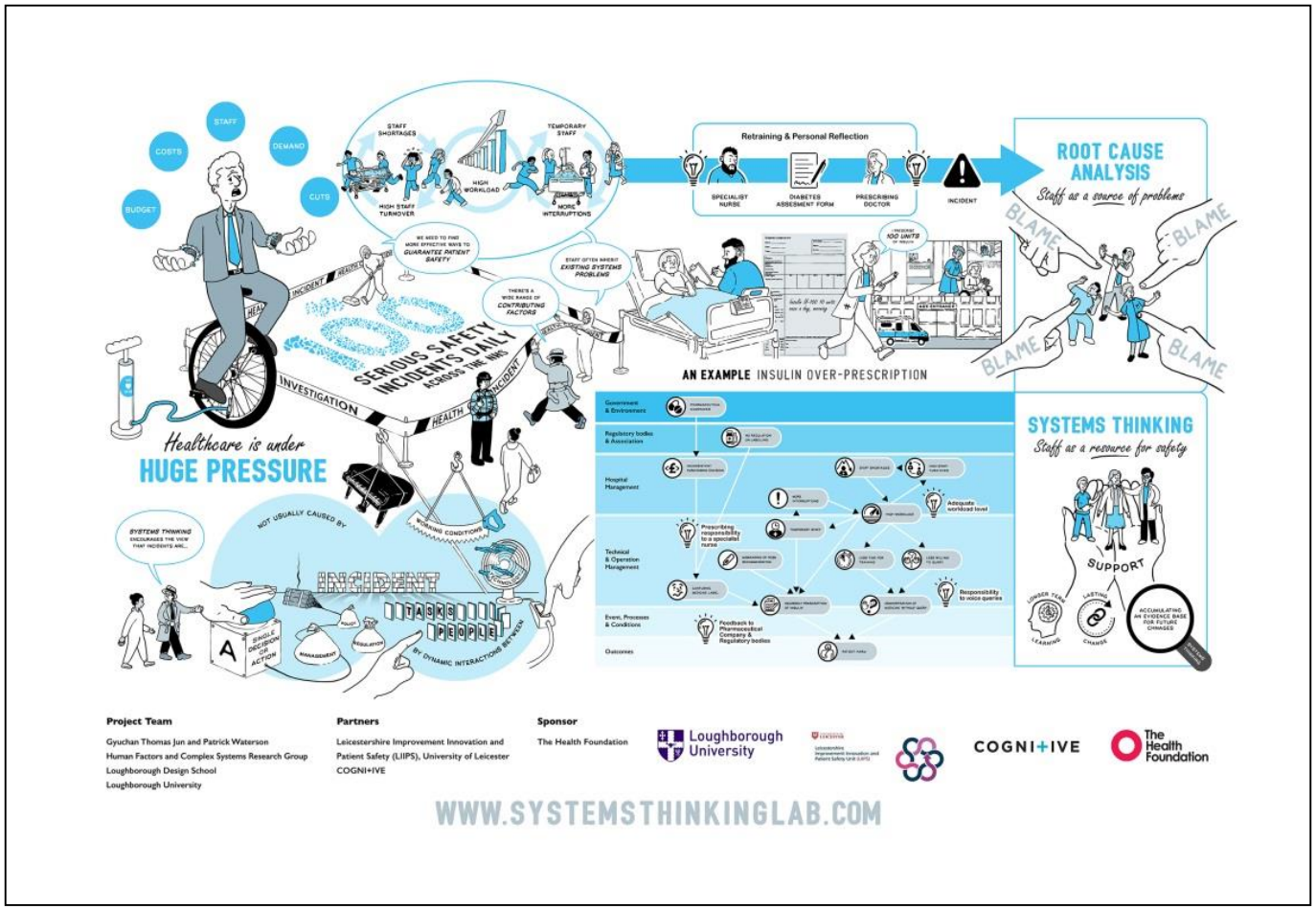
In a large acute hospital, a patient underwent a routine cataract surgery—an operation with a minimal risk profile—led by an experienced ophthalmologist. The wrong lens was inserted during the operation. The error was promptly recognised postoperatively; the patient was returned to the operating room and the procedure was safely redone.

A subsequent root cause analysis identified that two lenses were in the operating room, one (the wrong one) brought in by an operating department assistant and the other by the surgeon. The investigation report identified that having more than



Ways forward

- Training yes, courses yes, front-line staff yes, new collaborations yes, but we need much more
- The human factors community probably needs to reach out more
- Some interesting new developments – non-technical skills training, new ways of assessing safety culture, safety II (Shorrock, Hollnagel)
- Getting to decision-makers, Trust Boards, CEOs etc – this is very difficult (we are still a cottage industry)
- Learning from other industries (and what happened afterwards):
- 1999 Paddington Rail Accident
    - Led to the set-up of the Rail Accident Investigation Branch (RAIB) and Rail Safety and Standards Board (RSSB)
    - 1988 Piper Alpha – revolutionised human factors and safety in oil and gas



https://www.youtube.com/watch?v=5oYV3Dqe0A8

LOUGHBOROUGH
DESIGN
SCHOOL

Loughborough University

Thank you for your attention!

p.waterson@lboro.ac.uk
Twitter @PatrickWaterso1
https://systemsthinkinglab.com/