
Lessons Learnt from Using AcciMaps and the Risk Management Framework to Analyse Large-Scale Systemic Failures

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Background

- **Huge variety of accident investigation methods, tools etc. available**
 - **STAMP (Leveson)**
 - **Swiss Cheese Model (Reason)**
 - **AcciMaps (Svendung and Rasmussen)**
 - **Risk Management (ActorMap) Framework (RMF) (Rasmussen)**
- **AcciMaps and RMF**
 - **Lots of variations on a theme**
 - **Highly cited (224 citations for original RMF paper)**
 - **Many domains**
 - ***E. Coli* and BSE outbreaks (Vicente)**
 - **2010 Lyme Bay Canoeing Accident (Paul Salmon et al.)**

AcciMaps and RMF

Source	Scope	Characteristics of Application
Rasmussen; Svedung and Rasmussen	RMF, description of Conflict Map and AcciMap illustrated by examples from various accidents (e.g., transportation, the Zeebrugge accident)	Outline of RFM with components representing Government, regulators, company, management, staff, work context; Detailed examples of AcciMaps
Vicente and Christoffersen	RMF and AcciMap - Walkerton <i>E. coli</i> outbreak	Mapping of contributory factors leading up to the outbreak using the RMF and AcciMaps
Cassano-Piche et al.	RMF and AcciMap – UK BSE outbreak	Mapping of contributory factors leading up to the outbreak using the RMF and AcciMaps
Hopkins	AcciMap – Esso Gas Plant (Longford) Explosion	Causal diagram of contributory factors leading up to accident using AcciMaps
Johnson and de Almeida	RMF, AcciMap Brazilian space launch vehicle loss	Comparison between Rasmussen and Svedung's AcciMap and STAMP approaches; AcciMaps – 4 steps: ActorMap; AcciMap; Conflict Map; InfoFlowMap

ims

Work came about as a result of independent use of the methods

- **Waterson – infection control (RMF)**
 - **Jenkins – Stockwell incident (AcciMaps)**
- } **IEHF 2009/2010**

Working backwards

- **Our experiences with using the two methods**
- **Similarities and differences in use**

Longer term

- **Systematising common features**
- **Providing a set of overarching criteria (guidelines) for their selection and use**
- **Presentation: Outlining our first steps and current work**

Case studies

Waterson (2009)

- **Outbreak of *C. difficile* at Maidstone and Tunbridge Wells NHS**

Jenkins et al., (2010)

- **Stockwell shooting incident (July 2005)**

the *clostridium difficile* outbreak at Maidstone and Tunbridge Wells NHS Trust

- **Contributory factors (Healthcare Commission report, 2007)***

The role of external organisations

- **Trust board members under huge pressure to satisfy government set targets (bed occupancy, finances)**
- **Confusion of responsibilities (e.g, Health Protection Agency (HPA), Health Protection Unit (HPU))**

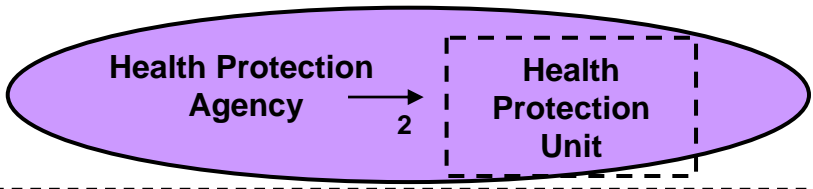
Hospital management

- **Management strategy “fragmentary and poorly understood” (HC report p. 77)**
- **Chief Executive leadership characterised as “autocratic”, “dictatorial” (HC, p. 91)**

Government



Laboratory

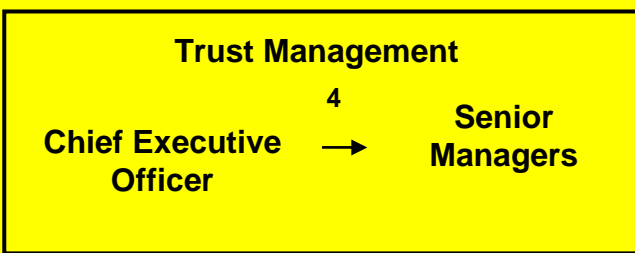


External

Trust Governance



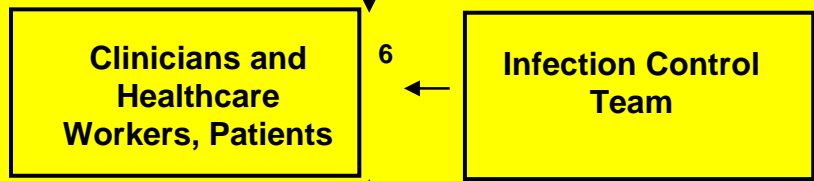
Hospital Management



Linkages between system components

1: Setting of budgets and targets
 2: HPU worked "reactively", no close involvement with trust
 3: Loose coupled relationship with SHA
 4: Poor information flow; autocratic leadership
 5: Poor management and allocation of resources for staffing
 6: Ill defined relationship and loose coupling with ward staff
 7: Rundown buildings; poor design for hygiene

Clinical Management



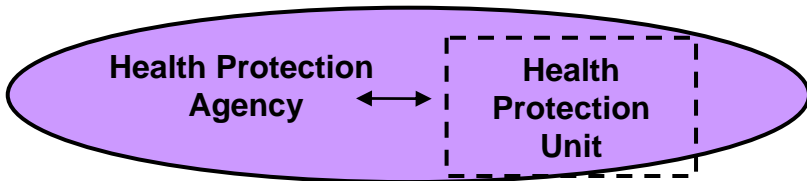
Internal

Government



Cross-level Relationships

Regulatory

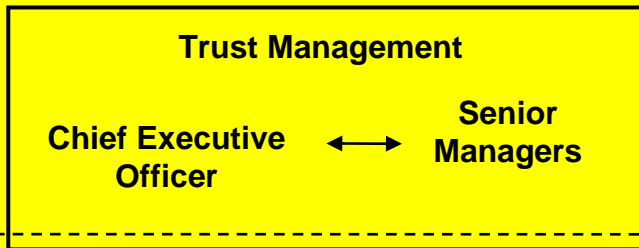


Organisational Mergers Targets

Trust Governance

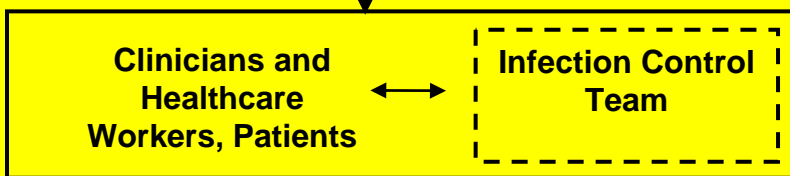


Capital Management

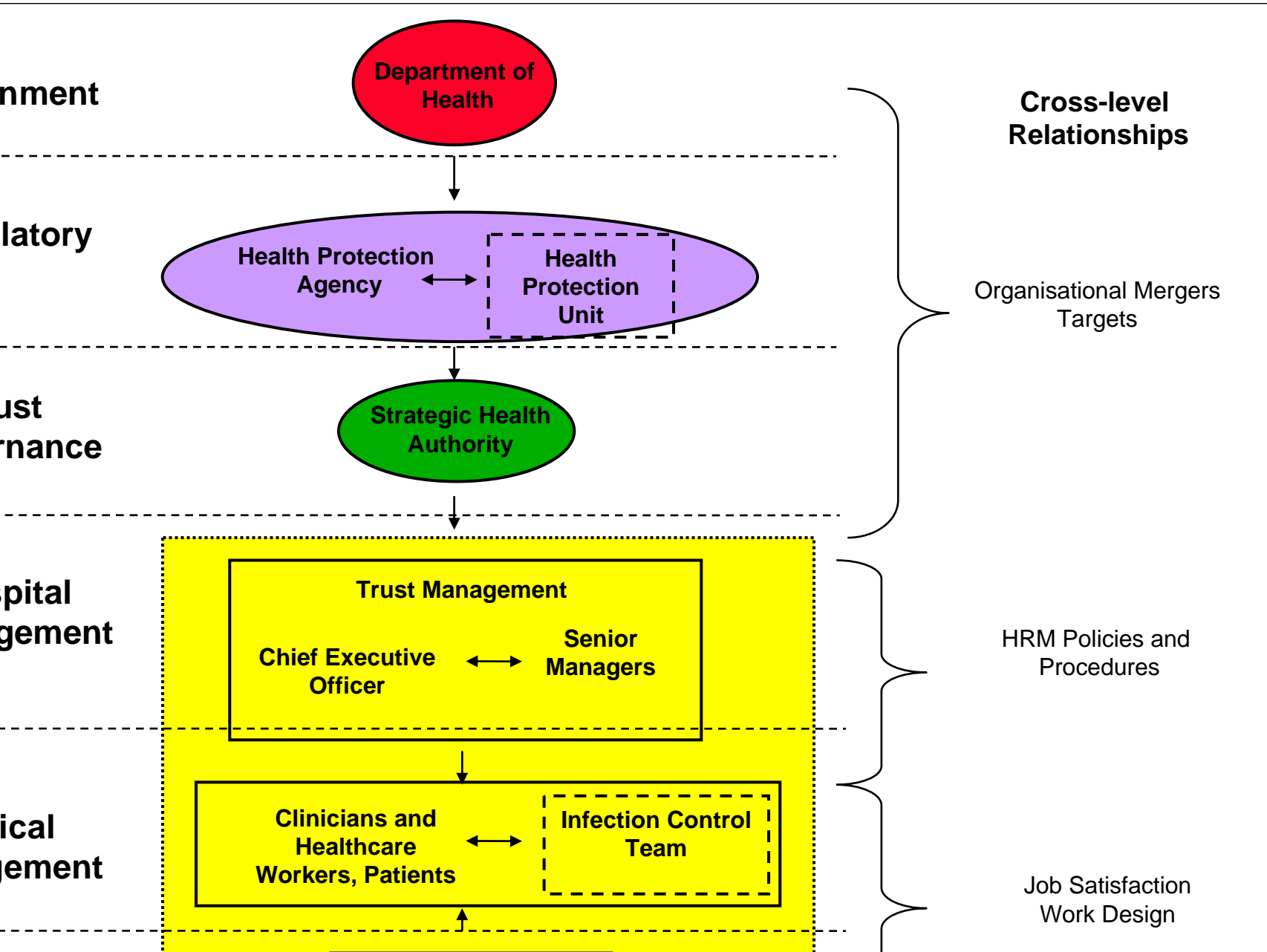


HRM Policies and Procedures

Clinical Management



Job Satisfaction Work Design



Case studies – Jenkins et al. (2010)

Background:

7th July 2005 London Bombings

Attempted bombings 21st July 2005

Intensive police search for bombers

Gym card membership had been found on one of the failed bombs

Traced back to Hussain Osman at a London address (21 Scotia Rd.)

Surveillance operation mounted at the address



Penkins et al. (2010) – Source and Map

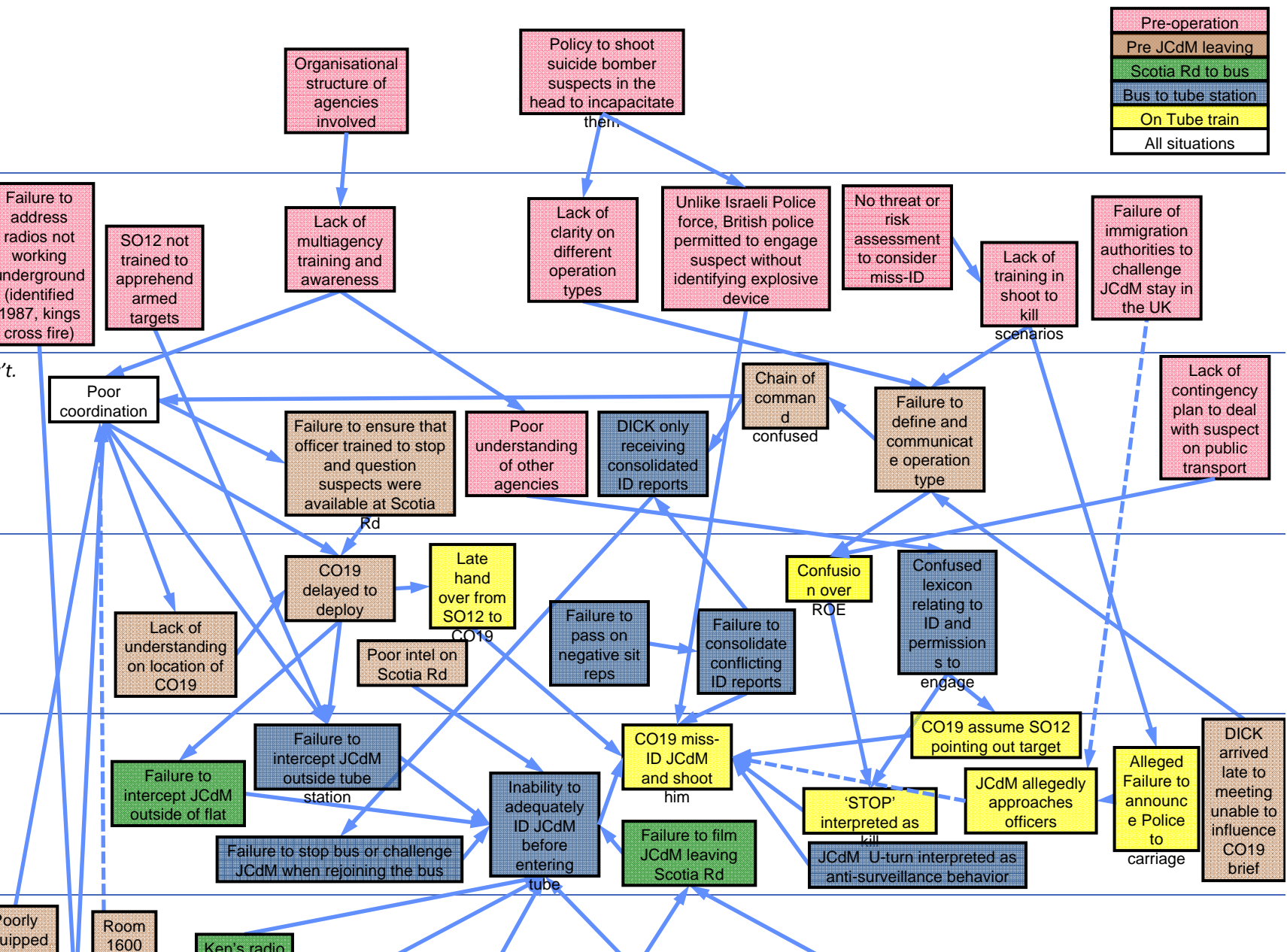
Building an AcciMap of the incident based on:

- **Independent Police Complaints Commission (2007)**
- **Metropolitan Police Authority Report (2008)**

AcciMap coded according to timescales

- **Pre-operation**
- **Pre-JC leaving the flat**

Resulting AcciMap made up of six levels



Penkins et al. (2010) – Conclusions

Many failings across whole range of system levels

E.g., Lowest levels

- **Surveillance camera not switched on (identifying JC as innocent)**

Mismatches between layers of communication

Equipment failures (radios didn't work underground)

Lack of well trained lexicon for commands and rules of engagement

Comparing our use of AcciMaps and the RMF

	AcciMaps Jenkins et al.	Risk Management (ActorMap) Framework Waterson
Context of use	Command and Control – Policing Anti-Terrorism	Healthcare – Hospital Acquired Infections
Purposes and intentions of use	Modeling of the events leading up to the shooting (e.g., capturing aspects of decision-making, communication, use of equipment and physical resources)	Use of the systems approach to analyse and explain causes of the outbreaks; to further understand causal linkages and dependencies across system levels
Procedure	<ol style="list-style-type: none"> 1. Description of events leading up to shooting <ol style="list-style-type: none"> (i) Social network diagramming of actors and linkages (ii) Chronology (timeline) of events (iii) Summary of observation statements (iv) Diagram of police office and witness locations 2. AcciMap analysis Annotation of causal factors according to temporal aspects of 	<ol style="list-style-type: none"> 1. Systems description <ol style="list-style-type: none"> (i) Timeline (ii) Summary of contributory factors in HC (2007): 2. Systems analysis Use of the Risk Management (ActorMap) framework focusing on: <ol style="list-style-type: none"> (i) Cross-level relationships related to previous findings in the literature (ii) Whole system relationships related to previous findings in the literature

Reflecting on our use of the methods

Large range of alternatives and options for configuring both methods

Bransford, Naikar and Hopkins (2009)

- Set of prompts for AcciMaps at each level of analysis
- Wider guidelines

Lessons learnt:

Establishing the purpose of the analysis

Maidstone study was largely exploratory

Data was not detailed

Timescales extended (~2 years) – ‘incubation period’ (Turner)

RMF (ActorMap) flexible and appropriate

Reflecting on our use of the methods (2)

Establishing the purpose of the analysis (cont.)

Stockwell – details (minutiae) of incident ('time-stamped')

Highly distributed, Command/Control/Communication perspective

AcciMap more appropriate

Causality, intentionality, nature of system error

Maidstone study aim to understand cross-level causal relationships

RMF (ActorMap) facilitated this

Stockwell study aim was more to map 'causal web'

AcciMaps facilitated this

reflecting on our use of the methods (3)

Domain specific considerations

Maidstone: Wide range of actors, organisational boundaries, loosely coupled relationships

Stockwell: loosely coupled at higher levels, tight coupling at lower, communication requirements different to Maidstone

Data and information inputs to the analysis

Both case studies did some prior 'domain analysis' (e.g., reports on other outbreaks, Kings Cross Fire)

Some data was missing (e.g., specific actions of managers) (-> RMF)

In other cases missing information could be inferred or hypothesised (by linking to other patient safety reports/literature on NDM/SA)

Reflecting on our use of the methods (4)

Constructing RMF/AcciMaps

Guidelines and prompts could be extended

Not just procedure, but coverage of options (e.g., use of decision-ladders, multi-level theory)

Reviewing and validating the analysis

The reliability and validity of both methods has been mentioned before (O'Hare, 2000; Johnson and de Almeida, 2008)

Maidstone – exploratory (no validation), Stockwell (validation by other co-authors)

Validation, reliability difficult to do

Need to acknowledge the subjective nature of both (Branford, PhD, 2007)?

Next Steps

Cumulating the lessons learnt based on other used of the methods

- **Systematising common features**
- **Providing a set of overarching criteria (guidelines) for their selection and use**

Probing deeper into issues of reliability/validity

- **PhD (Starting Oct 2011) at Loughborough**

Modifying the methods to capture aspects of:

- **Decision-making process**
- **Rationale (Formats for capturing this)**

Examining properties of other methods

- **PhD (Peter Underwood) at Loughborough**

Thanks for Listening

Questions?

Additional Slides

background (cont.)

Work within HF and Ergonomics on understanding the interaction between complex sociotechnical system components

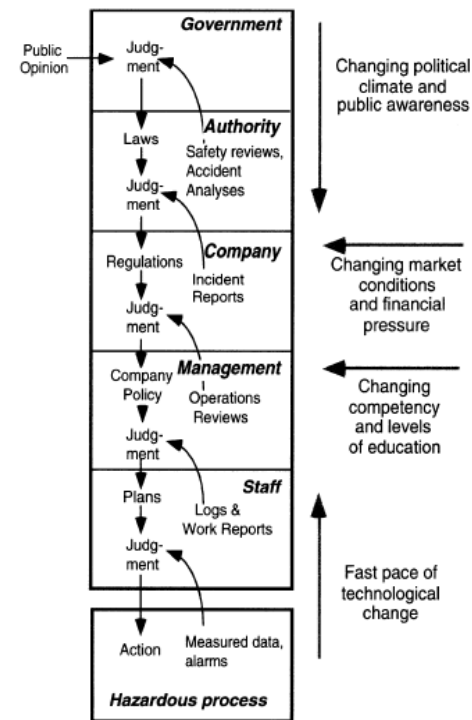
Rasmussen (1997)

- Risk Management Framework

Some work on infection outbreaks (*e.Coli*)

Vicente and Christoffersen (2006)

- Walkerton outbreak in Canada
- AcciMap description
- Leveson (2004) Systems Theory, Accident Modelling and Process (STAMP)

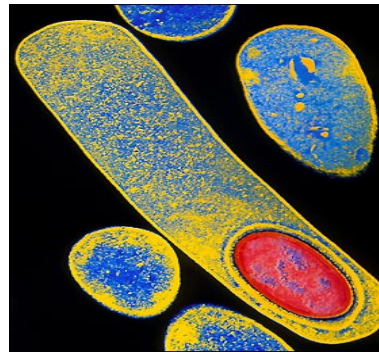


Case study: Infection Control in Acute Hospitals

Number of high profile hospital outbreaks (*C. diff* and MRSA) over the last few years in the UK

Focus on hygiene (e.g., hand washing campaigns)

Recent review highlighted the need for research on wider behavioural, social and organisational factors (Griffiths et al., 2008)



***Clostridium difficile* outbreak at Maidstone and Cambridge Wells NHS Trust**

- **Summary of main events**

Time Period	Event
April 2000	Trust established following merger
2001-2005	High turnover of senior managers
October 2005 – September 2006	500+ patients develop <i>C. diff.</i> , 60 estimated deaths
April 2006	Trust recognises second outbreak and reports this to SHA
April 2007	Healthcare Commission find unacceptable use of contaminated equipment
October 2007	Healthcare Commission report

the *clostridium difficile* outbreak at Maidstone and Tunbridge Wells NHS Trust

- **Clinical management**
- **Case note review of 50 patients who had died with C. diff showed that 80% at least one element of clinical management was unsatisfactory (HC, p. 4)**
 - **Infrequent reviews by doctors**
 - **Failure to change antibiotic treatment**
 - **Delays in starting treatment**
 - **Many possible diagnoses were missed**
 - **Fluid management was inconsistent**

The *clostridium difficile* outbreak at Maidstone and Tunbridge Wells NHS Trust

- Equipment and buildings
- Wards, bathrooms and commodes not clean
- Patients frequently had to share equipment (e.g., Zimmer frames)
- Old buildings had limited storage facilities and provision of hand basins



Utility room sink – HC, 2007 p. 49