Evaluation of Social Science Interventions

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Conflict of interest

• ACQSHC - $AU $77k – research grant
• Eastern Health - $ AU 5k – consultancy fees
• Academic bias RRT
Overview

- What are social science / complex interventions
- Problems with evaluation
- Approach to evaluation
- Effectiveness of RRT
- RRT patient
- The team
- Entire RRS
Social Science

- Anthropology
- Archaeology
- Criminology
- Economics
- Education
- Government
- Linguistics
- International relations
- Political science
- Sociology
- Geography
- History
- Law
- Psychology
Complex intervention

- **Bench-to-bedside review: The evaluation of complex interventions in critical care.** Anthony Delaney et al
  Critical care

- **Developing and evaluating complex interventions: new guidance.** Peter Craig et al for MRC UK
Complex interventions

• Developed from number components
• Act both independently and inter-dependently.

• Examples:
  » MET / RRT
  » EGDT for severe sepsis

• Function of intervention remains constant
  – E.g. Reduce hypoperfusion in patients with severe sepsis
  – E.g. RRT = review and manage deteriorating ward patients

• Contrast with RCT
  – inclusion/exclusion criteria
  – defined intervention
Is the RRT a complex intervention?

1. DeVita et al. CCM
Act independently or inter-dependently

• The patient
  – Age / chronic organ failure / functional status = reserve
  – Disease state admitted with

• Calling criteria / activation
  – Failed and delayed calling
  – Marked variation calling criteria between hospitals
  – Calling criteria usually based on physiological derangement
  – Many different conditions can cause
    » Hypotension – cardiogenic shock from AMI versus hypovolemia
    » Tachycardia – dehydration versus large pulmonary embolism

<table>
<thead>
<tr>
<th>Cause of the MET call</th>
<th>Number of calls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypoxia / Increased respiratory rate</strong></td>
<td>218</td>
</tr>
<tr>
<td>Pulmonary oedema / fluid overload</td>
<td>218</td>
</tr>
<tr>
<td>Pneumonia / aspiration</td>
<td>66</td>
</tr>
<tr>
<td>Exacerbation chronic obstructive airways disease</td>
<td>52</td>
</tr>
<tr>
<td>Sepsis</td>
<td>52</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>16</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>11</td>
</tr>
<tr>
<td>Sputum plug, narcotized, acidemia, pleural effusion, tracheostomy blocked, atelectasis, intracranial event</td>
<td>11</td>
</tr>
<tr>
<td>No cause documented</td>
<td>12</td>
</tr>
<tr>
<td><strong>Hypotension</strong></td>
<td>112</td>
</tr>
<tr>
<td>Sepsis</td>
<td>112</td>
</tr>
<tr>
<td>Bleeding / hypovolemia</td>
<td>30</td>
</tr>
<tr>
<td>Acute pulmonary oedema / myocardial ischemia</td>
<td>30</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>28</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>15</td>
</tr>
<tr>
<td>Epidural related, Pulmonary embolism, anaphylaxis, vasovagal, Narcosis</td>
<td>10</td>
</tr>
<tr>
<td>No cause documented</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>112</td>
</tr>
</tbody>
</table>
• Team
  – Marked variation in team composition MET / RRT between hospitals
  – Different level of seniority / experience
  – Rarely train together as repeated team
  – Variably funded between hospitals

• Critical care beds (number and type)

• Presence / experience of parent team

• System factors = time of day / day of week

Patient

Rapid Response Team

Home team (medical)

Patients family

Ward nurses

- Allied health
- Visiting teams
• Act independently and inter-dependently

• **Practice variation**
  – Within hospital
  – Between hospitals

• Practice variation that is positive = desirable

• Practice variation that worsens outcome = Undesirable or unwanted practice variation
**Two patients: SBP 85mmHg   HR 140 bpm**

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 yo fit female with moderate N+V</td>
<td>85 yo male with IHD, CRF, DM</td>
</tr>
<tr>
<td>No delay RRT call</td>
<td>Day 3 post laparotomy bowel Cancer</td>
</tr>
<tr>
<td>Call 930 am Wed</td>
<td>Cellulitic wound</td>
</tr>
<tr>
<td>ICU consultant team leader</td>
<td>Surgical admission</td>
</tr>
<tr>
<td>Admitted under Internal Med</td>
<td>Boarder on thoracic ward</td>
</tr>
<tr>
<td>On medical ward</td>
<td>RRT 3am Sat, 6hr delayed</td>
</tr>
<tr>
<td>ICU bed free if needed</td>
<td>No dedicated RRT registrar</td>
</tr>
<tr>
<td>ICU full</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- ICU consultant team leader
- Admitted under Internal Med
- On medical ward
- ICU bed free if needed

**Additional Notes:**
- Boarder on thoracic ward
- Surgical admission
- RRT 3am Sat, 6hr delayed
- No dedicated RRT registrar
- ICU full
Approach to evaluation

- Most studies
  - Effect of a RRT on outcomes of all hospitalised patients
    - Unplanned ICU admissions
    - Unexpected deaths
    - Cardiac arrests

Hospitalised patients (before)  RRT  Hospitalised patients (after)
• Majority have been before and after designs
  – Collect baseline period of data = historical control
  – Education / run-in / go-live with RRT
  – Period of post-intervention data collection

• Multiple before – after studies
  1-3
  – Australia = 10
  – USA = 7
  – UK = 3
  – Canada = 1

• Heterogeneity – outcomes, design, quality, RRT activations

• Problems with before and after studies
  – Patient populations in the before and after period may be different
  – If there is improvement then may be due to
    » Natural improvement with time
    » Other interventions
    » Effects of education / awareness alone
    » Hawthorne effect = staff know they are being watched
    » Regression to mean (statistics) = repeat sampling / chance
  – Patients are not randomised - ? Bias in selection of those reviewed

1. Moran and Soloman CCR 2005
• Can control for baseline variables
  – Age
  – Gender
  – Race
  – Admission diagnosis / Case-mix
  – Chronic co-morbidity – e.g. Carlson index
  – Season

• Time-series analysis / time-trends

• Generalised estimating equations models
• Randomized controlled trial
  – Individual patient
    » Staff may introduce intervention to controls = contamination
  – Randomize at the level of hospital ward

• Cluster RCT
  – Randomize at level of entire hospital
  – E.g. MERIT trial

1. Priestly et al 2004
2. Hillman et al Lancet 2005
• Problems with cluster RCT
  – Estimation of baseline incidence of event (power)
  – Variation between hospitals > effect of therapy
  – Like hospitals ≠ like (patients, other QI interventions, ICU beds, staff level, number admissions etc etc)
  – Variable implementation of intervention
    » Team availability & resourcing / composition / experience
    » Variable calling criteria
    » Use of team by ward staff (delayed and failed activation) - ITT
  – Issues similar to before – after studies
  – Expensive / complex and difficult to run = short follow-up
  – Use of intervention in control hospitals = contamination
Evaluating Mature RRSs

- Rapid Response Team
- Home team (medical)
- Ward nurses
- Patients family
- Patient
- • Allied health
  • Visiting teams
Summary

• Evaluation of effect of RRT on outcome of all hospitalised patients difficult

• What about evaluation of a mature/established
  – What is degree of practice variation
  – How can this be minimised
What about the team?

• Within team (intra-team) – Sam Radford
  – Defining roles = absolute / flexibility
  – Interactions
  – Crisis resource management / prioritisation
    » Assessed during simulation training
  – What tasks do they complete
  – What are the interventions
    » Effects of standardising / protocolising approach to intervention
- Inter-team interactions (assessing quality hand-off)
  - Getting handover from ward staff
  - Communicating with home team / nurses / patient after call
What about the patient?

- Epidemiology of the RRT patient
  - Who are they / how do they differ from non-RRT patient
  - Cause of RRT calls
    » physiological trigger / worried
    » Clinical cause of the deterioration = sepsis / AMI / APO / AF
      - Target for further interventions
  - Issues surrounding end-of-life care
  - What treatment is given
  - Disposition after review
  - Outcome after review
Mature RRS ......contin...

• Afferent
  – Quality vital sign assessment
  – Delayed calling
  – Adverse events that had calling criteria
  – Number of calls / 1000 admissions = RRT dose (Good / bad)

• Efferent
  – Adverse events shortly after review
• Whole system
  – RRT calls in first 24 hr admission = suboptimal triage
  – Mortality all hospital admissions / RRT patients
  – End of life care issues in the RRT
  – Repeat RRT calls
  – Admission to critical care after RRT review
  – Unplanned ICU admissions / cardiac arrests / unexpected deaths
  – Staff retention rates
  – Ward staff attitudes to RRT
Evaluating novel interventions

• Massive degree of practice variation between hospitals
  – Thresholds for calling criteria
  – Resourcing of team
  – Composition and availability of team

• Large variability in in-hospital mortality
  – Hospitalised patients overall
  – Patients subject to MET review

2. ANZICS-CORE MET dose investigators
• If investigating interventions MET-based in multiple site
  – Standardise calling criteria
  – Standardisation of team composition
  – Standardisation of types of patients reviewed
    » AF
    » Sepsis
    » Cardiogenic pulmonary oedema
  – Protocolise intervention
Conclusion

• RRS = example of complex intervention
  – Multiple components
  – Act independently and inter-dependently

• Difficult to evaluation effect on all patients

• In a mature RRS
  – Individual components
  – Aspects of team
  – Communication
  – Epidemiology of the RRT patient
Questions