Establishing a useful evidence base: research methods to support everyday work

Robyn Clay-Williams, Brette Blakely, Jeffrey Braithwaite
Background

Traditional research methods in healthcare are based on linear systems thinking:

* variables can be controlled
* results can be generalised
* local problems can be addressed independently of the larger system
* once a problem is solved, it is solved for good
* if the intervention is effective, we will see results (almost) immediately
* multiple interventions can be applied simultaneously, but assessed individually
* once we have planned an intervention, we should apply the intervention exactly as planned
* academic researchers autonomously determine the research questions
Background

Research methods in complex adaptive systems should consider:

* the system is **dynamic**
* causality is **not knowable**
* local problems will impact, and will be impacted by, the larger system
* validity of results limited by **context**
* ‘fix and forget’ does not work in healthcare – we must consider **sustainability**
* there is a time lag between intervention and results
* multiple interventions will interact
* we need to adapt the intervention to meet evolving needs
* academic researchers should determine research questions collaboratively with **clinicians and patients**
## Systems thinking approach

<table>
<thead>
<tr>
<th>Static thinking</th>
<th>Dynamic thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focusing on single events</td>
<td>Focusing on behavior patterns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System-as-effect thinking</th>
<th>System-as-cause thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>System behaviour driven by external forces</td>
<td>System behaviour driven by internal actors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tree-by-tree thinking</th>
<th>Forest thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on the details</td>
<td>Focus on the big picture, context</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factors thinking</th>
<th>Operational thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listing factors that correlate with a result</td>
<td>Understanding how behavior is generated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Straight line thinking</th>
<th>Loop thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causality single directional</td>
<td>Causality multi-directional, feedback loop</td>
</tr>
</tbody>
</table>

---

Which research methodology?

What is the problem you are trying to solve?

- Do you need more information about the problem?
- Are you testing one or more solutions (right answer, or BEST answer)?
- Do you need evidence of success – who is the audience?
  - how will you tell them?

Need *dynamic* methods, need to *understand* rather than just measure:

- Mathematical computational modelling
  - Agent Based Modelling, System Dynamics Modelling, Hybrid
- FRAM
- Qualitative methods: ethnography, interviews, focus groups
- Quantitative methods: metrics, surveys
Collecting the data

Quantitative methods – WHAT? WHEN? YES/NO?

• Tools: e.g. metrics, surveys

• Need multiple time points (the closer to continuous data stream, the better)

• Analysis: statistical methods

Qualitative methods – WHY? HOW?

• Tools: e.g. ethnography, interviews, focus groups, simulation

• Analysis: language based (e.g. thematic), computational modelling, etc
Examples of dynamic approaches (system/org, department, team levels)
Large system/org level – Agent Based Modelling (ABM)

HIV Diffusion and Syringe Usage

Number of users (by HIV status)

Distribution of Experience (by HIV status)

- Infected users
- Susceptible users

Experience (Infected)
Experience (Susceptible)
Large system/org level – ABM/Network Analysis
Department level – ABM/Discrete Event hybrid modelling

Emergency Department

Parameters
- Nurses
- PAs
- Technicians
- U-Sound devices

Resource utilization

Length of Stay

- Triage R.: 0.1
- EC R.: 0.355
- X-Ray: 0.39
- U. Snd: 0.37
- Nurses: 0.34
- PAs: 0.35
- Techs: 0.521
Department level – System Dynamics Modelling

[Clay-Williams, 2015]
Department/team level – FRAM

[Clay-Williams, Lane, Johnson, 2015]
Department/team level – Network analysis

- Problem solving networks in an ED

Nurses
Doctors
Allied health
Admin and support

[Creswick, Westbrook and Braithwaite, 2009]
Questions for discussion

1. How can we design research to arrive at relevant answers in a complex adaptive system?

2. How do we incorporate the ‘dynamic’ element into our research?

2. How can we communicate our results in ways that are effective, and usable for everyday work?

4. How can we more effectively include clinicians as research collaborators?

5. How can we more effectively include patients as research collaborators?
Thank you