Why do so many technology programmes in health and social care fail?

Professor Trisha Greenhalgh

Acknowledging input from co-researchers and funding from Wellcome Trust and NIHR
The NASSSS framework
Health technology adoption, non-adoption, abandonment, and challenges to scale-up, spread and sustainability
Objective: To explain why telehealth (and similar) programmes fail

Primary research:
- 6 diverse case studies of technology-supported health and social care programmes
- Followed for 2.5-3 years so far

Secondary research:
- Narrative systematic review

Draft framework covering 7 key domains

Peer review and testing on 10 new case studies

Final NASSS (nonadoption, abandonment, scale-up, spread, sustainability) framework
The NASSS framework
<table>
<thead>
<tr>
<th>SIMPLE</th>
<th>COMPLICATED</th>
<th>COMPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straightforward</td>
<td>Multiple interacting</td>
<td>Dynamic, unpredictable, not easily disaggregated</td>
</tr>
<tr>
<td>Predictable</td>
<td>components or issues</td>
<td>into constituent components</td>
</tr>
<tr>
<td>Few components</td>
<td></td>
<td></td>
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</tbody>
</table>

**SIMPLE**
- Straightforward
- Predictable
- Few components

**COMPLICATED**
- Multiple interacting components or issues

**COMPLEX**
- Dynamic, unpredictable, not easily disaggregated into constituent components
COMPLEXITY can occur in various domains

- Clinical
- Technical
- Value-related
- People-related
- Organisational / inter-organisational
- Environmental

EACH OF THESE DOMAINS MAY HAVE ELEMENTS OF

- Structural or logistical complexity (scale/ scope/ pace/ resources etc)
- Socio-political complexity (stakeholder goals /conflicts of interest etc)
- Emergent complexity (change over time / scope creep etc)
1. CONDITION
   1A Nature of condition or illness
   1B Comorbidities
   1C Socio-cultural factors
DOMAIN 1: The condition or illness

SIMPLE OR COMPLICATED

- Well-characterized, well-understood, predictable (=> standardised management)

CO-MORBIDITIES / SOCIO-CULTURAL FACTORS

- Unlikely to affect care significantly

COMPLEX

- Poorly characterised, unpredictable or high-risk

- Pose significant challenges to care planning & services
7. Continuous embedding and adaptation over time

6. Wider system

5. Health / care organization(s)
   implementation work, adaptation, tinkering

4. Adopter system
   staff
   patient caregivers

3. Value proposition

2. Technology

1. Condition

1A Nature of condition or illness
1B Comorbidities  1C  Socio-cultural factors

TECHNOLOGY
2A Material properties
2B Knowledge to use
2C Knowledge generated
2D Supply model
2E Who owns the IP?
DOMAIN 2: The technology

**WHAT ARE THE TECHNOLOGY’S MATERIAL FEATURES?**

**SIMPLE OR COMPLICATED**
- Already installed or off-the-shelf; dependable; freestanding OR interoperable with current system

**COMPLEX**
- Not yet developed; inter-operability [will be] a headache

**WHAT KNOWLEDGE IS NEEDED TO USE IT?**

**SIMPLE OR COMPLICATED**
- None or a simple set of instructions / IT support

**COMPLEX**
- Advanced training plus ongoing support

**WHAT KIND OF KNOWLEDGE DOES IT BRING INTO PLAY?**

**SIMPLE OR COMPLICATED**
- Data generated directly measures [changes in] the condition

**COMPLEX**
- Questionable link between data and [change in] condition
DOMAIN 2: The technology

**WHAT IS THE TECHNOLOGY SUPPLY MODEL?**

<table>
<thead>
<tr>
<th>SIMPLE OR COMPLICATED</th>
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</tr>
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<tbody>
<tr>
<td>Generic, plug-and-play or COTS (customisable off-the-shelf); easily substituted</td>
<td>Requires significant reconfiguration of current system; hard to substitute</td>
</tr>
<tr>
<td>Data remains on local system; its ‘ownership’ is unambiguous and agreed</td>
<td>Technology generates higher-order data e.g. algorithms, whose IP is contested</td>
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**WHO OWNS THE IP GENERATED BY THE TECHNOLOGY?**

- Data remains on local system; its ‘ownership’ is unambiguous and agreed
- Technology generates higher-order data e.g. algorithms, whose IP is contested
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3A Supply-side value (to developer)
3B Demand-side value (to patient)

4. Adopter system
   staff
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5. Health / care organization(s)
   implementation work, adaptation, tinkering

6. Wider system

7. Continuous embedding and adaptation over time
## DOMAIN 3: The value proposition

### SIMPLE OR COMPLICATED

<table>
<thead>
<tr>
<th>WHAT IS THE DEVELOPER’S BUSINESS CASE? [SUPPLY-SIDE VALUE]</th>
<th>COMPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business case is clear and rests on firm assumptions; strong chance of return on investment</td>
<td>Business case rests on questionable assumptions; significant risk to investors</td>
</tr>
<tr>
<td>Technology is known to be desirable for patients, safe and cost-effective</td>
<td>Patients may not want or need the technology, or it may be unsafe or unaffordable</td>
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4C Carers (available, type of input)

5. Health / care organization(s)
   implementation work, adaptation, tinkering

6. Wider system

7. Continuous embedding and adaptation over time
DOMAIN 4: The adopter system

WHAT CHANGES ARE IMPLIED FOR STAFF?

- SIMPLE OR COMPLICATED
  - No changes OR staff must learn new roles OR new staff be appointed

- COMPLEX
  - Threat to people’s jobs, scope of practice or professional identity

WHAT IS EXPECTED OF THE PATIENT OR PRIMARY CARER?

- SIMPLE OR COMPLICATED
  - Nothing OR very routine tasks e.g. log on, converse, enter data

- COMPLEX
  - Complex tasks e.g. make judgements, adjust treatment

WHAT IS ASSUMED ABOUT THE WIDER CARE NETWORK?

- SIMPLE OR COMPLICATED
  - No lay carer assumed

- COMPLEX
  - Network of lay carers is assumed
7. Continuous embedding and adaptation over time

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   5A Capacity to innovate
   5B Readiness for this technology
   5C Nature of adoption / funding decision
   5D Extent of change needed to organisational routines
   5E Work needed to implement change
## DOMAIN 5: The organisation

**WHAT IS ITS CAPACITY TO INNOVATE (IN ANYTHING)?**

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<thead>
<tr>
<th>SIMPLE OR COMPLICATED</th>
<th>COMPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-led; flat hierarchies; good relationships; slack resources; risk-taking is encouraged</td>
<td>Weak leadership; poor relations; rigid hierarchies; severe resource problems; risk-taking is punished</td>
</tr>
<tr>
<td>High tension for change; good innovation-system fit; widespread support (or opponents lack power)</td>
<td>No tension for change; poor innovation-system fit; key opponents have wrecking power</td>
</tr>
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**HOW READY IS IT FOR THIS TECHNOLOGY-SUPPORTED CHANGE?**

- **SIMPLE OR COMPLICATED**
  - High tension for change; good innovation-system fit; widespread support (or opponents lack power)
- **COMPLEX**
  - No tension for change; poor innovation-system fit; key opponents have wrecking power
## DOMAIN 5: The organisation

<table>
<thead>
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<th>HOW EASY WILL THE FUNDING DECISION BE?</th>
</tr>
</thead>
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<td><strong>SIMPLE OR COMPLICATED</strong></td>
</tr>
<tr>
<td>One organisation OR existing partnership; adequate funds; anticipated cost-neutral or savings; no new infrastructure</td>
</tr>
<tr>
<td><strong>COMPLEX</strong></td>
</tr>
<tr>
<td>Many organisations, not yet in partnership; funding model depends on cross-system savings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IMPLICATIONS FOR TEAM ROUTINES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SIMPLE OR COMPLICATED</strong></td>
</tr>
<tr>
<td>None or minor</td>
</tr>
<tr>
<td><strong>COMPLEX</strong></td>
</tr>
<tr>
<td>Significant disruptive changes needed</td>
</tr>
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</table>

<table>
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<tr>
<th>WHAT WORK IS NEEDED TO IMPLEMENT?</th>
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</thead>
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<tr>
<td><strong>SIMPLE OR COMPLICATED</strong></td>
</tr>
<tr>
<td>Shared vision already exists; few measures needed to develop and evaluate new practices</td>
</tr>
<tr>
<td><strong>COMPLEX</strong></td>
</tr>
<tr>
<td>Significant work needed to build shared vision and implement it</td>
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6. WIDER SYSTEM e.g.
6A Political / policy context
6B Regulatory / legal issues
6C Professional bodies
6D Socio-cultural context

7. Continuous embedding and adaptation over time
## DOMAIN 6: The wider system

<table>
<thead>
<tr>
<th><strong>POLITICAL AND POLICY CONTEXT</strong></th>
<th>SIMPLE OR COMPLICATED</th>
<th>COMPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current or potential policy push</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>REGULATORY OR LEGAL HURDLES</strong></td>
<td>None or easily surmountable</td>
<td></td>
</tr>
<tr>
<td><strong>PROFESSIONAL BODIES</strong></td>
<td>Positive or open to discussion</td>
<td></td>
</tr>
<tr>
<td><strong>CITIZENS / LAY PUBLIC</strong></td>
<td>Positive or open to discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Political opposition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Many, no easy way through</td>
<td></td>
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<tr>
<td></td>
<td>Opposed</td>
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<tr>
<td></td>
<td>Opposed</td>
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<tr>
<td>Section</td>
<td>Description</td>
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<tr>
<td>---------</td>
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<td></td>
</tr>
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<td>1. CONDITION</td>
<td>Nature of condition or illness, Comorbidities</td>
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<td>2. Technology</td>
<td>Material properties, Knowledge to use, Supply model</td>
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<td>7. EMBEDDING AND ADAPTATION OVER TIME</td>
<td>Scope for adaptation over time, Organisational resilience</td>
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<td></td>
<td></td>
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</table>
DOMAIN 7: Embedding and adapting over time

**How much scope is there to adapt / co-evolve technologies and services?**

- **Simple or complicated:** Considerable scope, built into programme design

- **Complex:** Significant barriers to further adaptation

**How resilient is the organisation for adapting to critical events?**

- **Simple or complicated:** Sense-making, reflection and adaptive action are ongoing and encouraged

- **Complex:** Implementation model is rigid and inflexible; no reflection / adaptation allowed
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7. EMBEDDING AND ADAPTATION OVER TIME
   7A Scope for adaptation over time
   7B Organisational resilience

7. Continuous embedding and adaptation over time
A technology-supported programme will be readily adopted, spread and sustained if all domains are ‘simple’

If several domains are ‘complicated’, the programme will be difficult, expensive and slow (but not impossible) to implement and sustain

If several domains are ‘complex’, it will be almost impossible to achieve sustained and widespread adoption of the programme
WHAT TO DO WITH THE NASSS FRAMEWORK?

1. Inform technology design
2. Reject technology ‘solutions’ that have limited chance of success
3. Explain past failures
4. Use NASSS Complexity Assessment Tool to identify, understand, reduce and manage complexity in new and emerging programs

We have begun to work with policymakers, design consultancies and technology companies in UK, Australia, Italy & Canada to apply the NASSS framework
IN PROGRESS: USING NASSS TO MANAGE COMPLEXITY

IDENTIFY AND UNDERSTAND COMPLEXITY
• Apply NASSS complexity assessment tool
• Tease out uncertainties and interdependencies (e.g. via narrative)

REDUCE COMPLEXITY WHERE POSSIBLE
• Limit scale / scope / interdependencies / pace (extend timescale)

‘RUN WITH’ COMPLEXITY e.g.
• Strengthen programme leadership
• Co-develop and sustain a clear and compelling vision
• Develop individuals and support their adaptive actions
• Provide slack resources
• Create incentives (but leave the detail to front-line people)
• Build relationships and manage stakeholder conflict
• Control programme growth (e.g. minimise scope creep)
• Improve policy or regulatory context
THANK YOU FOR YOUR ATTENTION

Professor Trisha Greenhalgh

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