Rapid Cycle Systems Modeling and Decision Sampling to Inform Development and Implementation of System-Wide Innovations to Promote Pediatric Mental and Behavioral Health

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Drs. Mackie and Sheldrick have no financial relationships to disclose or other Conflicts of Interest (COIs) to resolve.
Research Evidence Adoption for Child Health (REACH)

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Increased reliance on system-wide innovations in pediatric emotional, behavioral, and mental health care

- Innovations that can influence access and quality of care through agency-, organization-, or system-level initiatives.
System-wide Interventions:
- Trauma-informed systems of care
- Universal screening programs
- Medication monitoring programs
- Delivery and payment reform
Why study system-wide innovations?

• Rapid expansion
• Potentially:
  • Provide redress to the structural and systemic barriers to quality care
  • Improve population health, especially for the underserved
  • Potential for multiple impacts on the delivery system, care received, and associated outcomes, both intended and unintended consequences.
• Yet, studies of how to promote the use of research evidence in these system-wide innovations lags behind the emphasis on addressing the translational gap in clinical intervention.

The Problem: Evidence-Policy Gap

“Much of the research [on policymakers’ use of research evidence] is theoretically naïve, focusing on the uptake of research evidence as opposed to evidence defined more broadly.”

“more critically and theoretically informed studies of decision-making.”

“Decision sciences provide unique theoretic and scientific insights by demonstrating that evidence does not in and of itself answer the question ‘what to do’, but importantly informs the process of making policy decisions [endorsing system-wide innovations].”

From evidence-based to evidence-informed policy decisions: Balancing evidence, expertise & judgement, values & preferences

**Evidence-informed decisions:** Good decisions rest on (1) evidence, (2) expertise & judgement, and (3) stakeholder values & preferences

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Definition</th>
<th>Question</th>
<th>Illustrative Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence refers to the body of facts or information that demonstrates whether a belief is true or valid.</td>
<td>What is the strength of the evidence supporting adoption of this policy innovation?</td>
<td>California Evidence Based Clearinghouse. Provides a rating of available evidence based practices with information on relevance child welfare populations. Website:</td>
<td></td>
</tr>
<tr>
<td>Research evidence is a type of evidence derived from applying systematic methods and analyses to address a predefined question or hypothesis.</td>
<td>To what extent is this evidence relevant to our delivery system?</td>
<td></td>
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</tr>
<tr>
<td>Values &amp; preferences refers to the beliefs that inform evaluation of the importance, worth, or usefulness of different policy options</td>
<td>Have studies of this innovation been conducted among child welfare populations similar to those we serve?</td>
<td></td>
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</table>

**Expertise & judgement**

- Expertise & judgement refers to the input and discernment received from an individual or committee competent in a particular field of knowledge
- Who will judge whether the evidence is applicable to our jurisdiction’s populations?
- Who can help determine the feasibility, acceptability, and capacity for us to implement the intervention?
- Do they have the relevant expertise?

**Values & preferences**

- Values & preferences refers to the beliefs that inform evaluation of the importance, worth, or usefulness of different policy options
- How will decision-makers compromise potentially differing outcomes related to effectiveness and feasibility?
- When considering potentially differing outcomes whose advice will be considered?

Our Talk in Three Parts [Papers]

**Part 1:** Application of decision sciences to investigate evidence use in system-wide innovations: Decision Sampling Framework as a methodological template


**Part 2:** Simulation modeling as an analytic tool


**Part 3:** Simulation modeling as implementation strategy

Part 1: Application of decision sciences to investigate evidence use in system-wide innovations: Decision Sampling Framework

Engaging the decision sciences to inform future strategies to promote evidence use
Case study: “Policy Window”

- **Evidence-Policy Gap:** Lack of evidence in policy and population-level programmatic response to identify and treat the trauma of children entering foster care.

- **Policy Window:** Child and Family Services Improvement and Innovation Act of 2011 (P.L. 112-34) required child welfare agencies to develop a protocol of routinely screened, assessed and treated for trauma.

A new methodology: Decision Sampling Framework

Evidence Use Studies

Anchor: Research evidence
Key Domains:
• Types/sources of evidence use
• Information needs
• Barriers/facilitators
Role of Policymaker: Consumer
Unit of Analysis: Respondent

Decision Sampling Framework

Anchor: Recent and important decision(s) in policy domain
Key Domains:
• Decision/s, options, trade-offs
• Evidence and other types of information, expertise, values, and other factors
Role of Policymaker: Active decision-maker
Unit of Analysis: Decision


**Decision sampling framework**

**Method:** Cross-sectional semi-structured interviews

**Sample:**
- 12 states with recent innovation in building a trauma-informed child welfare system
- Public sector mid-level managers (n=90)
  - Mental health (n=46)
  - Medicaid (n=19)
  - Child welfare (n=11)
  - Other (n=14)
- Decisions
  - Screening and assessment (n=30)
  - Trauma-specific treatment (n=8)
  - Trauma-informed care (n=32)
Relevant parties confront **multiple decisions** along a dynamic decision continuum when bringing EBPs to scale.

- Referenced a dynamic continuum of discrete and inter-related decisions
- Systematic characterization of the decisions revealed important information on:
  - **Trade-offs** considered during the decision-making process
  - Evidence and other types of information, expertise, and values
Reach
Whether to screen the entire population or a sub-population with a specific screening tool?  Whether to and the frequency for when to rescreen for trauma?

Screening Content
Whether screen would assess adequately for trauma exposure and/or symptoms?  What specific trauma-informed screening or assessment tool should be used?

Threshold
What is the appropriate threshold for referral?

Resources to Start-up and Sustain Protocol
Who can administer the screening/assessment?  Whether and extent of training, supervision, and “refreshers” required to maintain fidelity?  How to sustain the protocol?

Capacity of Service Delivery System to Respond
What is delivery-system capacity to provide trauma-specific services?
Choices across the decision continuum

“what we looked at is we said where would we need to draw the line, literally draw the line…”

–Child Welfare

Threshold: Where to set the “cut-score?”

Research threshold:

Higher threshold:
Decisions are informed by a vast array of information [beyond what we publish] and specific to the decisions confronted.

- Global evidence
  - Published studies
  - Clearinghouses and Briefs
  - Government reports
  - Professional guidelines
  - Administrative data
  - Testimony
  - Personal experience of decision-maker

Local knowledge

Hyde et al, 2016
Trade-offs evaluated in light of available information and expertise: Illustrative example of values

Published studies

Expertise

“...children who have 3 or more identified areas of trauma screen are really showing clinical significance for PTSD, these are kids you should be assessing. We looked at how many children that was [in our administrative data], and we said we can’t afford that.” –Child Welfare
Trade-offs evaluated in light of available information, values, and expertise: Illustrative example of values

“...children who have 3 or more identified areas of trauma screen are really showing clinical significance for PTSD, these are kids you should be assessing. We looked at how many children that was [in our administrative data], and we said we can’t afford that.” –Child Welfare
Trade-offs evaluated in light of available information and expertise: Illustrative example of effectiveness and feasibility

“...children who have 3 or more identified areas of trauma screen are really showing clinical significance for PTSD, these are kids you should be assessing. We looked at how many children that was [in our administrative data], and we said we can’t afford that.” –Child Welfare
“what we looked at is we said where would we need to draw the line, literally draw the line, to be able to afford based on the available dollars we had within the waiver.” —Child Welfare
What is the value of this illustrative example?

Our analyses in the framework suggest:

1. Decision-makers require tools that present these trade-offs in model scope and facilitate integration of available information.

2. In-depth investigation of the decision-making process helps to clarify the decision continuum in any policy domain.

3. In a single policy domain, the best available evidence, expertise, and values at play are frequently dependent on the specific decision confronted (i.e., setting thresholds vs. reach).

Threshold: Where to set the “cut-score?”

Research threshold:

Higher threshold:

Resources to Start-up and Sustain Protocol:
- Capacity to facilitate caseworker referral

Capacity of Service Delivery to Respond to Identified Needs
Part 1: Take-home Point (1)

• Consider starting with the decisions, not the research evidence alone.

• Acknowledge the decision continuum in the policy domain of interest. Multiple decisions are required in developing an evidence-informed policy
  • Identification of gaps in research evidence.
  • Potential trade-offs confronted by decision-makers.

• Recognize how research evidence is integrated with other types of information

• Information (including research evidence) was always applied with expertise and values; if we aspire to science-based decision-making, all three are part of a decision-making process for an evidence-informed policy.

• Opens up lots of possibilities for research.
Part 1: Take-home points (2)

The article aims to offer a methodological template:

• To assist in the systematic qualitative analysis of decision-making, optimally transferable to the context of other system-wide innovations/ policy domains.

• To help in development of simulation modeling to facilitate analysis and implementation strategies in this and hopefully other policy domains.
Part 2: Simulation modeling as an analytic tool


Simulation models: 2 definitions

• **Narrow definition**: “a computer simulation is a program that is run on a computer and that uses step-by-step methods to explore the approximate behavior of a mathematical model... Usually...of a real-world system”

• **Broad definition**: “a comprehensive method for studying systems...includes choosing a model; finding a way of implementing that model in a form that can be run on a computer; calculating the output of the algorithm; and visualizing and studying the resultant data. The method includes this entire process—used to make inferences about the target system that one tries to model—as well as the procedures used to sanction those inferences.”

I. Simulation modeling as an analytic tool

1. Synthesizes evidence
2. Makes assumptions explicit
3. Reveals contradictions in assumptions
4. Helps to explore implications of assumptions
A common example: You are planning a new study of an important treatment. So, you:

• Synthesize prior evidence on the treatment as well as the outcome measures used to assess it
• Make some assumptions about the risk of error you are willing to accept

The simulation model helps to reveal:
1. The implications of your evidence + assumptions (e.g., sample size needed to detect effect), and
2. Possible contradictions in assumptions (try asking for 80% power with a 30% type 1 error rate)
We call this a power analysis, and it is widely accepted as integral to the design of almost any quantitative research study.

Is there an equivalent in implementation science?
Case example: Implications of ACEs Screening for Behavioral Health Services: A Scoping Review and Systems Modeling Analysis

Finding evidence to synthesize: A systematic review

- broad search terms of “Adverse Childhood Experiences” and “Adverse Childhood Events.”
- 1,644 unique studies screened
- 12 articles met the inclusion criteria for
  - screening in medical settings (n=9) or
  - reporting prevalence (n=3)

Provided evidence regarding:
- Sample characteristics
- % positive at various thresholds (i.e., cut scores)
- Limited data regarding referrals
Results of systematic review

• Sample sizes ranged from 111 to 2569 patients screened
• Administration methods included self-report for adults and adolescents, caregiver report for children under age 12. Results could also be anonymous (national surveys) or “de-identified” (item responses redacted)
• Screening Completion Proportions ranged from 28-92.1%
• 6% to 64% of patients scored positive, depending on threshold, study, age and method
• One study reported that 2% of patients were referred; a second that 47% were referred (77.5% enrolled)
What are the implications of these data for implementation of ACEs screening in primary care settings?

A monte carlo simulation model
Children screened each month

Screen positive

Screen negative

Referred

Not referred

Complete

Declined

Wait for tx

Tx
Children with DevBeh Problems (process sensitivity)

- Children screened each month
  - Screen positive
    - Referred
      - Complete
      - Wait for tx
      - Tx
  - Screen negative
    - Not referred
    - Declined

No Problems (process specificity)

- Children screened each month
  - Screen positive
    - Referred
      - Complete
      - Declined
      - Wait for tx
      - Tx
  - Screen negative
    - Not referred
    - Declined
Children screened each month

Screen positive

Referred

Complete

Tx

Providers

Wait for tx

Tx

Prevalence=20%

Sens/spec=75%

80% referred

80% complete

No Problems

(process specificity)

Children screened each month

Screen positive

Referred

Complete

Tx

Wait for tx

Tx

No Problems

(process specificity)

Screen negative

Not referred

Declined

Hires

Quit
Children with high ACEs

- Screen positive
- Screen negative
- Referred
- Not referred
- Complete
- Declined

Children with low ACEs

- Screen positive
- Screen negative
- Referred
- Not referred
- Complete
- Declined

Workforce size
Therapist capacity
Quit rate
Hiring rate

Prevalence
Sensitivity
Specificity

% referred
% retained

Feedback loops

Model parameters

Figure 1. Simulation model structure
Testing 1st of 3 sets of assumptions

Baseline Scenario
behavioral screening

% screened | 85.0%
sensitivity | 80.0%
specificity | 90.0%
% positive | 13.0%

presumption of high accuracy

implied prevalence | 4.0%

% of positives referred | 80.0%
% of negatives referred | 5.0%

Wissow et al., 2013
Wissow et al., 2013

% to complete referrals | 77.5%

Kia-Keating et al., 2019

workforce parameters

calibrated to yield
persistent waitlists for
treatment services
averaging 1-2 months

Jellinek et al., 1999

implied prevalence (4.0%)

% of positives referred (80.0%) Wissow et al., 2013
% of negatives referred (5.0%) Wissow et al., 2013
% to complete referrals (77.5%) Kia-Keating et al., 2019

workforce parameters

calibrated to yield
persistent waitlists for
treatment services
averaging 1-2 months

Jellinek et al., 1999
Scenario A: Baseline
[Generic behavioral screening process]
<table>
<thead>
<tr>
<th></th>
<th>Baseline Scenario</th>
<th>Scenario #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>behavioral screening</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% screened</td>
<td>85.0%</td>
<td>56.0%</td>
</tr>
<tr>
<td>sensitivity</td>
<td>80.0%</td>
<td>30.0%</td>
</tr>
<tr>
<td>specificity</td>
<td>90.0%</td>
<td>99.9%</td>
</tr>
<tr>
<td>% positive</td>
<td>13.0%</td>
<td>0.2%</td>
</tr>
<tr>
<td>implied prevalence</td>
<td>4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>% of positives referred</td>
<td>80.0%</td>
<td>80.0%</td>
</tr>
<tr>
<td>% of negatives referred</td>
<td>5.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>% to complete referrals</td>
<td>77.5%</td>
<td>77.5%</td>
</tr>
</tbody>
</table>

Calibrated to yield persistent waitlists for treatment services averaging 1-2 months. 

Selvaraj et al., 2019

Working parameters:

Persistent waitlists for treatment services averaging 1-2 months
Testing 3rd of 3 sets of assumptions

<table>
<thead>
<tr>
<th></th>
<th>Baseline Scenario</th>
<th>Scenario #2 lower demand</th>
<th>Scenario #3 higher demand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>% screened</strong></td>
<td>85.0%</td>
<td>56.0%</td>
<td>73.0%</td>
</tr>
<tr>
<td><strong>sensitivity</strong></td>
<td>80.0%</td>
<td>30.0%</td>
<td>30.0%</td>
</tr>
<tr>
<td><strong>specificity</strong></td>
<td>90.0%</td>
<td>99.9%</td>
<td>99.9%</td>
</tr>
<tr>
<td><strong>% positive</strong></td>
<td>13.0%</td>
<td>0.2%</td>
<td>19.3%</td>
</tr>
<tr>
<td><strong>implied prevalence</strong></td>
<td>4.0%</td>
<td>4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td><strong>% of positives referred</strong></td>
<td>80.0%</td>
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</tr>
</tbody>
</table>

modified from Kia-Keating et al., 2019

workforce parameters calibrated to yield persistent waitlists for treatment services averaging 1-2 months same same
Sensitivity analyses: feedback loops

Analysis #1: effect of long waitlists on referrals

When average waitlists are above a threshold of 150 days (over twice as high as the average at baseline) for at least 6 months, the probability of referral and the probability of referral completion each decline by 0.1% per month until waitlists fall below the threshold.

Analysis #2: effect of long waitlists on referrals & quit rate

In addition, this analysis includes an additional feedback loop. When average waitlists are above a threshold of 150 days for at least 12 months, the quit rate for treatment providers increases by 0.01% per month.
Figure. Potential influence of feedback loops on waitlists

**Mean number of patients waiting for treatment**

**Scenario C:** high demand

**Positive Feedback:**
- ↑Waitlists lead to
- ↑Staff turnover

**Negative Feedback:**
- ↑Waitlists lead to
- ↓Demand
Implications of findings

• Wide range of parameter estimates from published literature suggest a wide range of possible scenarios
• Plausible feedback loops add to uncertainty in implementation

Yet RCSM also deepened our understanding of the data in ways that are important for:

1. implementation
2. future research
1. Regarding the % who screen positive, child age is likely to matter (a lot)
2. “process sensitivity” is likely <<<< screener sensitivity
3. Impact on MH workforce is plausible given data

Is this sufficient evidence to recommend ongoing monitoring?
4. Feedback loops could have a profound effect on implementation

Feedback loops

Dynamic
Complexity

Dynamic
resistance

"the often counterintuitive behavior of complex systems that arises from the interactions of the agents over time."

"when seemingly obvious solution do not work as well as intended, or even make the problem worse"
5. **Evidence gap**: There is no direct evidence on accuracy of ACEs screeners

- no good reference standard
- % positive commonly reported as “prevalence”
- Sensitivity can itself be modeled as “opportunity to disclose”
6. **Evidence gap: Referrals**

- only a small number of studies reported:
  -% of children referred
  -% referral completion
- these data are critical for modeling impact
- readily available in some administrative databases
Part 3: Simulation modeling as an implementation strategy

Simulation Modeling as Implementation strategy

• “model and simulate change” is recognized as a potential implementation strategy by the Expert Recommendations for Implementing Change (ERIC) project

• Facilitates exchanges of evidence, knowledge

• Can influence decision-makers’ attitudes, subjective norms and intentions; help achieve alignment that is necessary for community action → i.e., behavior change


Philosophical foundations

David Eddy, PhD

“Uncertainty creeps into medical practice through every pore...”

Choice in the face of scientific uncertainty
Some traditions in evidence-based medicine derive from decision analysis and therefore recognize the need for:

1. the best available evidence,

2. the expertise to address scientific uncertainty in the application of that evidence, and

3. stakeholder values to define model scope and purpose and to weigh tradeoffs between competing outcomes.
### Philosophical foundations

<table>
<thead>
<tr>
<th>Deductive logic</th>
<th>Abductive logic</th>
<th>Inductive logic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reasoning from general principles to particular conclusions</strong>&lt;br&gt;e.g., <em>modus ponens</em>&lt;br&gt; If argument is valid, then conclusion can be proven to certain or impossible</td>
<td><strong>Reasoning to the best explanation</strong>&lt;br&gt;e.g., <em>critical dialog</em>&lt;br&gt; If argument is accepted as valid, then conclusion can be shown to plausible or implausible</td>
<td><strong>Reasoning from particular observations to general principles</strong>&lt;br&gt;e.g., inferential statistics&lt;br&gt; If analysis is valid, then conclusions can be shown to be probable or improbable</td>
</tr>
</tbody>
</table>

Abductive reasoning & dialog

If conclusions cannot be proven nor demonstrated to be highly probable, then the depth of dialog becomes critical for assessing plausibility, including

1. how many of arguments were brought forward...,
2. how many of these arguments were undercut or defeated,
3. how many implicit premises were revealed ...
4. how well the discussion was informed of the relevant facts on the issue, and
5. how strongly the ...whole dialog supported or refuted the fundamental thesis at issue

Cultural exchange theory

Posits that:

• Critical dialog, deliberation, and 2-way exchanges of information and values facilitate implementation


Conceptual Model

Stakeholders

Practical knowledge & local evidence
Conceptual Model

Stakeholders

- Practical knowledge & local evidence
- Decisions to be made
- Qs for research
Conceptual Model

Stakeholders

- Practical knowledge & local evidence
- Decisions to be made
- Qs for research

Research team

- Research evidence
Conceptual Model

Stakeholders

- Practical knowledge & local evidence
- Decisions to be made
- Qs for research

Research team

- Questions for decision-makers
- Research evidence
Conceptual Model

Stakeholders
- Practical knowledge & local evidence

Decisions to be made
- Qs for research

Simulation model facilitates exchange of evidence & ideas

Questions for decision-makers
- Research evidence

Research team
Evidence-informed decisions, planning

Stakeholders
- Practical knowledge & local evidence
- Decisions to be made

Simulation model facilitates exchange of evidence & ideas

Questions for decision-makers
- Research evidence

Research team
- Qs for research

Conceptual Model
Evidence-informed decisions, planning

Generation of new questions

Simulation model facilitates exchange of evidence & ideas

Practical knowledge & local evidence

Decisions to be made

Qs for research

Questions for decision-makers

Research evidence

Research team

Stakeholders
Rapid Cycle Systems modeling

1. Elicit stakeholder questions & priorities
Rapid Cycle Systems modeling

1. Elicit stakeholder questions & priorities

2. Develop simulation models
Rapid Cycle Systems modeling

1. Elicit stakeholder questions & priorities

2. Develop simulation models

3. Dialog regarding model utility, need for refinement
Group interviews: Assessing utility and face validity

**Decision-makers (n=8)**
- 8 of the 31 decision-makers from REACH study who discussed decisions specific to screening and assessment.
- Provided a presentation summarizing:
  - Decision sampling results
  - Monte Carlo simulation model
- Analysis: Immersion crystallization

**Intermediaries (n=8)**
- 8 intermediaries, including relevant screening tool developers, EBT developers, implementation scientists, and intermediaries.
- Provided a presentation summarizing:
  - Decision sampling results
  - Monte Carlo simulation model
- Analysis: Immersion crystallization
Results

Modeling was relevant

• “Oh yeah, these are kind of typical points of conversation, questions, decision making that we run into.”

• “there's plenty of decisions that I anticipate we will have to make on an ongoing basis to put forth the best practices.”

Data are available

• “these are data that we generally have available.”
Results

RCSM has value

- facilitates “actually having a more technical conversation about the expected implications.”
- “it applies across the board to my field specifically but anyone that's really looking to improve the efficiency of a delivery system.”
Results

Example: effect of screening on system capacity

• “There's a lot of focus on who and how to screen. There's a lot of conversation particularly around trauma on the pros and cons of screening for ACES whether directly in a child population or an adult population. But if you want to do it effectively the conversation has to entail the implications on the delivery system.”

• “I don't think that our partners think about it in this way with the addition of thinking about how it impacts other system partners and other dynamics of the system of care.”
Results

Example: complexity of referral chain

• “The challenge we see is from referred to completion because that's where you run into the wait times, the different providers, the lack of capacity, or the intervention of someone with a disagreement or that things because a child is stable in care, they don't need mental health services. Things like that. So that's an active area that we'll actually be exploring is how to create that automated pathway to make sure that the referral results in a warm care coordination handoff to ongoing care.”

• “I wouldn’t say it’s obvious...I don't think that our partners think about it in this way with the addition of thinking about how it impacts other system partners and other dynamics of the system of care.”
**Results**

Example: modeling with respect to changing screening thresholds (cut scores):

• “I do know that CTAC, who developed the [screening] tool, feels very strongly that it's a good indicator of what needs to happen, and they'd like to see our thresholds much lower than what they are for the kind of intervention. So I think, if anything, it might help the developer in our department feel better about what we've set as potential thresholds. Whether or not they would welcome that, I don't know.”
Thresholds: tradeoffs in screening thresholds


Thresholds: tradeoffs in screening thresholds
Thresholds: tradeoffs in screening thresholds

Research threshold: 1 2 3 4 5 6 7 8 9

- Affected children (process sensitivity)
- Unaffected children (process specificity)

Proportion of children receiving treatment

Children receiving treatment

Month
Thresholds: tradeoffs in screening thresholds

- Research threshold: 1 2 3 4 5 6 7 8 9
- Higher threshold: 1 2 3 4 5 6 7 8 9

Chart showing the proportion of children receiving treatment over months.

Graphs represent affected and unaffected children, with sensitivity and specificity tradeoffs indicated.
Thresholds: tradeoffs in screening thresholds

Research threshold: 1 2 3 4 5 6 7 8 9

Higher threshold: 1 2 3 4 5 6 7 8 9
Thresholds: tradeoffs in screening thresholds

Figure 3. Influence of screening threshold on system capacity, demand for treatment, & waitlists
Figure 3. Influence of screening threshold on system capacity, demand for treatment, & waitlists.
Conclusion

*Rapid cycle systems modeling has proven useful for:*

• Engaging key stakeholders in productive dialog
• Synthesizing diverse forms of evidence
• Identifying a range of potential systems solutions to a shared problem

*Moving forward, we anticipate that RCSM will be useful for:*

• Benchmarking measures of process improvement
• Identify potential for *dynamic resistance*
Our Talk in Three Parts [Papers]

Part 1: Application of decision sciences to investigate evidence use in system-wide innovations: Decision Sampling Framework


Part 2: Simulation modeling as an analytic tool


Part 3: Simulation modeling as an implementation strategy

Thank you for joining in these challenging times!
Thank you!

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Implementation Research Institute

Questions?

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Tom Mackie
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The Waterfall Model of product design

Users can’t clarify requirements at beginning of process.

Designers can’t foresee all complications & difficulties.

Implementation & Verification reveal ‘edge cases’ that require re-design.

Maintenance must address secular changes.
Iterative & incremental design

Requirements

Design

Implementation

Verification

Maintenance

Continuous Quality Improvement

Plan → Do → Check → Act → Plan