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

October 20, 2020

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no financial relationships to disclose or other Conflicts of Interest (COIs) to resolve.

Research Evidence Adoption for Child Health (REACH)

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ACKNOWLEDGEMENTS:

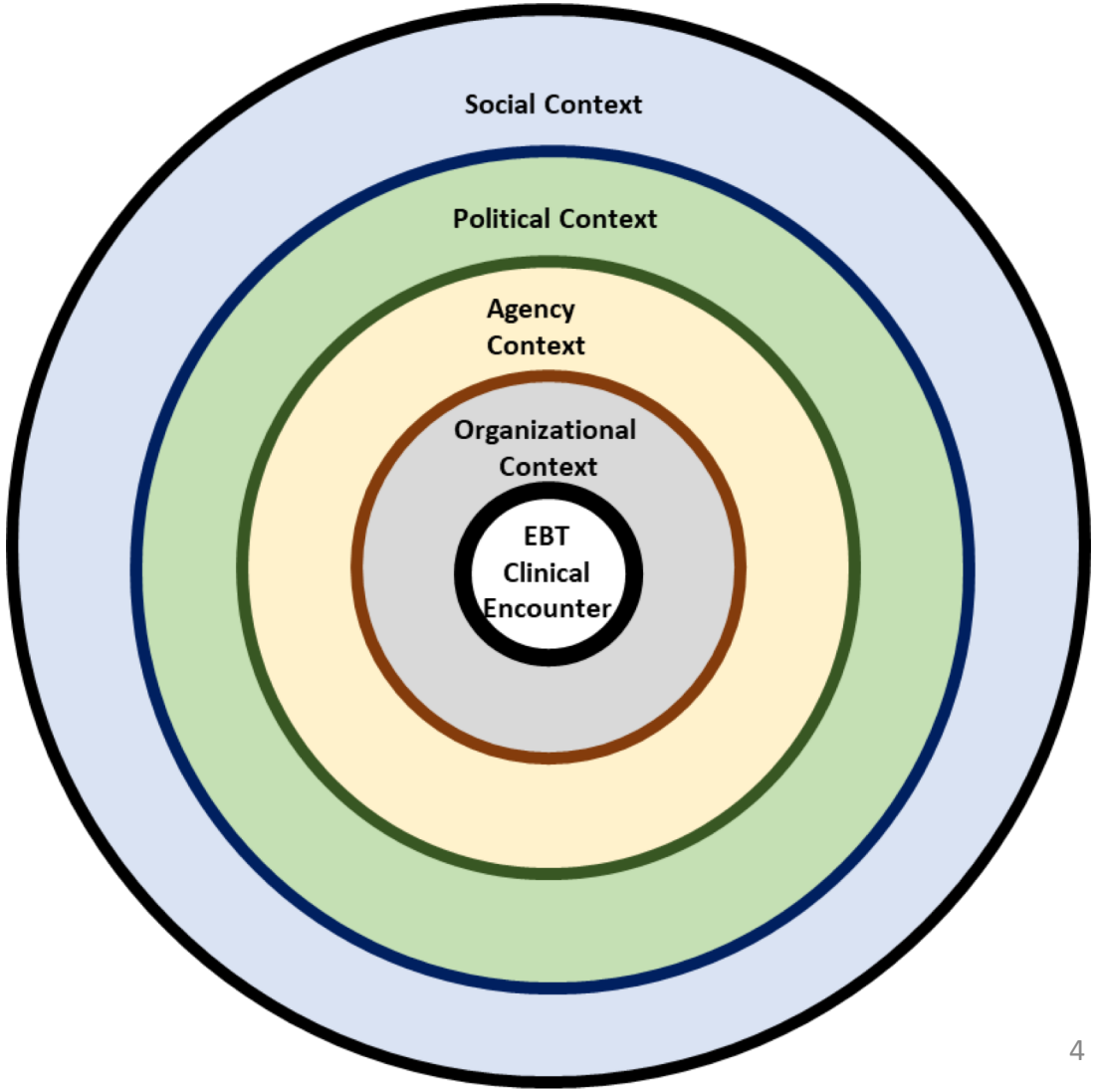
William T. Grant FOUNDATION

Integrating Theoretic and Empirical Findings of Research Evidence Use: A Healthcare Systems Engineering Approach [PI: Mackie]

IRI **Implementation Research Institute**

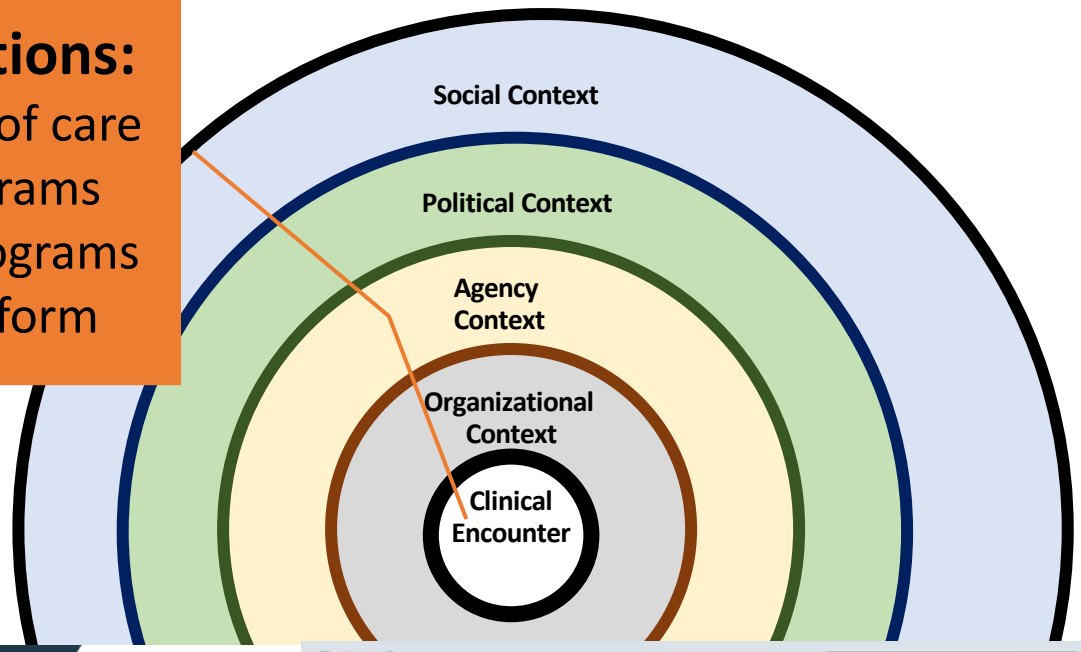
Increased reliance on system-wide innovations in pediatric emotional, behavioral, and mental health care

- 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.

Brownson, R. C., Gurney, J. G., & Land, G. H. (1999). Evidence-based decision making in public health. *Journal of Public Health Management and Practice*, *5*, 86-97.

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."

Oliver et al. BMC Health Services Research 2014, 14:2
http://www.biomedcentral.com/1472-6963/14/2

BMC Health Services Research

RESEARCH ARTICLE Open Access

A systematic review of barriers to and facilitators of the use of evidence by policymakers

Kathryn Oliver[1*], Simon Innvar[2], Theo Lorenc[3], Jenny Woodman[4] and James Thomas[5]

Abstract

Background: The gap between research and practice or policy is often described as a problem. To identify new barriers of and facilitators to the use of evidence by policymakers, and assess the state of research in this area, we updated a systematic review.

Methods: Systematic review. We searched online databases including Medline, Embase, SocSci Abstracts, CDS, DARE, PsychIt, Cochrane Library, NHSEED, HTA, PAIS, IBSS (Search dates: July 2000 - September 2012). Studies were included if they were primary research or systematic reviews about factors affecting the use of evidence in policy. Studies were coded to extract data on methods, topic, focus, results and population.

Results: 145 new studies were identified, of which over half were published after 2010. Thirteen systematic reviews were included. Compared with the original review, a much wider range of policy topics was found. Although still primarily in the health field, studies were also drawn from criminal justice, traffic policy, drug policy, and partnership working. The most frequently reported barriers to evidence uptake were poor access to good quality relevant research, and lack of timely research output. The most frequently reported facilitators were collaboration between researchers and policymakers, and improved relationships and skills. There is an increasing amount of research into new models of knowledge transfer, and evaluations of interventions such as knowledge brokerage.

Conclusions: Timely access to good quality and relevant research evidence, collaborations with policymakers and relationship- and skills-building with policymakers are reported to be the most important factors in influencing the use of evidence. Although investigations into the use of evidence have spread beyond the health field and into more countries, the main barriers and facilitators remained the same as in the earlier review. Few studies provide clear definitions of policy, evidence or policymaker. Nor are empirical data about policy processes or implementation of policy widely available. It is therefore difficult to describe the role of evidence and other factors influencing policy. Future research and policy priorities should aim to illuminate these concepts and processes, target the factors identified in this review, and consider new methods of overcoming the barriers described.

Oliver, K., Innvar, S., Lorenc, T., Woodman, J., & Thomas, J. (2014). A systematic review of barriers to and facilitators of the use of evidence by policymakers. *BMC health services research*, *14*(1), 2.

Decision Sciences to Study Evidence Use in System-wide Innovations

"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]."**

Evidence & Policy • vol xx • no xx • 1–13 • © Policy Press 2019
Print ISSN 1744-2648 • Online ISSN 17442656 • https://doi.org/10.1332/174426419X15677739896923
Accepted for publication 06 September 2019 • First published online 26 September 2019

debate

The debate over rational decision making in evidence-based medicine: Implications for evidence-informed policy

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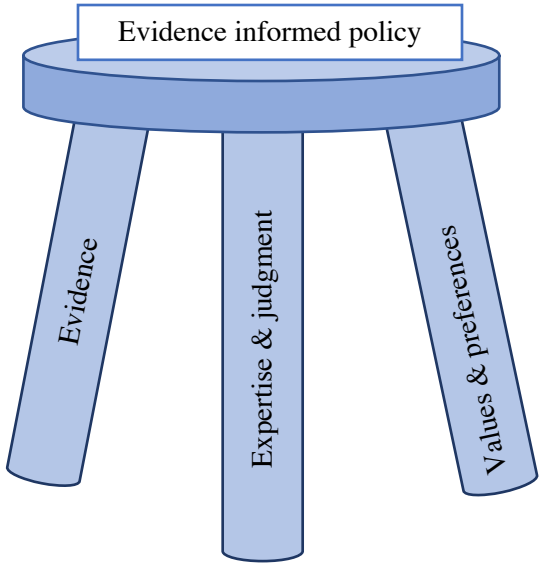
Many of the resources developed to promote the use of evidence in policy aspire to an ideal of rational decision making, yet their basis in the decision sciences is often unclear. Tracing the historical development of evidence-informed policy to its roots in *evidence-based medicine* (EBM), we distinguish between two understandings of how research evidence may be applied. Advocates for EBM all seek to use research evidence to optimise clinical care. However, some proponents argue that 'uptake' of research evidence should be direct and universal, for example through wide-scale implementation of 'evidence-based practices'. In contrast, other conceptualisations of EBM are rooted in *expected utility*

Sheldrick, C. R., Hyde, J., Leslie, L. K., & Mackie, T.I. (2019). The debate over rational decision making in evidence-based medicine: Implications for evidence-informed policy. *Evidence & Policy: A Journal of Research, Debate and Practice*.

From evidence-based to evidence-informed policy decisions: Balancing evidence, expertise & judgement, values & preferences[1]

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



	Definition	Question	Illustrative Example
Evidence	• **Evidence** refers to the body of facts or information that demonstrates whether a belief is true or valid. • **Research evidence** is a type of evidence derived from applying systematic methods and analyses to address a predefined question or hypothesis.[2]	• What is the strength of the evidence supporting adoption of this policy innovation? • To what extent is this evidence relevant to our delivery system? • Have studies of this innovation been conducted among child welfare populations similar to those we serve?	• California Evidence Based Clearinghouse. Provides a rating of available evidence based practices with information on relevance child welfare populations. *Website:*
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?	• Advisory board of youth, caregivers, frontline administrators and supervisors to asses policy options available. • Other child welfare leaders and state policy decision-makers • Clinical experts.
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?	• Commitments of organization, individuals, and financing mechanisms.

1. Sheldrick, C. R., Hyde, J., Leslie, L. K., & Mackie, T. (2020). The debate over rational decision making in evidence-based medicine: Implications for evidence-informed policy. *Evidence & Policy: A Journal of Research, Debate and Practice*.
2. Tseng, V. (2012). The Uses of Research in Policy and Practice and commentaries. *Social policy report*, *26*(2), 1-24.

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

Mackie, T.I., Schaefer, A.C., Hyde, J., Leslie, L.K., Bosk, E., & Sheldrick, R.C. (revise & resubmit). Decision sampling: A qualitative approach to improve evidence use in health policies and system-wide innovation.

Part 2: Simulation modeling as an analytic tool

Barnett, M. L., Sheldrick, R.C., Liu, S., Kia-Keating, M., Negriff, S. L. (in press). Implications of ACEs Screening on Behavioral Health Services: A Scoping Review and Systems Modeling Analysis. *American Psychologist*

Part 3: Simulation modeling as implementation strategy

Sheldrick, R.C., Schaefer, A., Cruden, G., Leslie, L.K., Hyde, J., & T.I. Mackie (in preparation). Rapid Cycle Systems Modeling to improve evidence use in system-wide interventions.

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

Mackie, T.I., Schaefer, A.C., Hyde, J., Leslie, L.K., Bosk, E., & Sheldrick, R.C. (revise & resubmit). Decision sampling: A qualitative approach to improve evidence use in health policies and system-wide innovation.

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.

Hayek, M., Mackie, T. I., Mulé, C. M., Bellonci, C., Hyde, J., Bakan, J. S., & Leslie, L. K. (2014). A multi-state study on mental health evaluation for children entering foster care. APMH, 41(4), 552-567.

A new methodology: Decision Sampling Framework

Evidence Use Studies

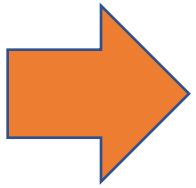
Anchor: Research evidence

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

Hyde, J. K., Mackie, T. I., Palinkas, L. A., Niemi, E., & Leslie, L. K. (2016). Evidence use in mental health policy making for children in foster care. *APMH, 43*(1), 52-66.

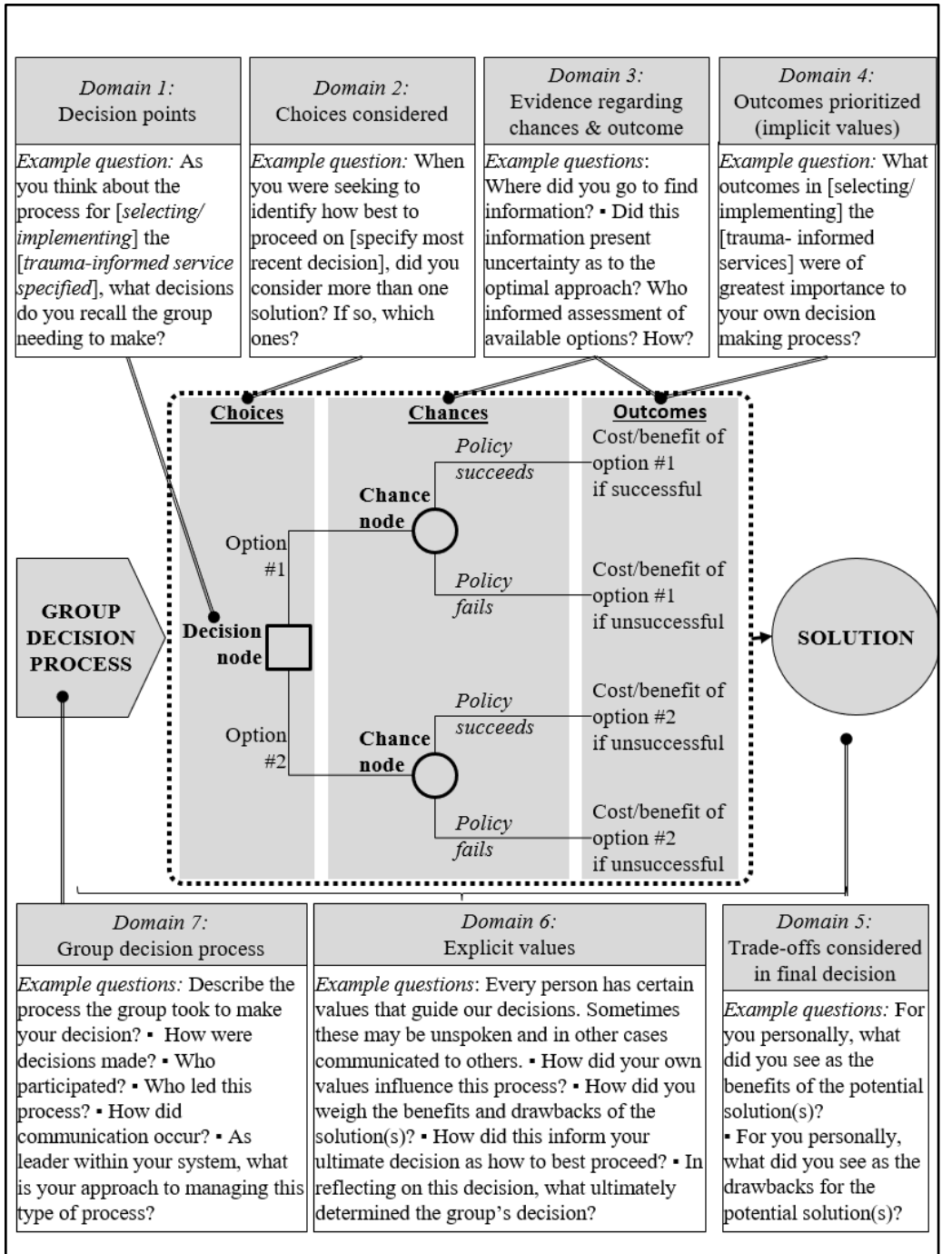
Mackie, T.I., Schaefer, A.C., Hyde, J., Leslie, L.K., Bosk, E., & Sheldrick, R.C. (revision & resubmit). Decision sampling: A qualitative approach to improve evidence use in health policies and system-wide innovation.

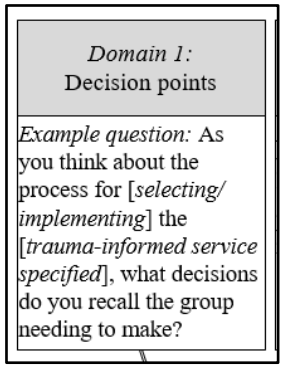
Decision sampling framework

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?

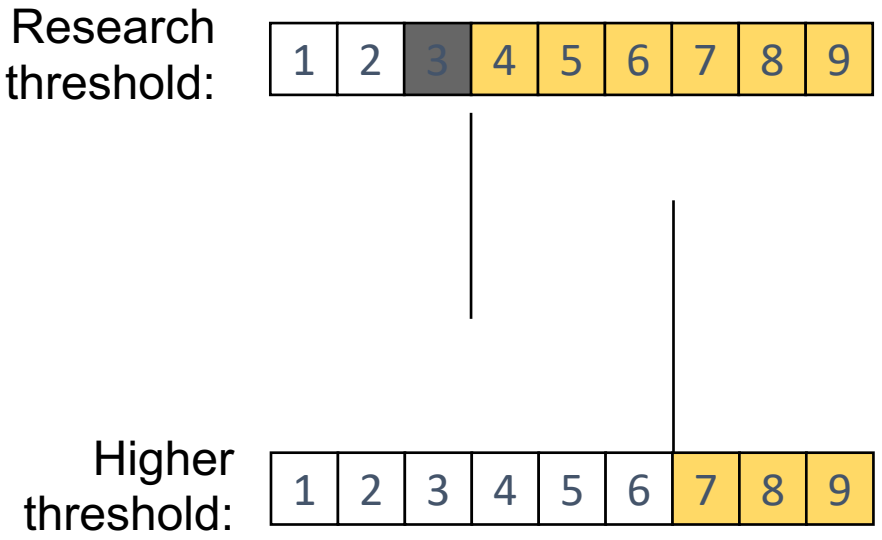
Domain 2:
Choices considered

Example question: When you were seeking to identify how best to proceed on [specify most recent decision], did you consider more than one solution? If so, which ones?

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?"



Domain 3:
Evidence regarding chances & outcome

Example questions: Where did you go to find information? ▪ Did this information present uncertainty as to the optimal approach? Who informed assessment of available options? How?

Decisions are informed by vast array of information [beyond wha we publish] and <u>specific to the decisions confronted.</u>

Global evidence

Published studies

Clearinghouses and Briefs

Government reports

Professional guidelines

Administrative data

Testimony

Personal experience of decision-maker

Local knowledge

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?

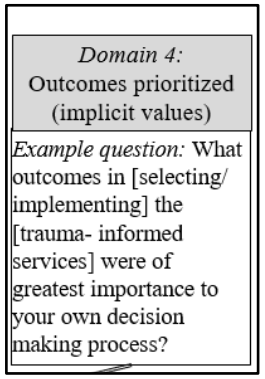
Threshold
What is the appropriate threshold for referral?
How do we turn the screener into a sustainable practice?

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?

1

Hyde et al, 2016



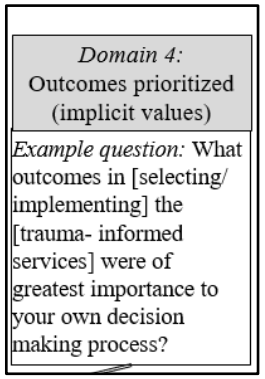
Trade-offs evaluated in light of available information and expertise: Illustrative example of values

Effectiveness

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

Local expertise

Administrative data

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

Domain 5: Trade-offs considered in final decision
Example questions: For you personally, what did you see as the benefits of the potential solution(s)? • For you personally, what did you see as the drawbacks for the potential solution(s)?

Trade-offs evaluated in light of available information and expertise: Illustrative example of effectiveness and feasibility

Effectiveness

Published studies

Expertise

Administrative data

Local expertise

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

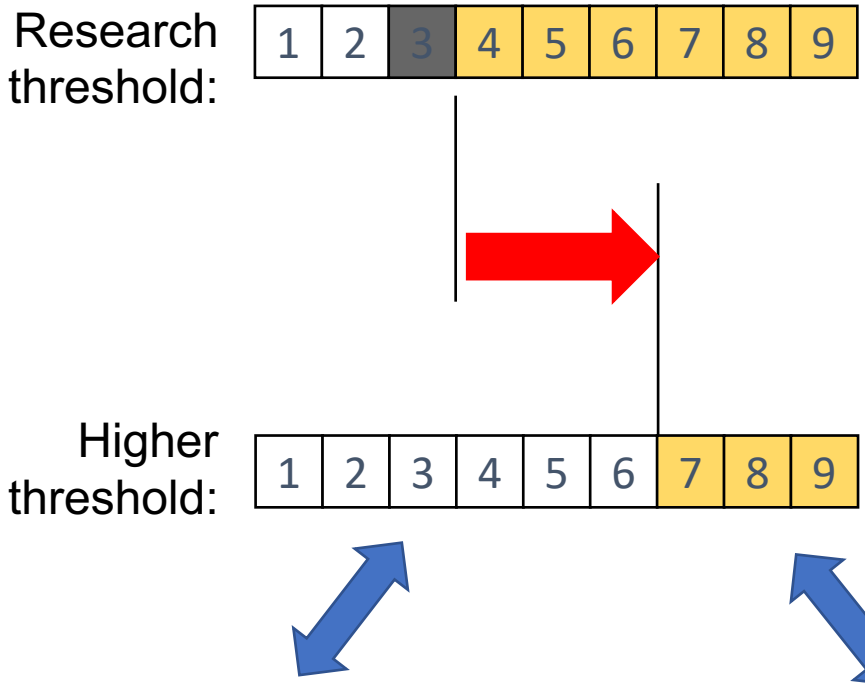
Domain 2:
Choices considered

Example question: When you were seeking to identify how best to proceed on [specify most recent decision], did you consider more than one solution? If so, which ones?

Choices

"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

Threshold: Where to set the "cut-score?"



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

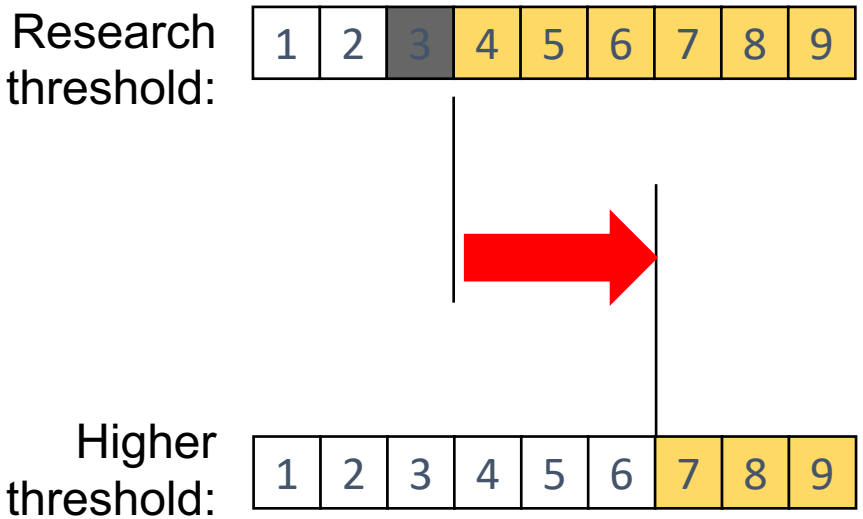
Capacity of Service Delivery to Respond to Identified Needs

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?"



Resources to Start-up and Sustain Protocol:

- Capacity to facilitate caseworker referral

Capacity of Service Delivery to Respond to Identified Needs

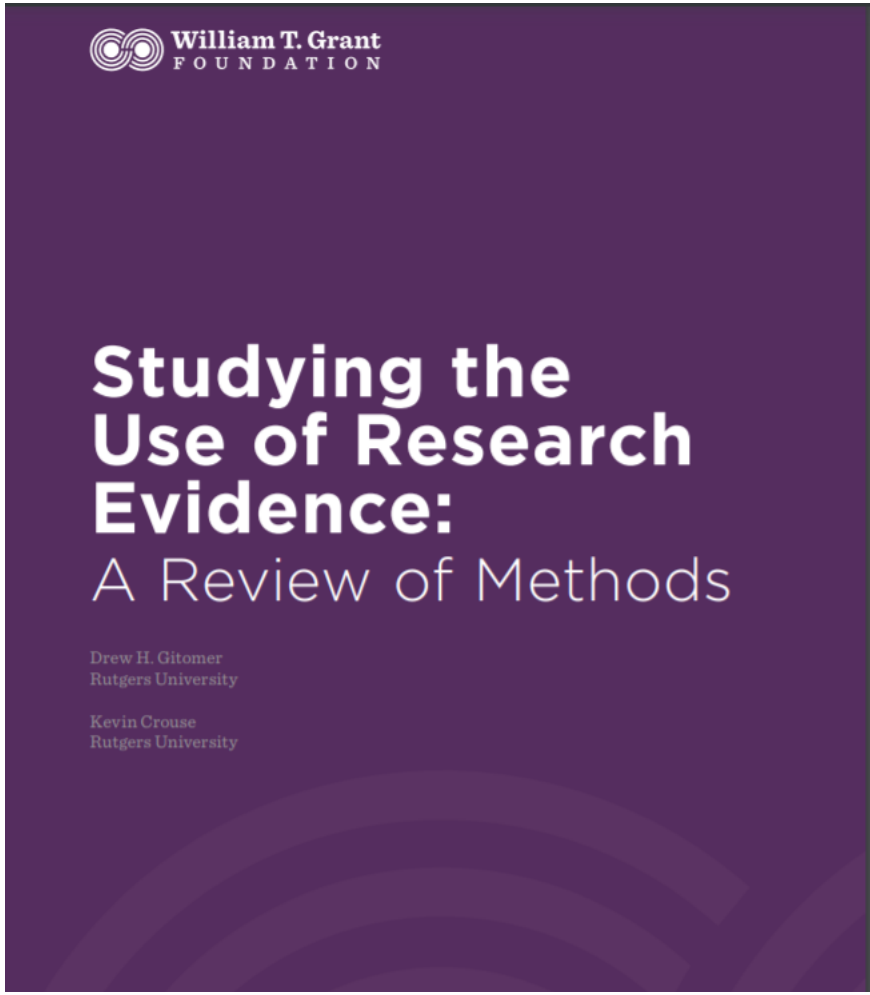
Part 1: Take-home Point (1)

- **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*

Barnett, M. L., Sheldrick, R.C., Liu, S., Kia-Keating, M., Negriff, S. L. (in press). Implications of ACEs Screening on Behavioral Health Services: A Scoping Review and Systems Modeling Analysis. *American Psychologist*

Sheldrick, R. C., Stadnick, N., Kuhn, J., Mackie, T., Augustyn, M., Broder-Fingert, S. (2019, December). Rapid Cycle Systems Modeling to Optimize Implementation: A Case Example of Family Navigation for Early Identification of Autism. Oral session presented at the *Annual Conference on the Science of Dissemination and Implementation*, Washington, DC.

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.”

Winsberg, Eric, "Computer Simulations in Science", *The Stanford Encyclopedia of Philosophy* (Winter 2019 Edition), Edward N. Zalta (ed.), URL = < https://plato.stanford.edu/archives/win2019/entries/simulations-science / >.

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

Barnett, M. L., Sheldrick, R.C., Liu, S., Kia-Keating, M., Negriff, S. L. (in press). Implications of ACEs Screening for Behavioral Health Services: A Scoping Review and Systems Modeling Analysis. *American Psychologist*

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)

<u>Provided evidence regarding</u>:

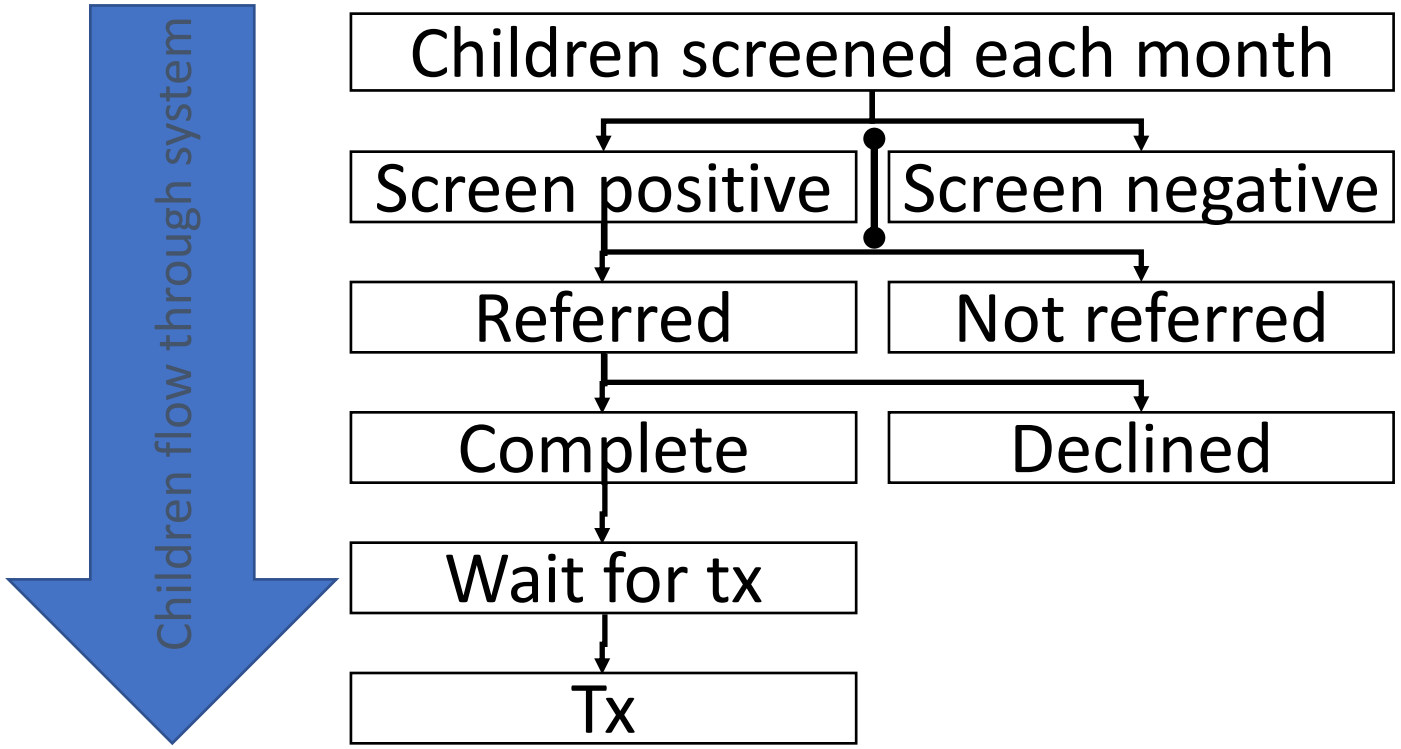
- Sample characteristics
- % positive at various thresholds (i.e., cut scores)
- Limited data regarding referrals

Results of systematic review

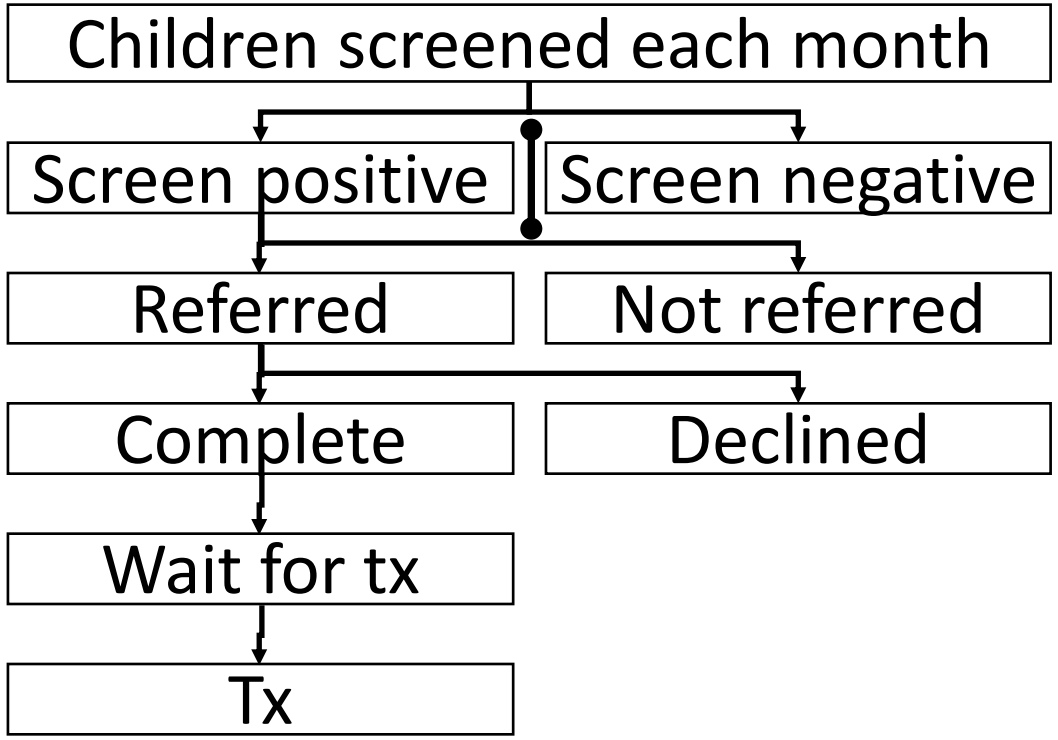
- Sample sizes ranged from 111 to 2569 patients screened
- Administration methods included self-report for adults and adolescents, caregiver report for children under age 12. Results could also be anonymous (national surveys) or “de-identified” (item responses redacted)
- Screening Completion Proportions 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?

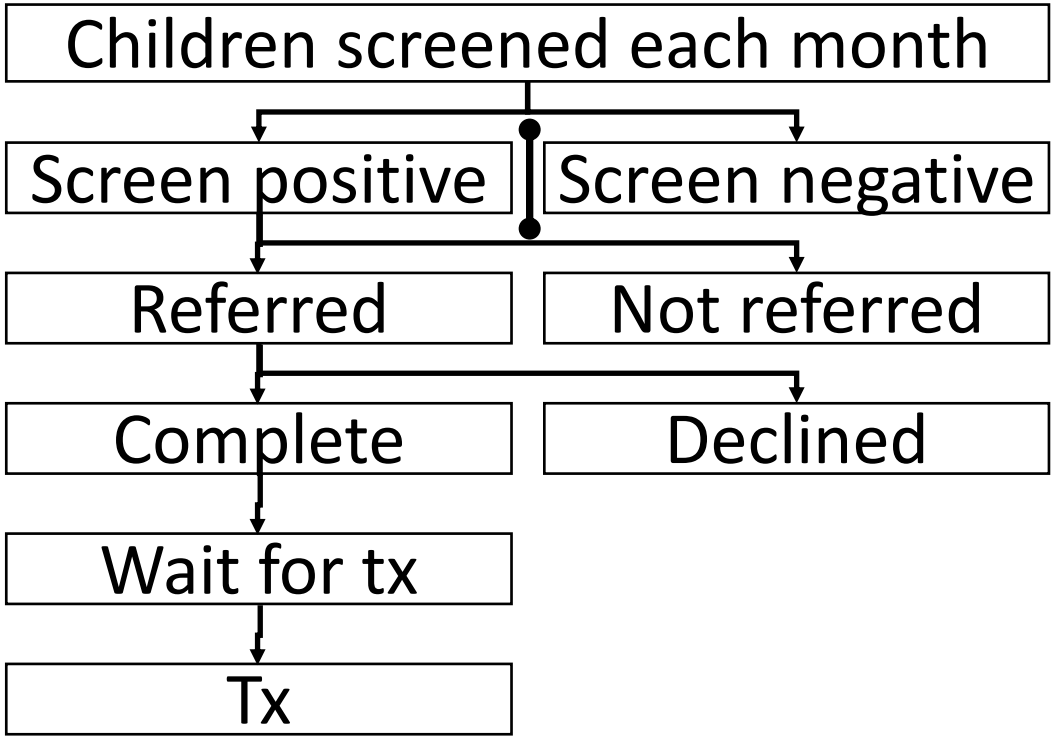
A monte carlo simulation model

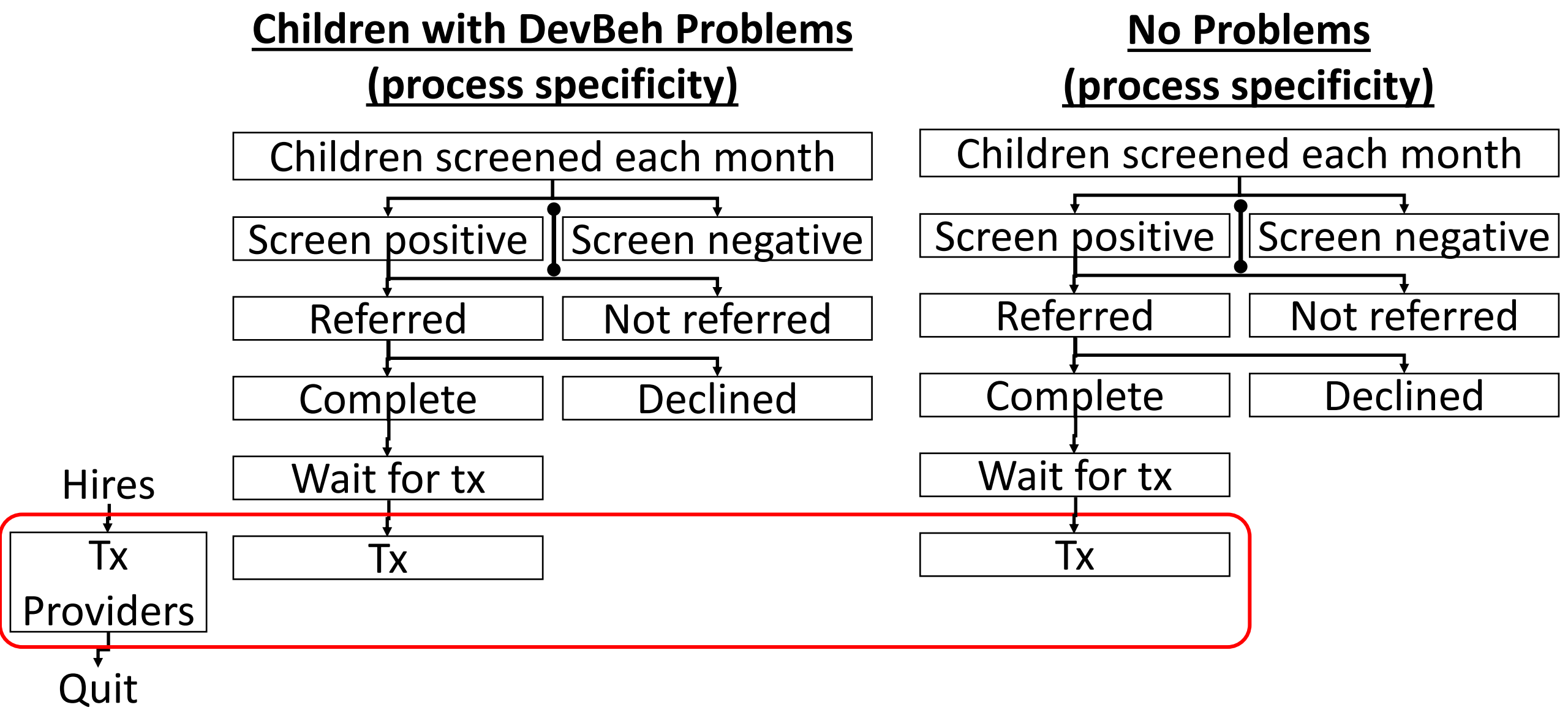

Children flow through system
Children screened each month
Screen positive
Screen negative
Referred
Not referred
Complete
Declined
Wait for tx
Tx

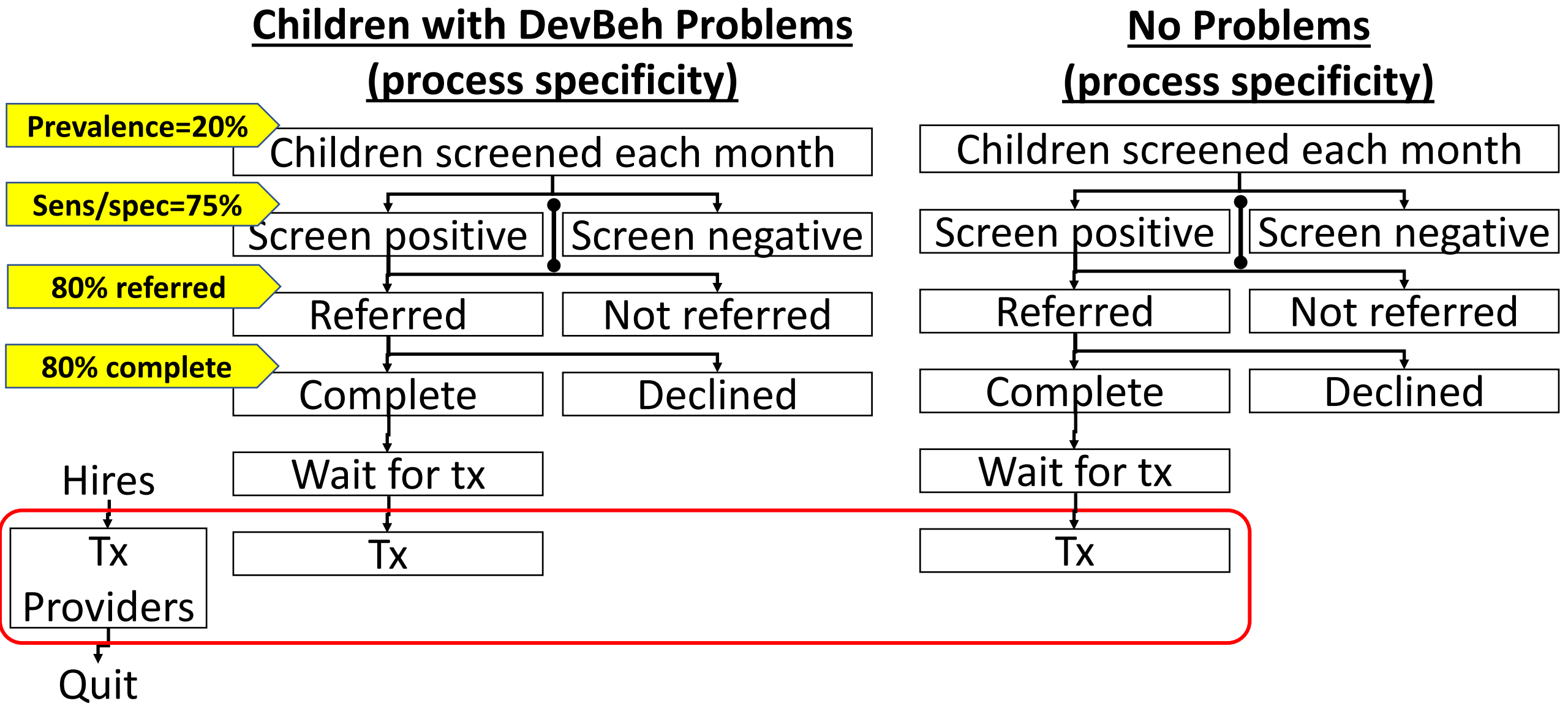
Children with DevBeh Problems (process sensitivity)

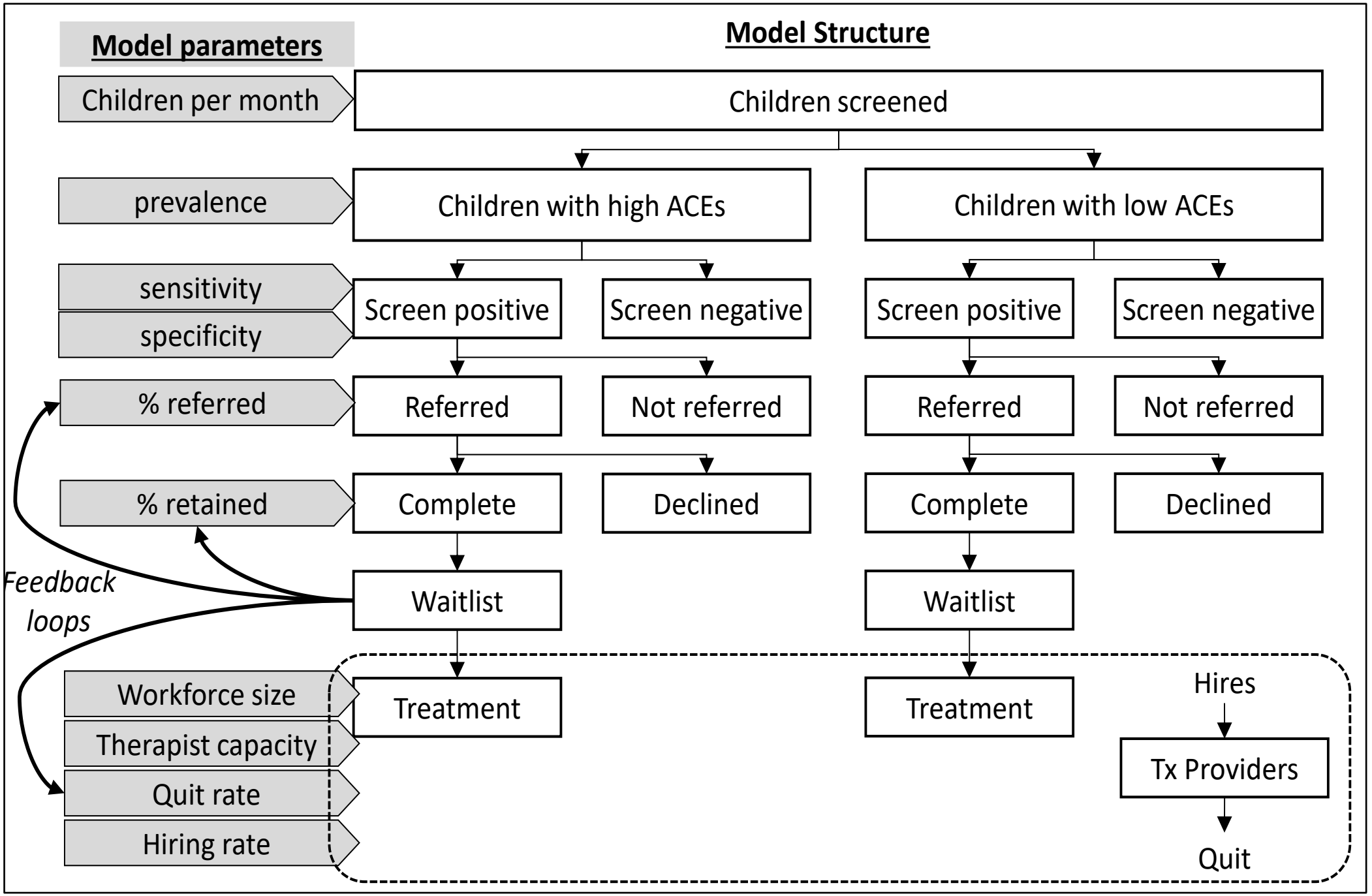


No Problems (process specificity)




Children with DevBeh Problems
(process specificity)
No Problems
(process specificity)
Children screened each month
Screen positive
Screen negative
Referred
Not referred
Complete
Declined
Wait for tx
Tx
Children screened each month
Screen positive
Screen negative
Referred
Not referred
Complete
Declined
Wait for tx
Tx
Hires
Tx Providers
Quit


Children with DevBeh Problems
(process specificity)
No Problems
(process specificity)
Prevalence=20%
Sens/spec=75%
80% referred
80% complete
Children screened each month
Screen positive
Screen negative
Referred
Not referred
Complete
Declined
Wait for tx
Tx
Children screened each month
Screen positive
Screen negative
Referred
Not referred
Complete
Declined
Wait for tx
Tx
Hires
Tx Providers
Quit

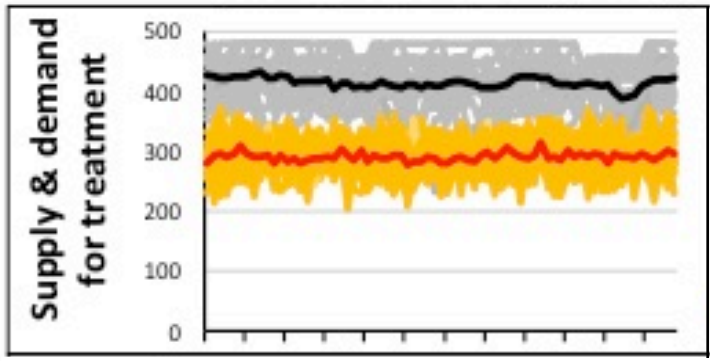

Model parameters
Model Structure
Children per month
Children screened
prevalence
Children with high ACEs
Children with low ACEs
sensitivity
specificity
Screen positive
Screen negative
Screen positive
Screen negative
% referred
Referred
Not referred
Referred
Not referred
% retained
Complete
Declined
Complete
Declined
Feedback loops
Waitlist
Waitlist
Workforce size
Therapist capacity
Quit rate
Hiring rate
Treatment
Treatment
Hires
Tx Providers
Quit

Testing 1st of 3 sets of assumptions

	Baseline Scenario behavioral screening	
% screened	85.0%	
sensitivity	80.0%	presumption of high accuracy
specificity	90.0%	
% positive	13.0%	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	

Scenario A: Baseline

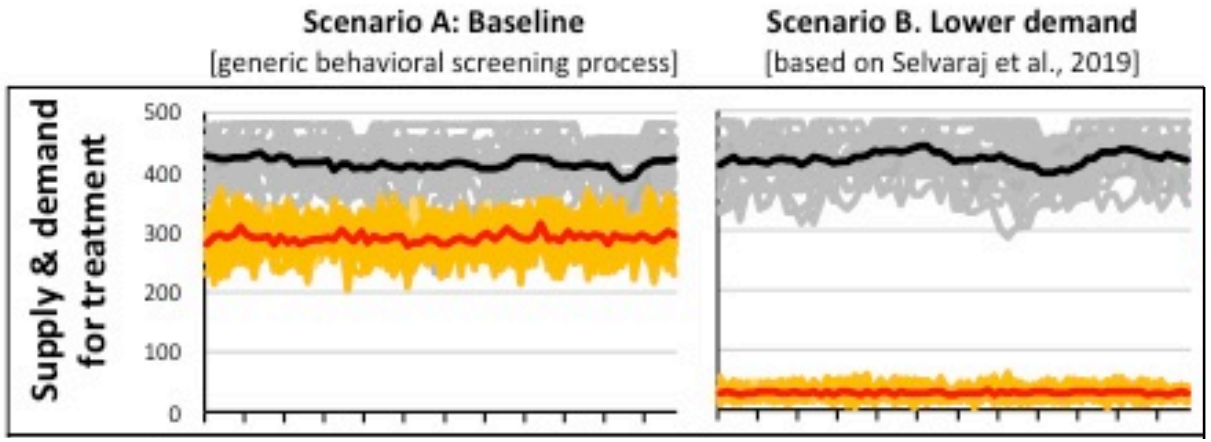
[generic behavioral screening process]



Testing 2nd of 3 sets of assumptions

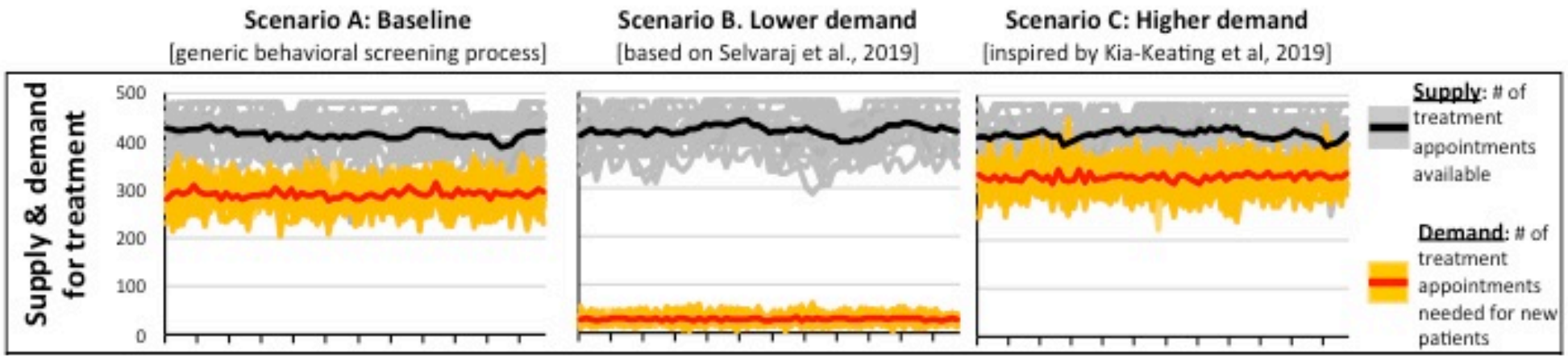
	Baseline Scenario behavioral screening	Scenario #2 lower demand
% screened	85.0%	56.0%
sensitivity	80.0%	30.0%
specificity	90.0%	99.9%
% positive	13.0%	0.2%
implied prevalence	4.0%	4.0%
% of positives referred	80.0%	80.0%
% of negatives referred	5.0%	2.0%
% to complete referrals	77.5%	77.5%
workforce parameters	calibrated to yield persistent waitlists for treatment services averaging 1-2 months	same

Selvaraj et al., 2019


Scenario A: Baseline
[generic behavioral screening process]
Scenario B. Lower demand
[based on Selvaraj et al., 2019]
Supply & demand for treatment
500
400
300
200
100
0

Testing 3rd of 3 sets of assumptions

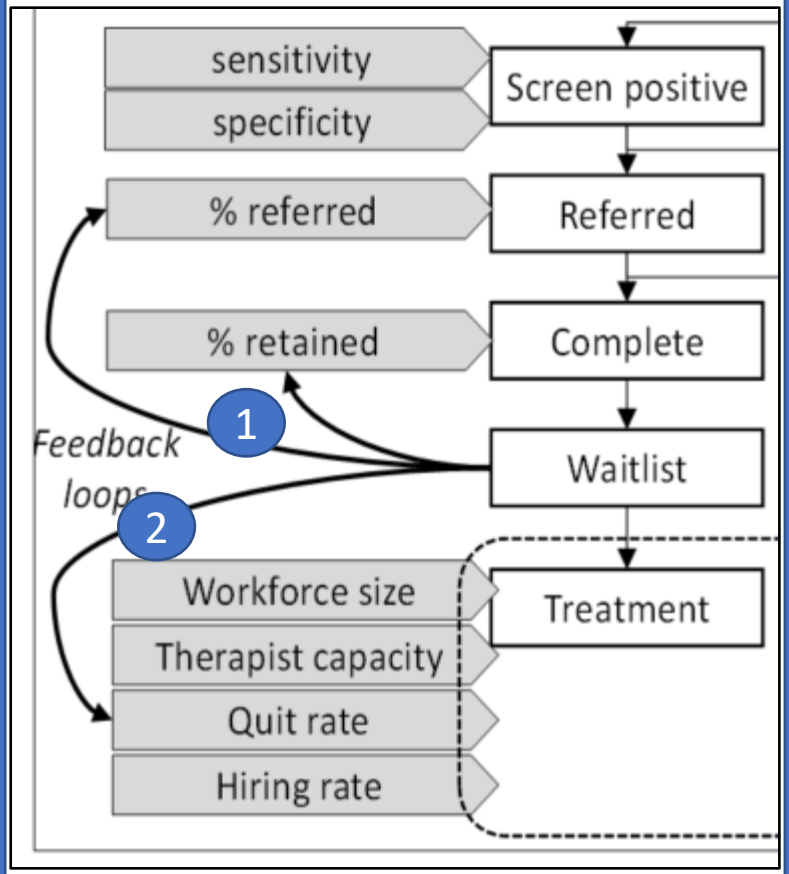
	Baseline Scenario behavioral screening	Scenario #2 lower demand	Scenario #3 higher demand	
% screened	85.0%	56.0%	73.0%	
sensitivity	80.0%	30.0%	30.0%	
specificity	90.0%	99.9%	99.9%	modified from
% positive	13.0%	0.2%	19.3%	Kia-Keating et al., 2019
implied prevalence	4.0%	4.0%	4.0%	
% of positives referred	80.0%	80.0%	80.0%	
% of negatives referred	5.0%	2.0%	2.0%	
% to complete referrals	77.5%	77.5%	77.5%	
workforce parameters	calibrated to yield persistent waitlists for treatment services averaging 1-2 months	same	same	


Scenario A: Baseline
[generic behavioral screening process]
Scenario B. Lower demand
[based on Selvaraj et al., 2019]
Scenario C: Higher demand
[inspired by Kia-Keating et al, 2019]
Supply & demand for treatment
500
400
300
200
100
0
Supply: # of treatment appointments available
Demand: # of treatment appointments needed for new patients

Sensitivity analyses: feedback loops

Analysis #1: effect of long waitlists on referrals

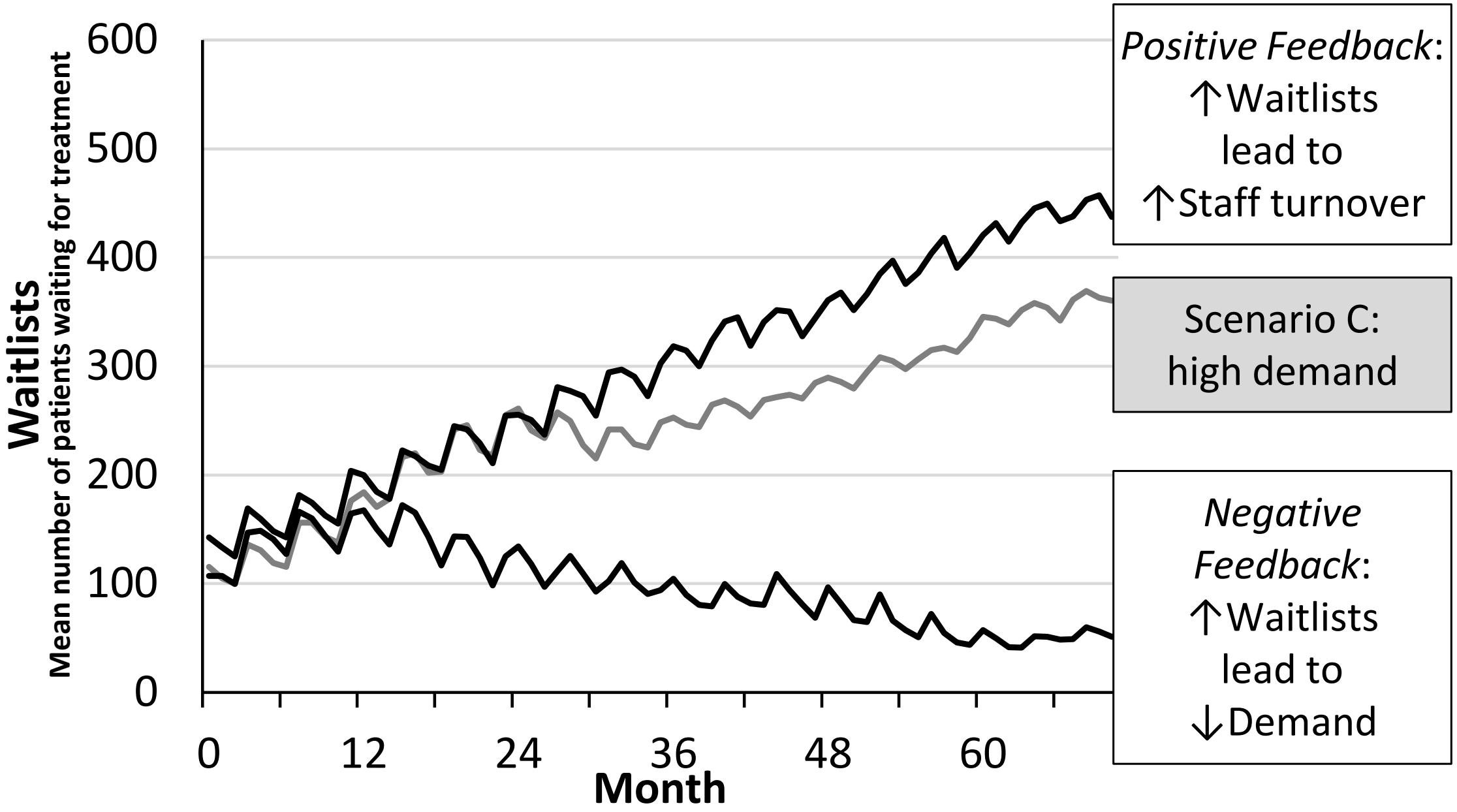
when average waitlists are above a threshold of 150 days (over twice as high as the average at baseline) for at least 6 months, the probability of referral and the probability of referral completion each decline by 0.1% per month until waitlists fall below the threshold.



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



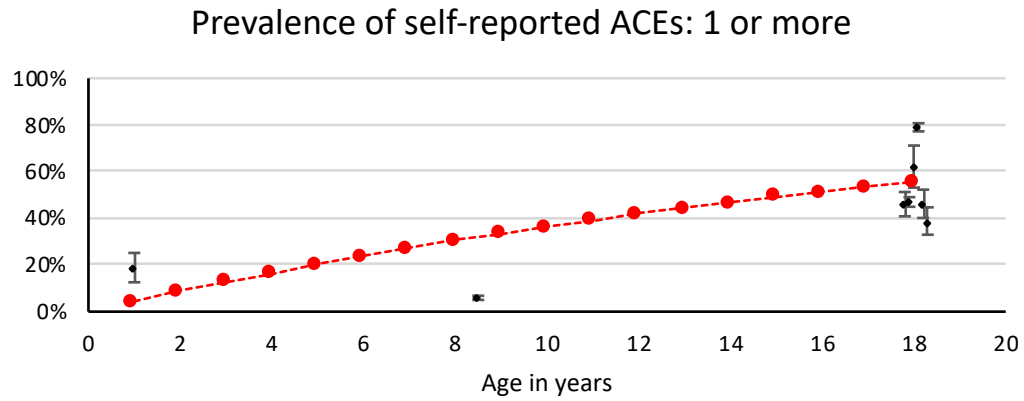
Implications of findings

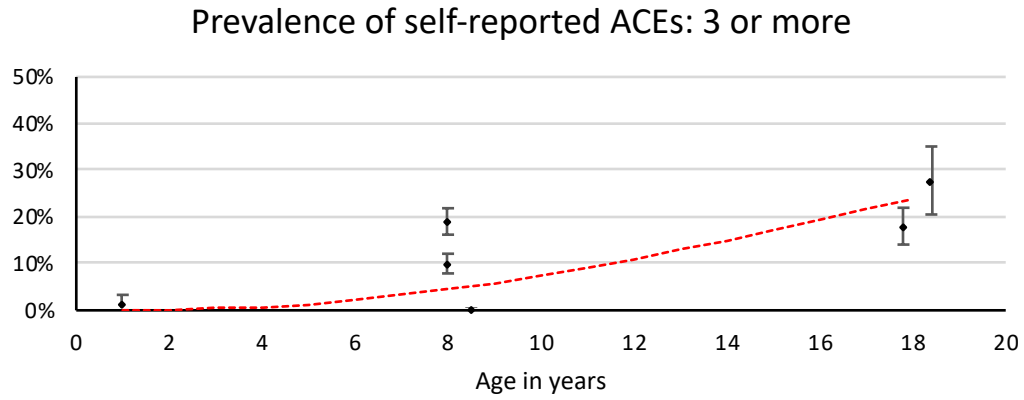
- Wide range of parameter estimates from published literature suggest a wide range of possible scenarios
- Plausible feedback loops add to uncertainty in implementation

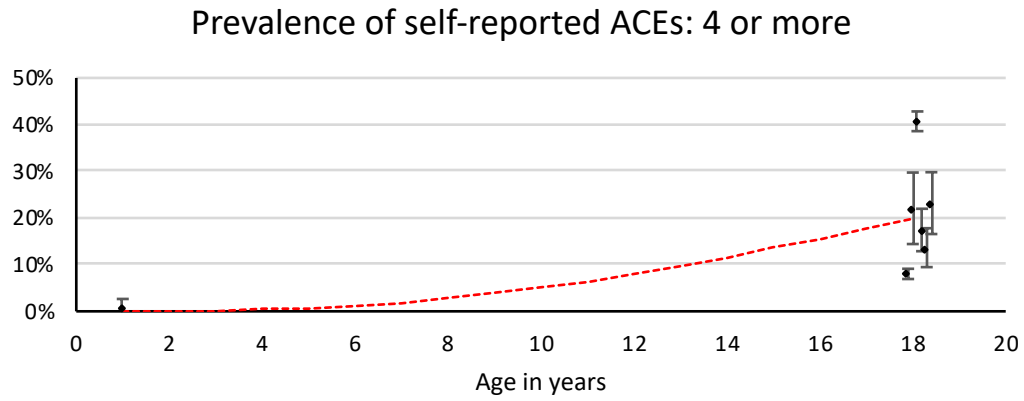
Yet RCSM also deepened our understanding of the data in ways that are important for:

1. implementation
2. future research

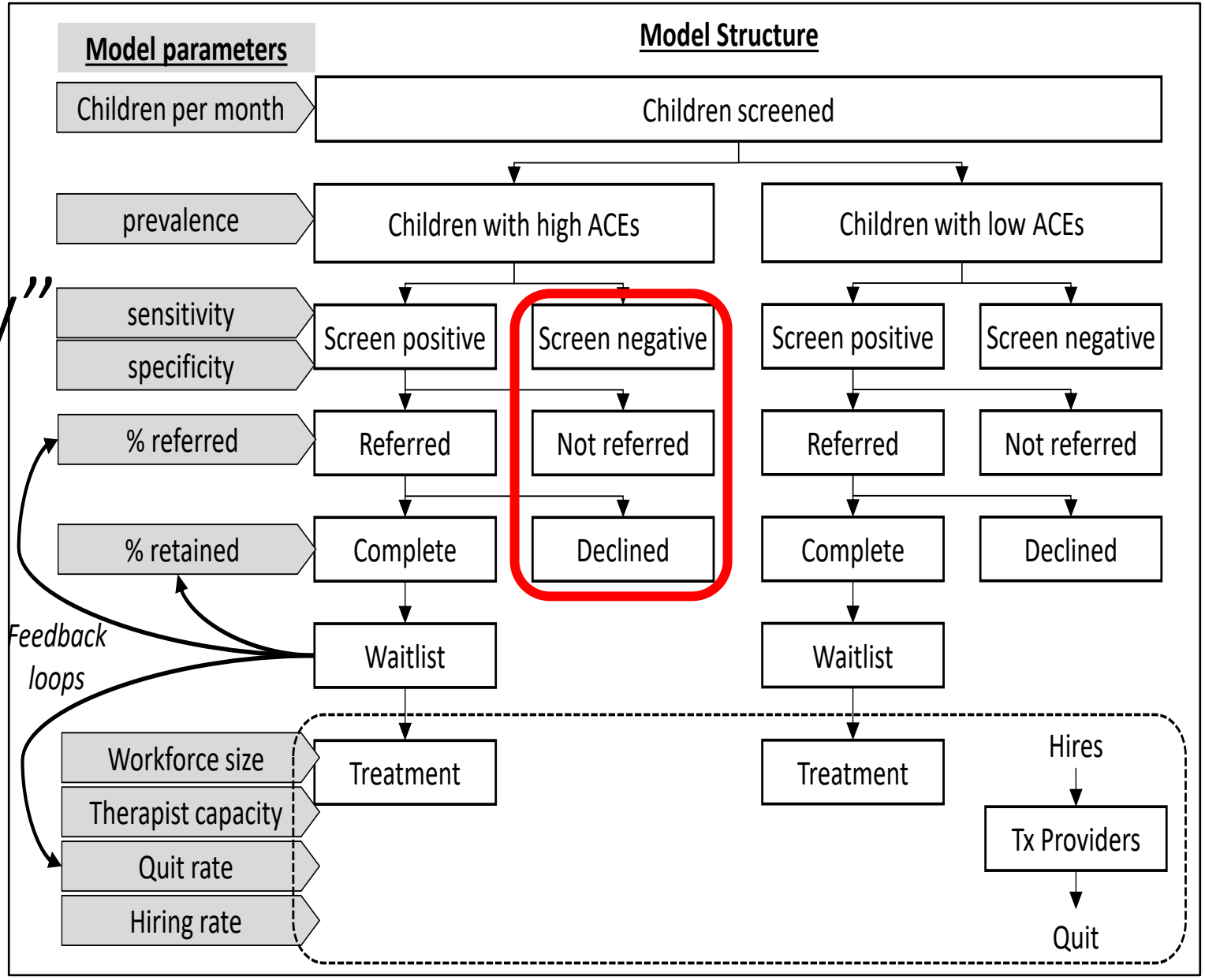
1. Regarding the % who screen positive, **child age** is likely to matter (a lot)







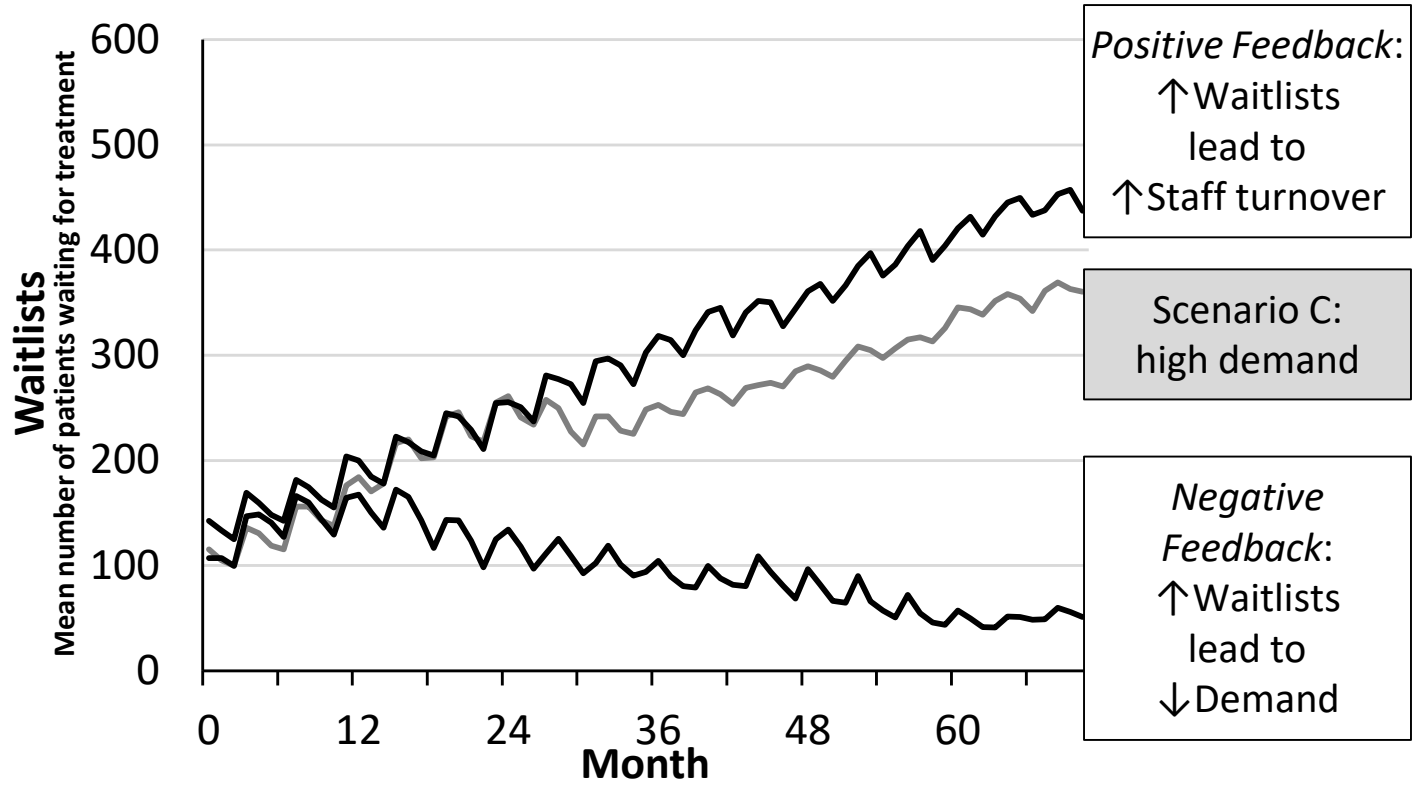
2. “process sensitivity” is likely <<< screener sensitivity



3. Impact on MH workforce is plausible given data

Is this sufficient evidence to recommend ongoing monitoring?

Figure. Potential influence of feedback loops on waitlists



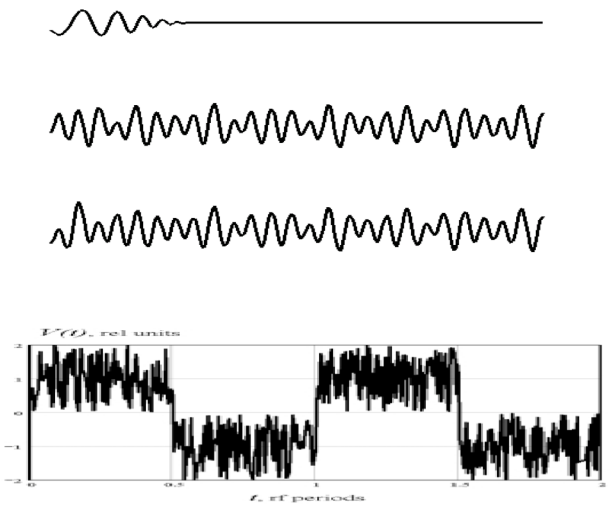
4. Feedback loops could have a profound effect on implementation

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*

Sheldrick, R.C., Schaefer, A., Cruden, G., Leslie, L.K., Hyde, J., & T.I. Mackie (in preparation). Rapid Cycle Systems Modeling to improve evidence use in system-wide interventions.

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

- Rouwette, E. A., Korzilius, H., Vennix, J. A., & Jacobs, E. (2011). Modeling as persuasion: the impact of group model building on attitudes and behavior. *System Dynamics Review*, *27*(1), 1-21.
- Atkinson, J. A., O'Donnell, E., Wiggers, J., McDonnell, G., Mitchell, J., Freebairn, L., ... & Rychetnik, L. (2017). Dynamic simulation modelling of policy responses to reduce alcohol-related harms: rationale and procedure for a participatory approach. *Public Health Research and Practice*, *27*(1).
- Loyo, H. K., Batcher, C., Wile, K., Huang, P., Orenstein, D., & Milstein, B. (2013). From model to action: using a system dynamics model of chronic disease risks to align community action. *Health promotion practice*, *14*(1), 53-61.

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.

Evidence & Policy • vol xx • no xx • 1–13 • © Policy Press 2019
Print ISSN 1744-2648 • Online ISSN 17442656 • https://doi.org/10.1332/174426419X15677739896923
Accepted for publication 06 September 2019 • First published online 26 September 2019

debate

The debate over rational decision making in evidence-based medicine: Implications for evidence-informed policy

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Many of the resources developed to promote the use of evidence in policy aspire to an ideal of rational decision making, yet their basis in the decision sciences is often unclear. Tracing the historical development of evidence-informed policy to its roots in *evidence-based medicine* (EBM), we distinguish

Philosophical foundations

Deductive logic	Abductive logic	Inductive logic
Reasoning from general principles to particular conclusions *e.g., modus ponens* If argument is valid, then conclusion can be proven to certain or impossible	*Reasoning to the best explanation* *e.g., critical dialog* If argument is accepted as valid, then conclusion can be shown to plausible or implausible	*Reasoning from particular observations to general principles* e.g., inferential statistics If analysis is valid, then conclusions can be shown to be probable or improbable

- Douven, Igor, "Abduction", *The Stanford Encyclopedia of Philosophy* (Summer 2017 Edition), Edward N. Zalta (ed.), URL = <https://plato.stanford.edu/archives/sum2017/entries/abduction/>.
- Walton, D. *Informal logic: A pragmatic approach*. Cambridge University Press, 2008.
- Walton, D. (2014). *Abductive reasoning*. University of Alabama Press.

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

Walton, D. N. (2007). *Dialog theory for critical argumentation*. John Benjamins Pub.

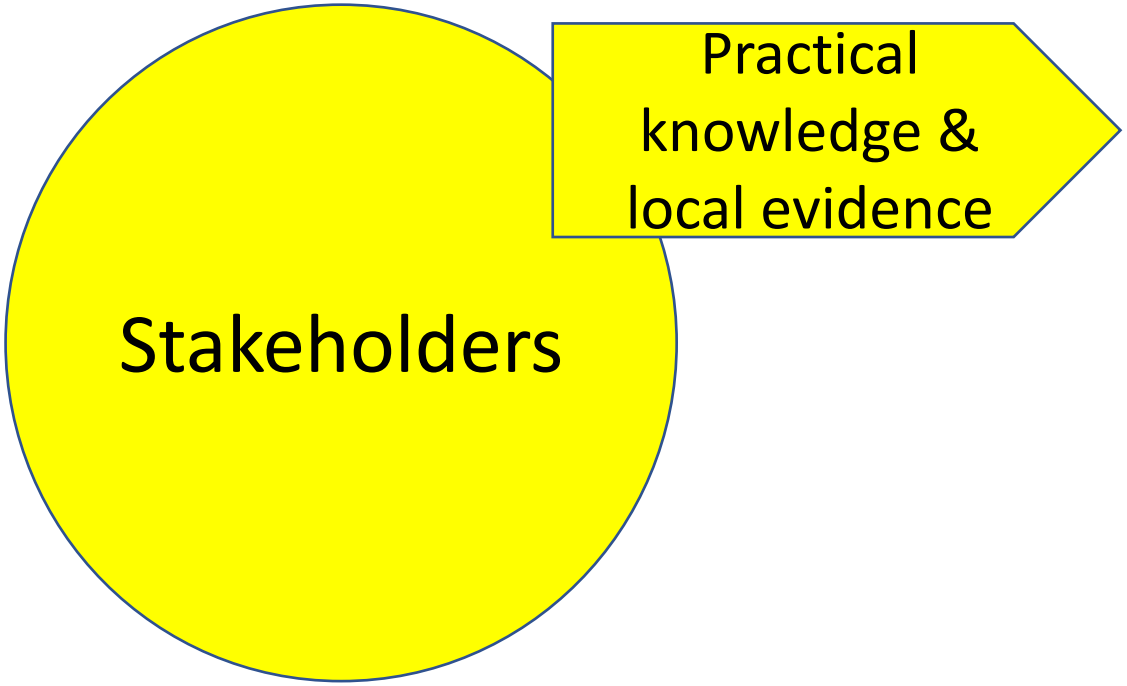
Cultural exchange theory

Posits that:

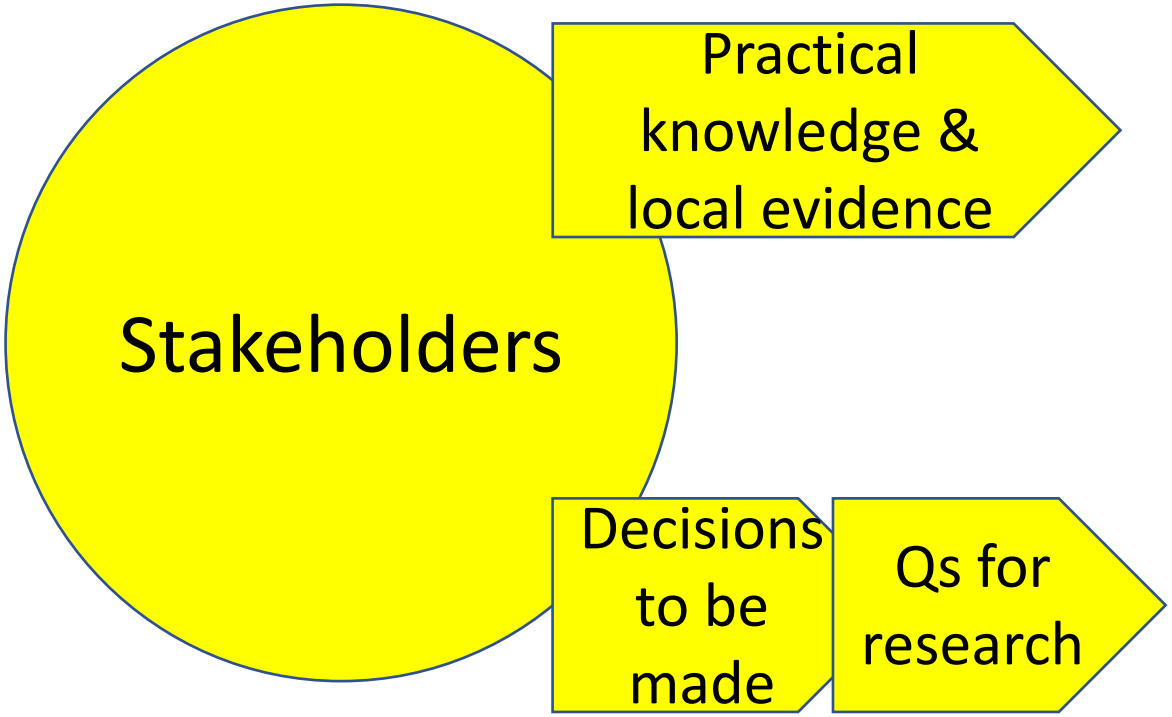
- Critical dialog, deliberation, and 2-way exchanges of information and values facilitate implementation

- Palinkas, L. A., Aarons, G. A., Chorpita, B. F., Hoagwood, K., Landsverk, J., & Weisz, J. R. (2009). Cultural exchange and the implementation of evidence-based practices: Two case studies. *Research on social work practice*, *19*(5), 602-612.
- Palinkas, L. A. (2010). Commentary: Cultural adaptation, collaboration, and exchange. *Research on Social Work Practice*, *20*(5), 544-546.

Conceptual Model



Conceptual Model



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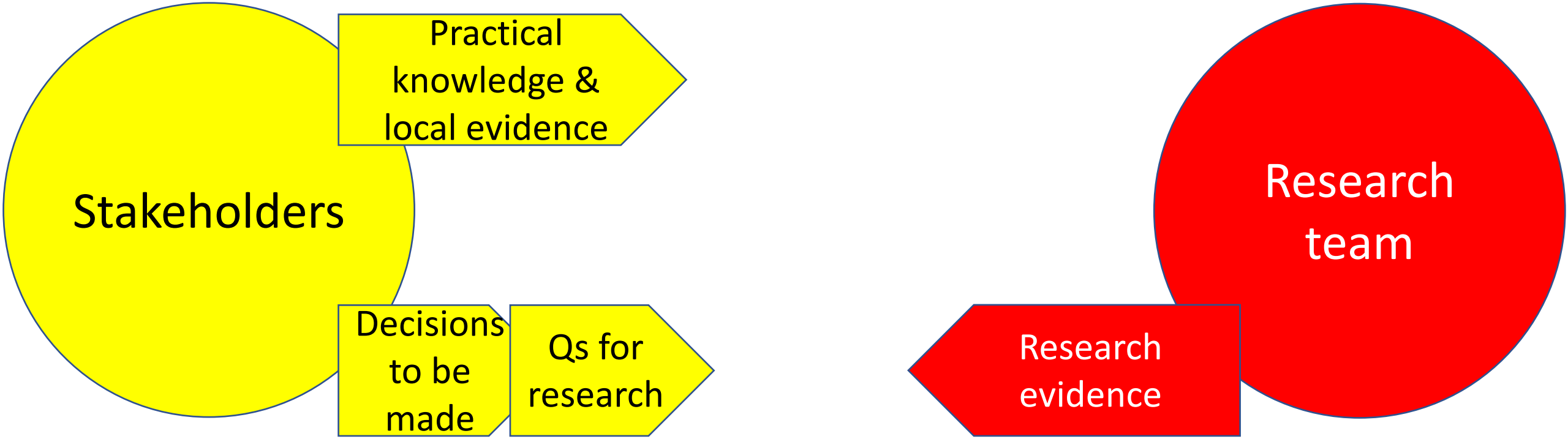

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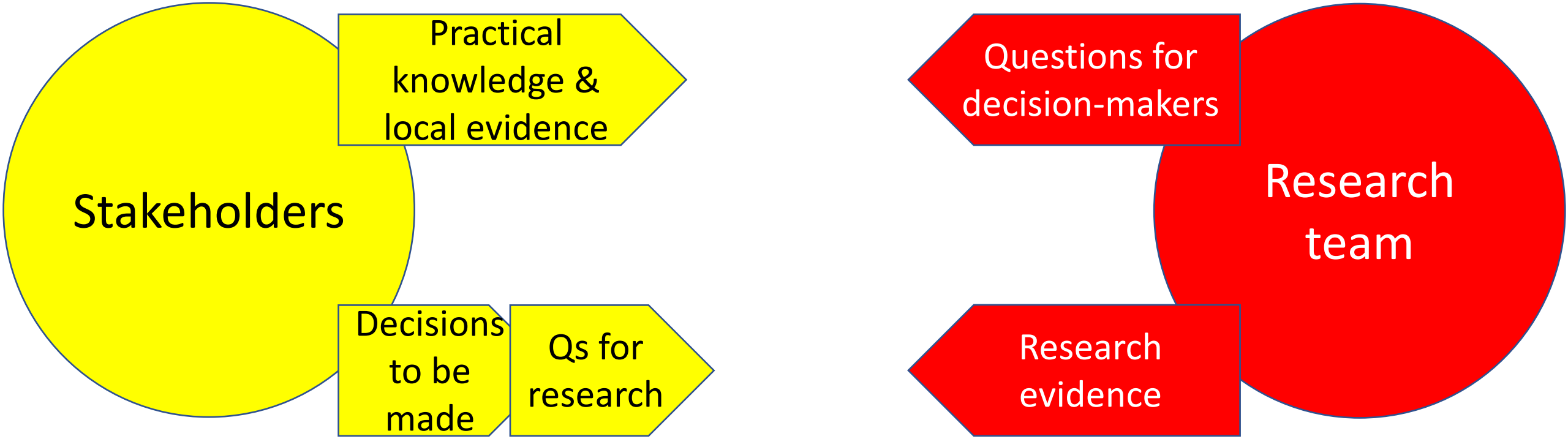

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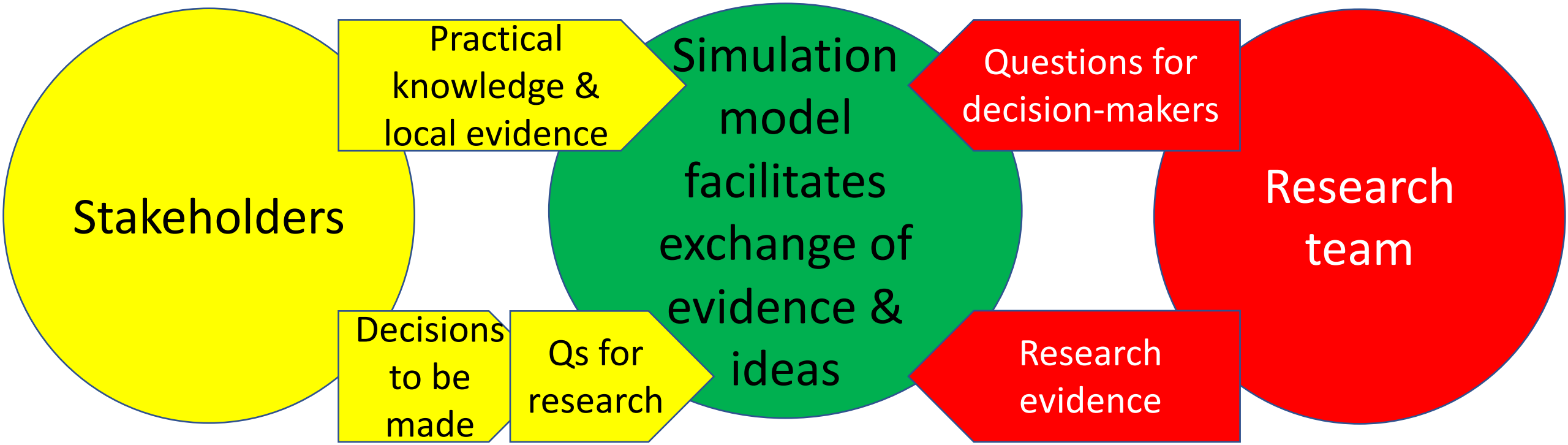

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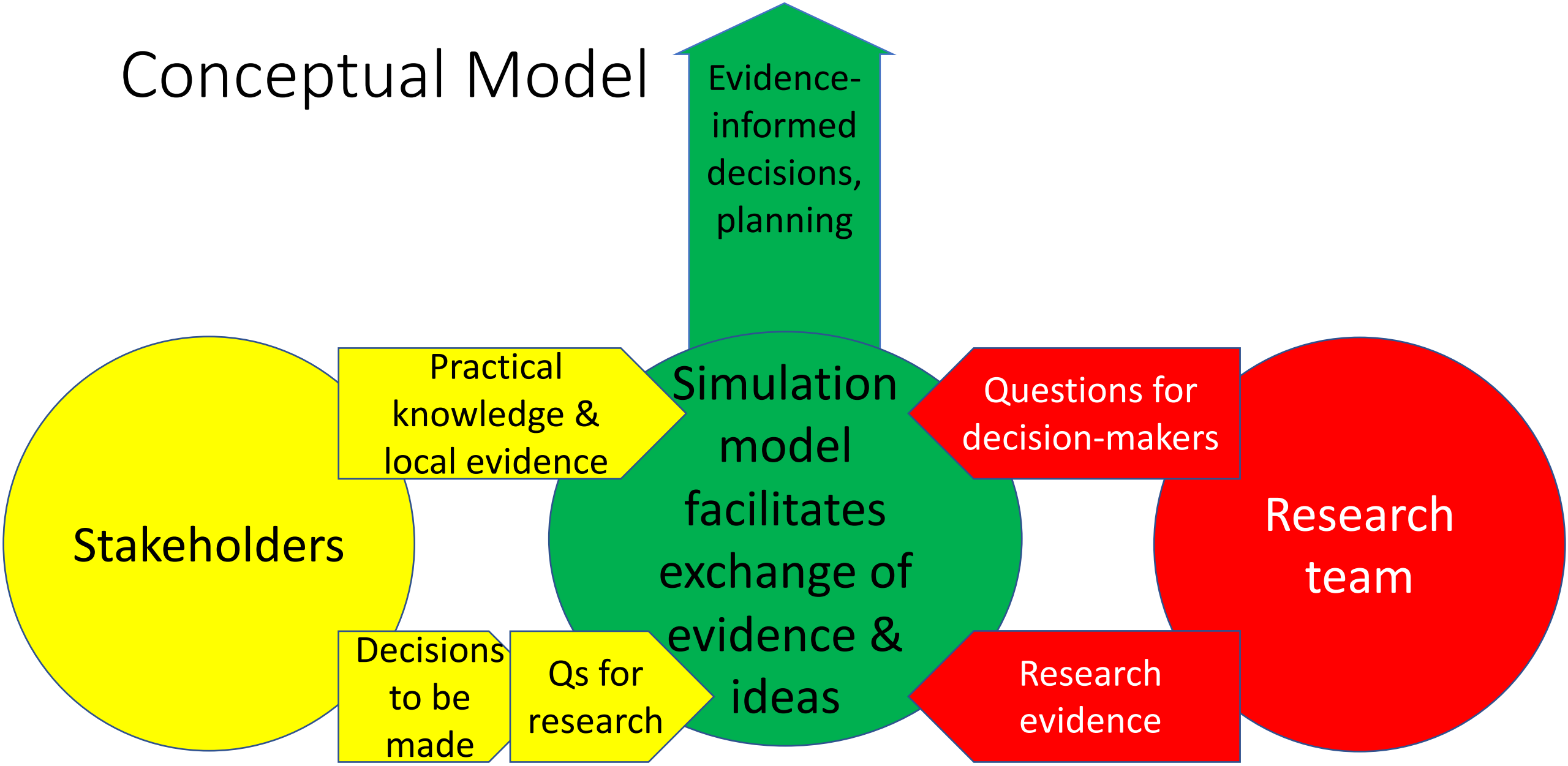

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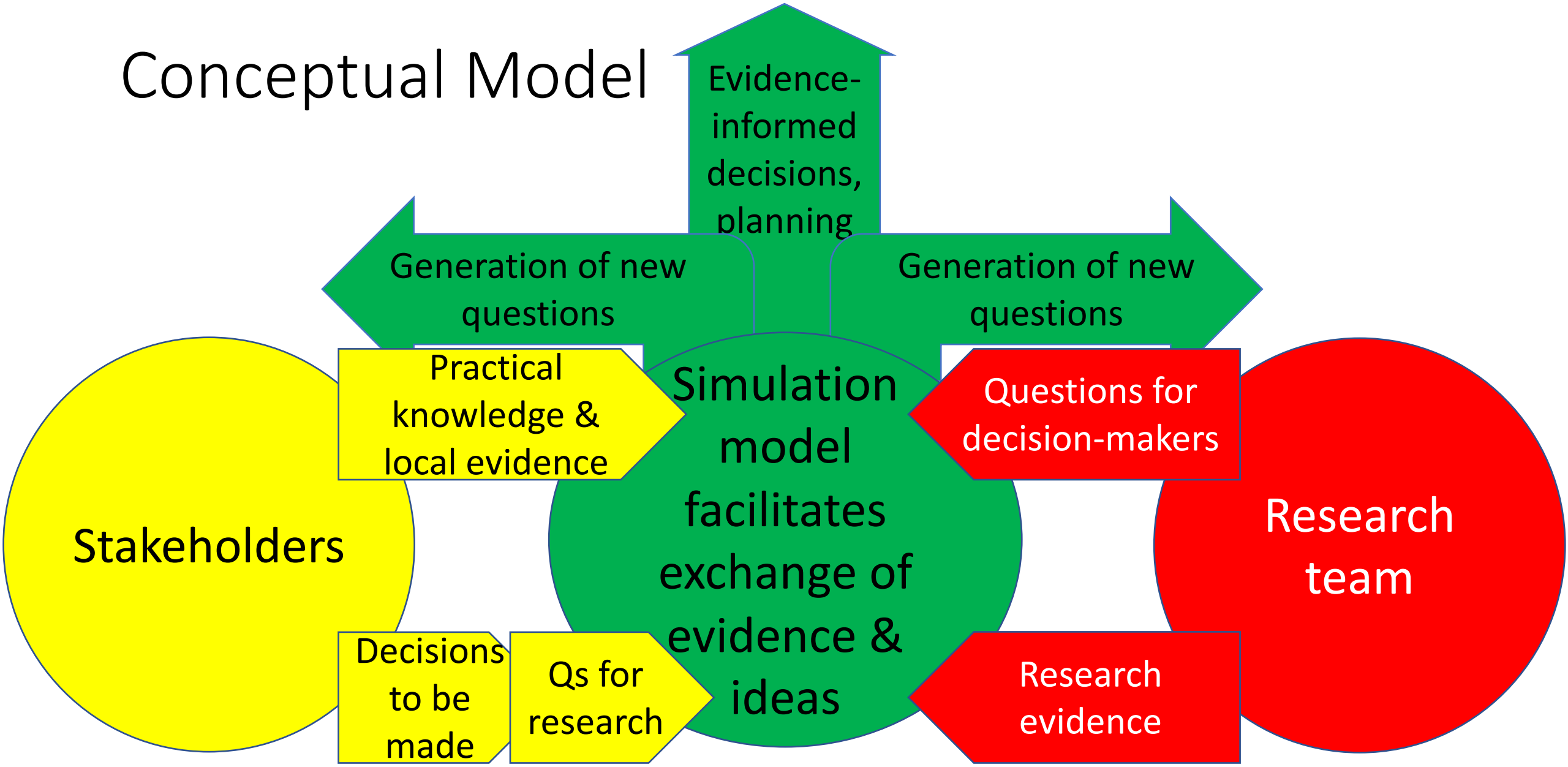
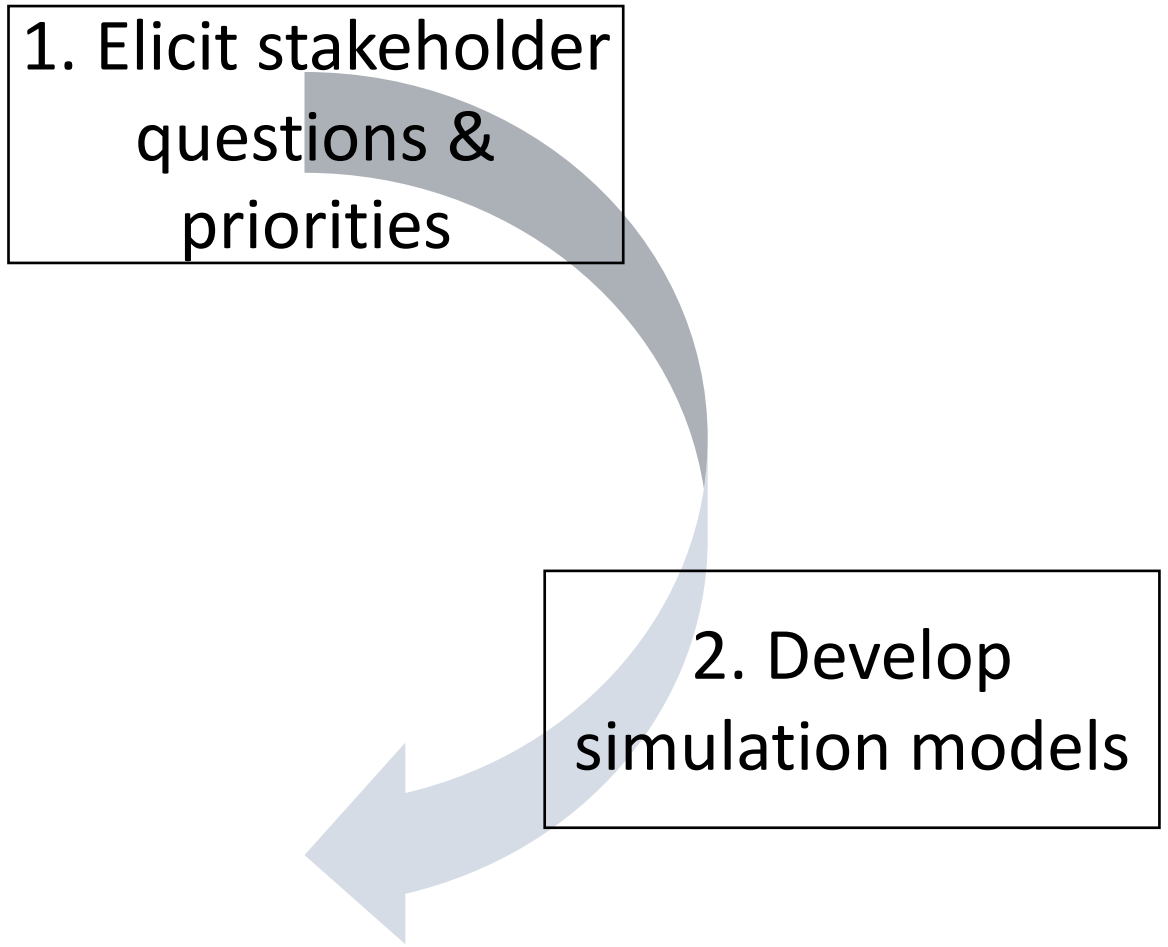


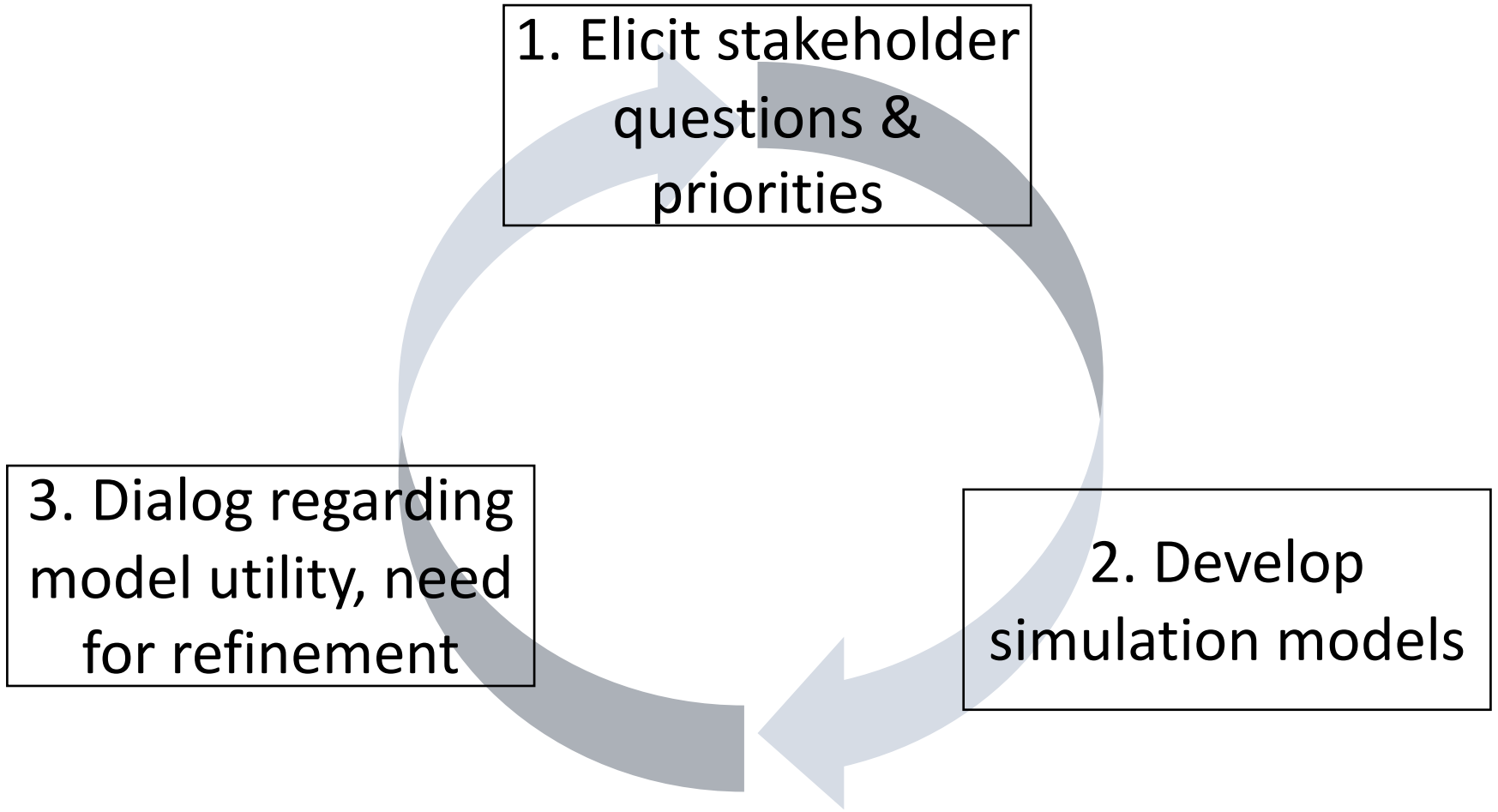
Rapid Cycle Systems modeling

1. Elicit stakeholder questions & priorities

Rapid Cycle Systems modeling



Rapid Cycle Systems modeling



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

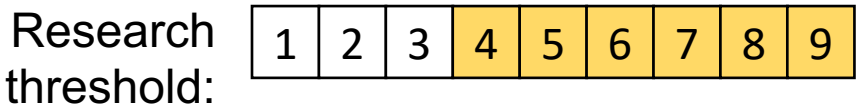
1	2	3	4	5	6	7	8	9

Sheldrick, R. Christopher, and Daryl Garfinkel. "Is a positive developmental-behavioral screening score sufficient to justify referral? A review of evidence and theory." *Academic pediatrics* 17.5 (2017): 464-470.

Sheldrick, R. C., Benneyan, J. C., Kiss, I. G., Briggs-Gowan, M. J., Copeland, W., & Carter, A. S. (2015). Thresholds and accuracy in screening tools for early detection of psychopathology. *Journal of Child Psychology and Psychiatry*, *56*(9), 936-948.

Sheldrick, R. C., Breuer, D. J., Hassan, R., Chan, K., Polk, D. E., & Benneyan, J. (2016). A system dynamics model of clinical decision thresholds for the detection of developmental-behavioral disorders. *Implementation Science*, *11*(1), 156.

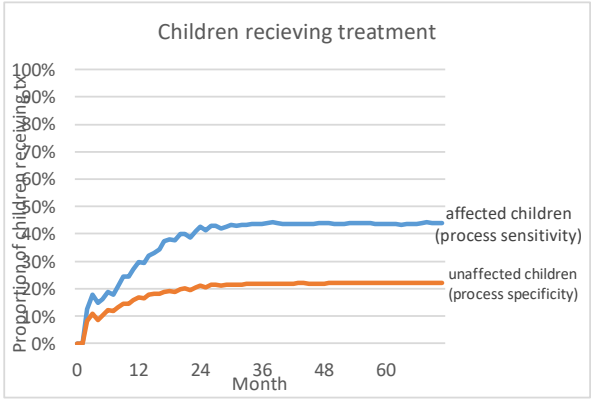
Thresholds: tradeoffs in screening thresholds



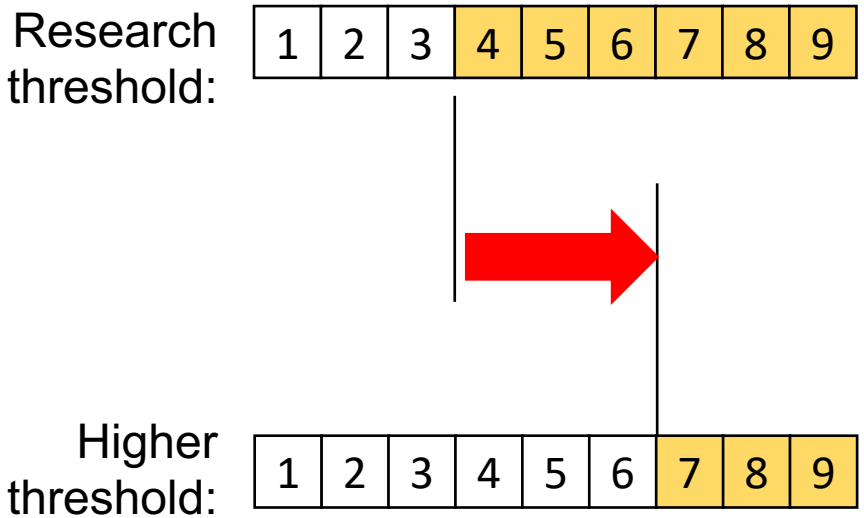
Thresholds: tradeoffs in screening thresholds

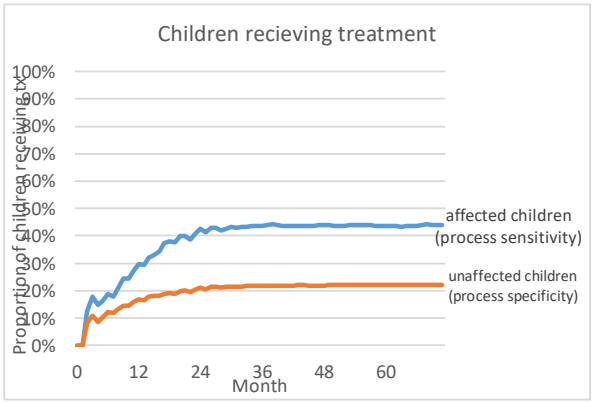
Research threshold:

1	2	3	4	5	6	7	8	9

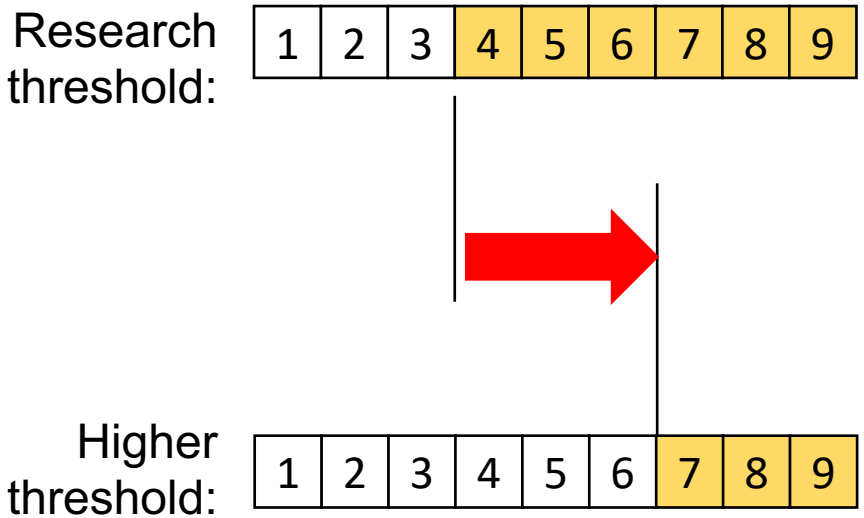


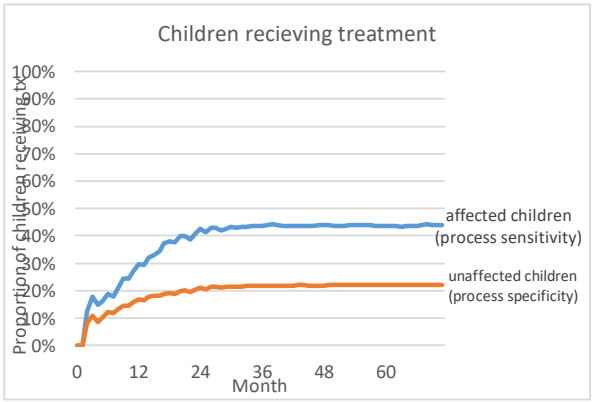
Thresholds: tradeoffs in screening thresholds

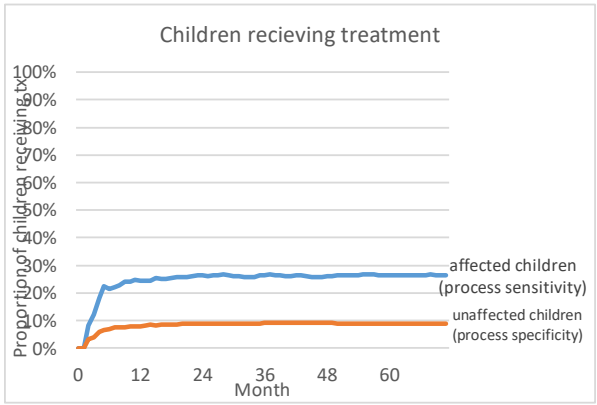




Thresholds: tradeoffs in screening thresholds

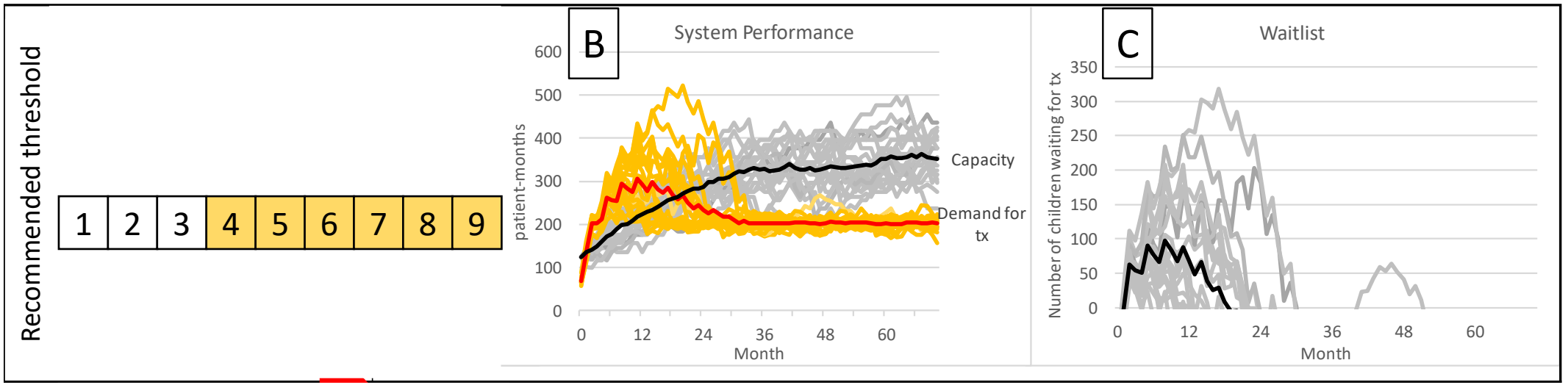






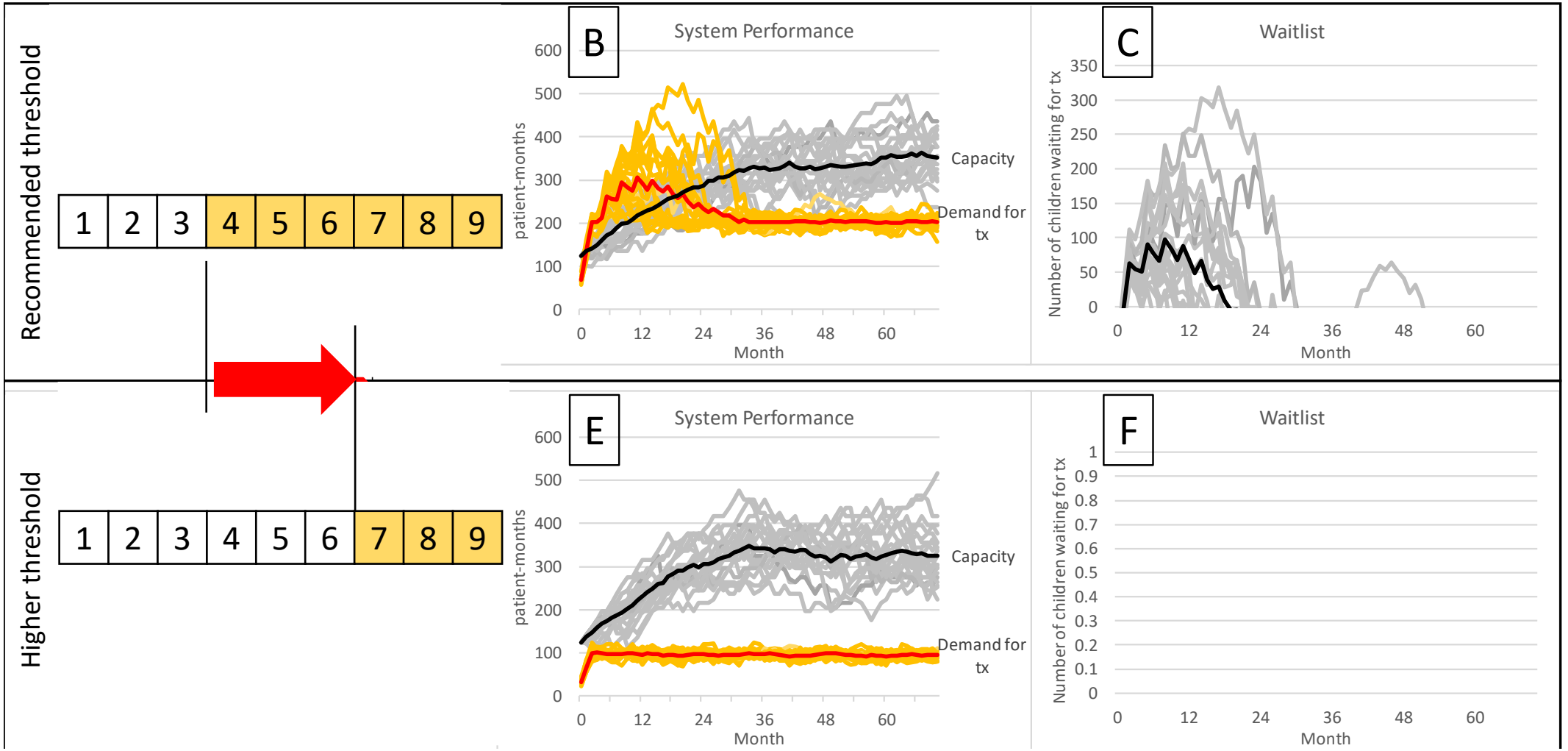
Thresholds: tradeoffs in screening thresholds

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



Thresholds: tradeoffs in screening thresholds

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

Mackie, T.I., Schaefer, A.C., Hyde, J., Leslie, L.K., Bosk, E., & Sheldrick, R.C. (revise & resubmit). Decision sampling: A qualitative approach to improve evidence use in health policies and system-wide innovation.

Part 2: Simulation modeling as an analytic tool

Barnett, M. L., Sheldrick, R.C., Liu, S., Kia-Keating, M., Negriff, S. L. (in press). Implications of ACEs Screening on Behavioral Health Services: A Scoping Review and Systems Modeling Analysis. *American Psychologist*

Part 3: Simulation modeling as an implementation strategy

Sheldrick, R.C., Schaefer, A., Cruden, G., Leslie, L.K., Hyde, J., & T.I. Mackie (in preparation). Rapid Cycle Systems Modeling to improve evidence use in system-wide interventions.

Thank you for joining in these challenging times!

Thank you!

THE STATE UNIVERSITY OF NEW JERSEY RUTGERS

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CHOIR
Center for Healthcare Organization and Implementation Research

Thanks for support from:

William T. Grant FOUNDATION

IRI Implementation Research Institute

Questions?

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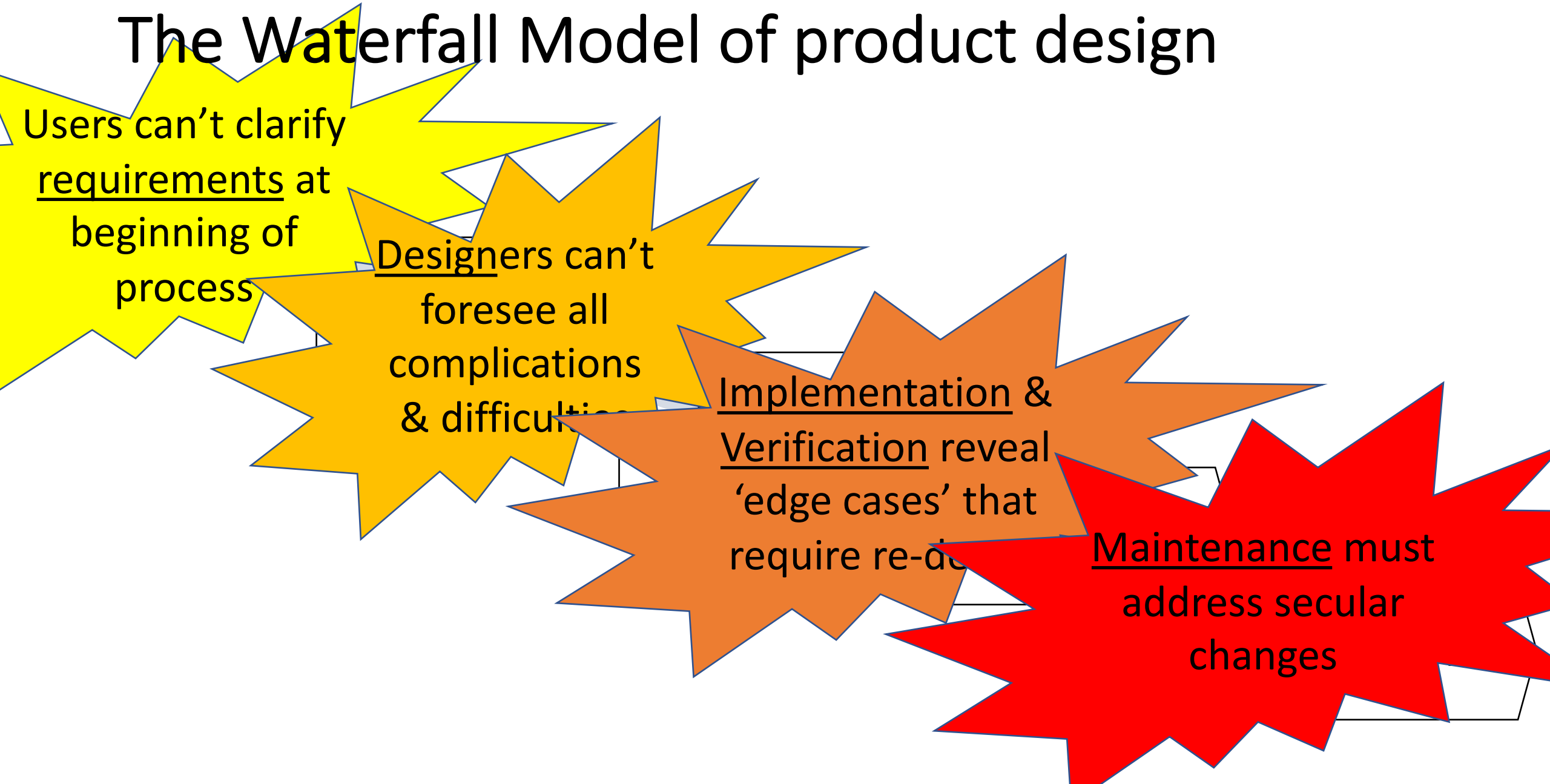
The Waterfall Model of product design



Iterative & incremental design