Making Complexity Pragmatic Again:
Practical Steps to Systems Mapping
and Modeling

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Objectives

- Share my "top 10 tips" for making complexity pragmatic

- Expose and encourage openness to diverse systems mapping and modeling methods

- Introduce a broad set of systems mapping and modeling applications (pointing to references if you want to read more)
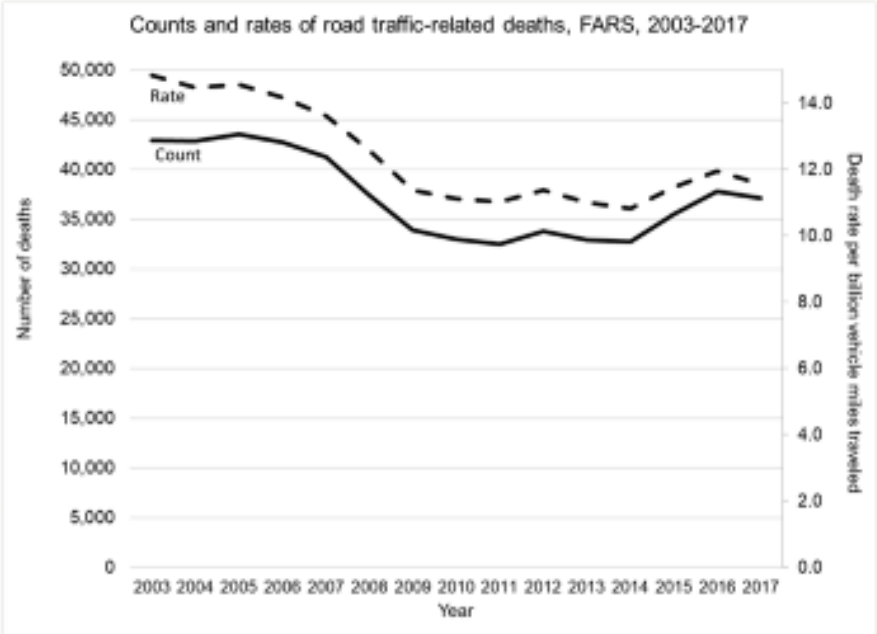
Dynamic Problem: Stagnation of Road Traffic-Related Deaths

Counts and rates of road traffic-related deaths, FARS, 2003-2017

What is the curve you want to bend?

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What is the curve you want to bend?

Dynamic Problem: Stagnation of Road Traffic-Related Deaths

Annual Road Traffic-Related Deaths

Feared

Hoped

Safe Systems Summit 2018 | April 24, 2019

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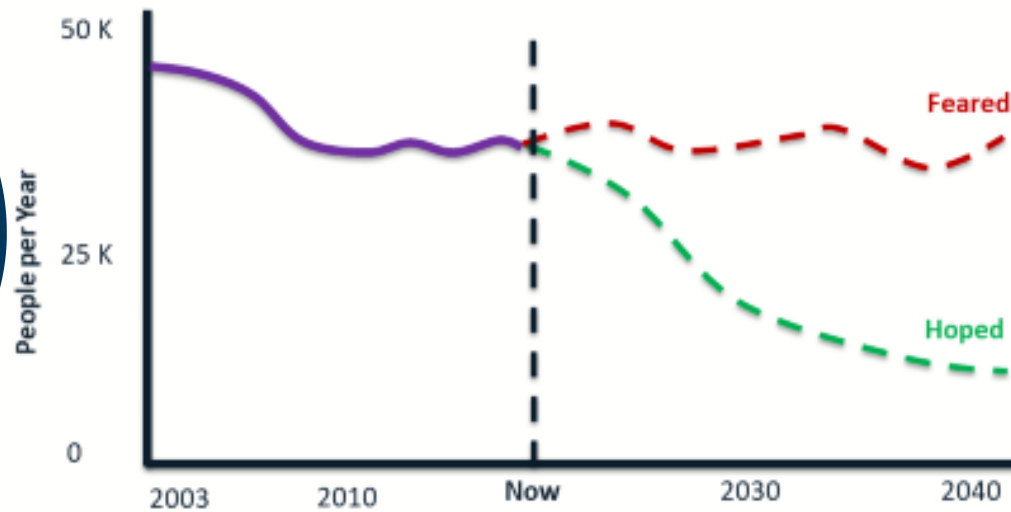
What is the curve you want to bend?

It's ok to wonder why outcomes have been flat…

- What have we tried?

- Has it worked? (Why not?)

- Have other things gotten worse?

What is the scope of work you want to (implement, sustain, improve….)

Establish boundaries!

- Where does the intervention start and stop?

- What boundaries do you want to place around the work?
  - ○ Target population
  - ○ Organizations partnering
  - ○ Disciplines considered
  - ○ Other?

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TIP 2: If you're overwhelmed, zoom in (narrow scope) or out and look at "the big picture" (with less detail!)

A SYSTEM IS...

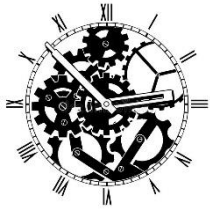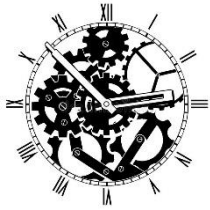A SET OF ELEMENTS

INTERCONNECTED IN A STRUCTURE

THAT PRODUCES OUTCOMES

WE CARE ABOUT.

- ADAPTED FROM MEADOWS AND WRIGHT, 2008

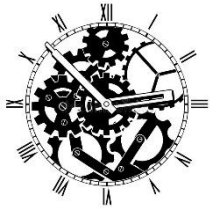**COPRH Con**
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A **watch** is a system made up of gears & materials that work together to tell time

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A ***family*** or ***household*** is a system that works together to navigate the world

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A ***state health department*** is a system that organizes resources, activities, & people to promote health & wellbeing

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What is the system that is shaping the problem you're working on, or affecting your change effort's success – in the most critical ways?

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Back to not "studying the system" (Tip 1)…

A *watch* is a system made up of gears & materials that work together to tell time

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You might be interested in:

- Household dynamics and contextual factors affecting increasing trends in an adverse childhood experience (ACE) or ACE "profile"

- How families approach supporting children's physical, social, and/or emotional wellness

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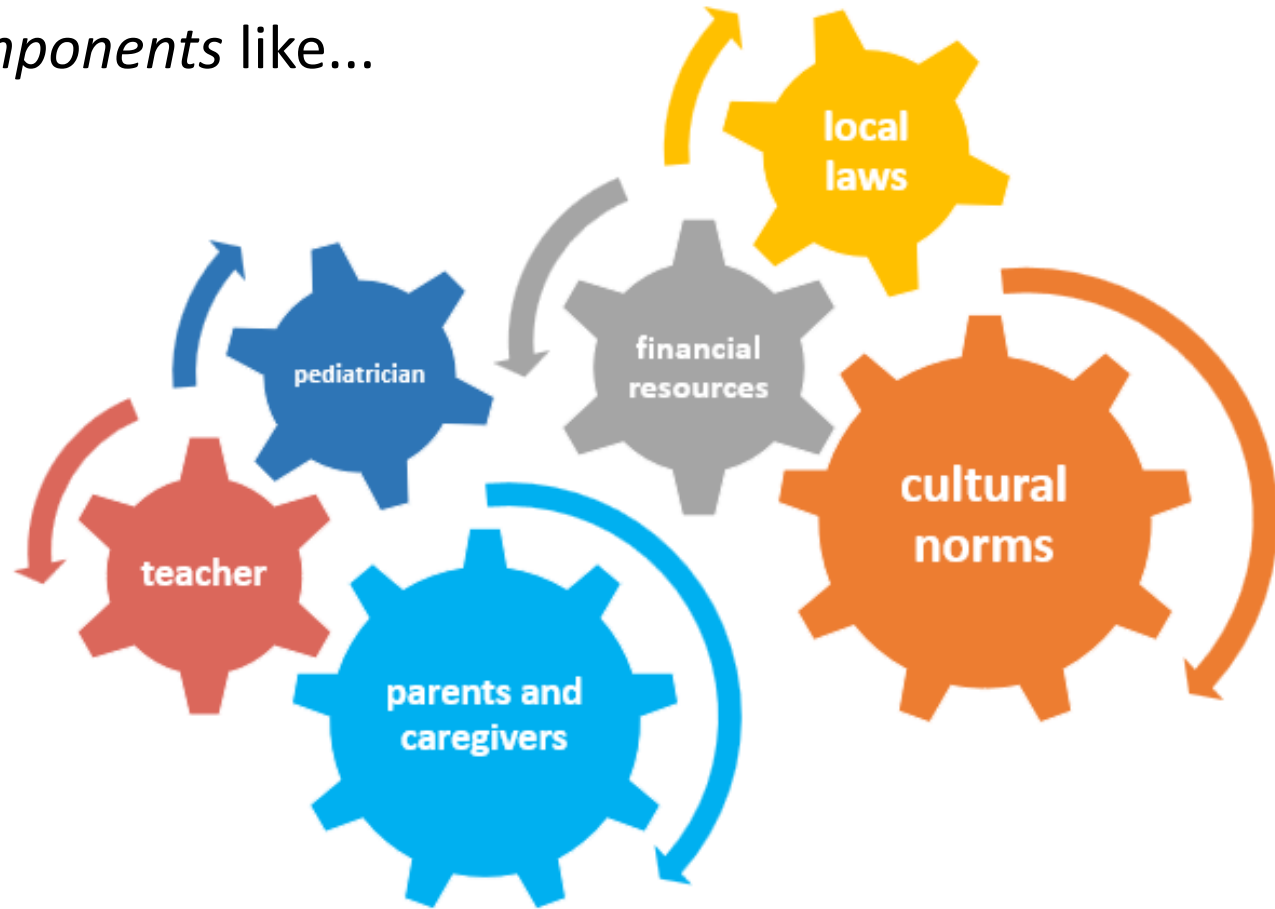- What does the system look like that shapes outcomes (*e.g., satisfaction with care coordination and supportive services*) for children with special health care needs?

The components or parts of this system might include *people* like...
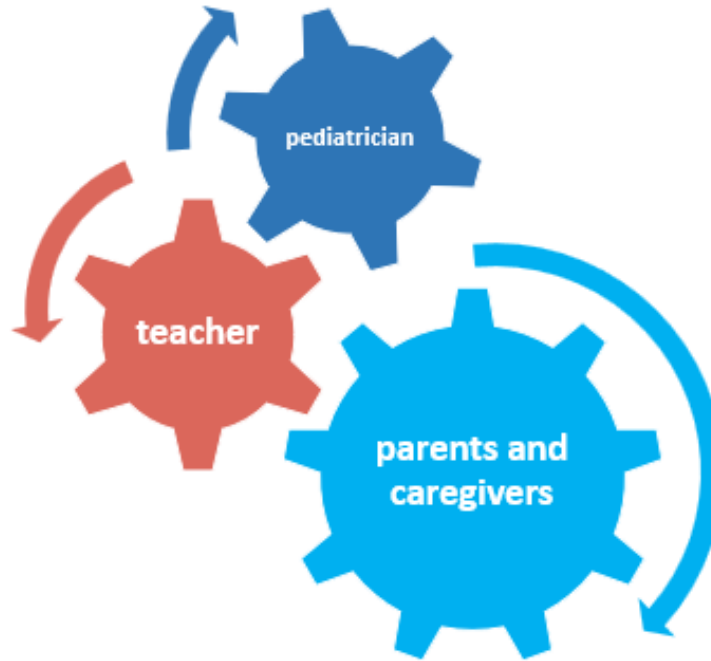
The parts of this system aren't just made up of people. We should also consider the *other components* like...

Finally, we should think about how these individual parts connect with one
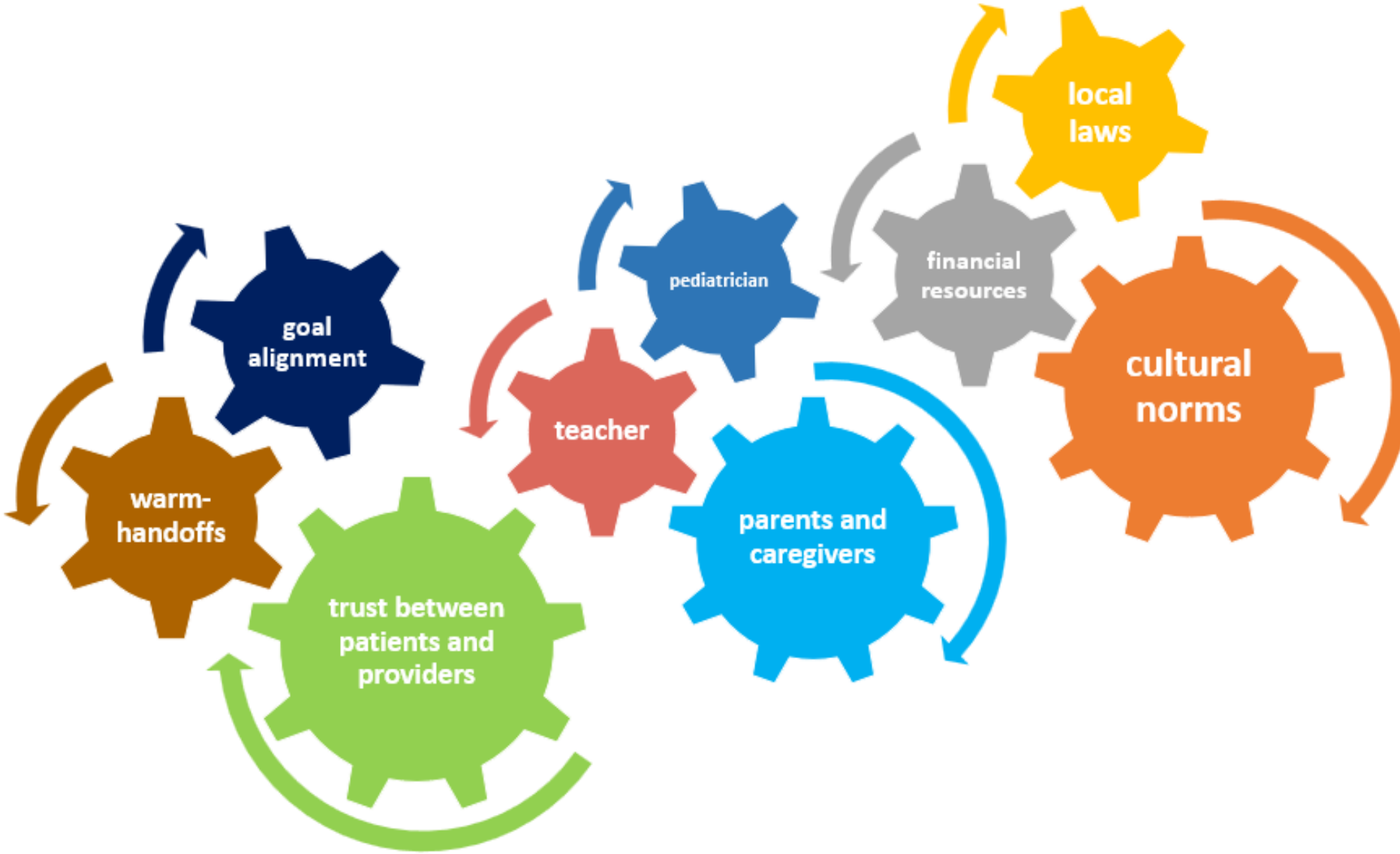
Thinking about systems means you should describe:

- System components

- Boundary (noting whether it's open or closed)

- Perspectives

- Nature of the relationships

- Transformation processes

TIP 4: Motivate the value of systems inquiry

- Coordination is hard when the left hand doesn't know what the right hand is doing (with reminder about coordination objectives)

- Policy resistance – when our effort is undermined by the system (wasted), or makes things worse (unanticipated consequences)
  - Policy resistance is pervasive
  - Give 1-2 concrete examples of what might undermine the impact of your change

- Fragmentation can lead to the "wrong pocket problem," and systems inquiry is required to motivate change
  - Show that failing to act comes back to bite you (in ways you care about)

- Our intuition is often wrong when systems behave in dynamically complex ways

We model to support our intuition

- Simulation allows us to build up a replica of complex real-world systems

- … putting pieces of information together

- … learning how (in)efficiencies here translate into (in)efficiencies there

- … asking "What if?" questions that can guide development of better systems.

Customer arrives every 1 minute (on average)

Each service takes 3.8 minutes (on average)

Customer arrives every 1 minute (on average)

Each service takes 3.8 minutes (on average)

Average time in system

Four Servers: 22.437
Five Servers: 5.274

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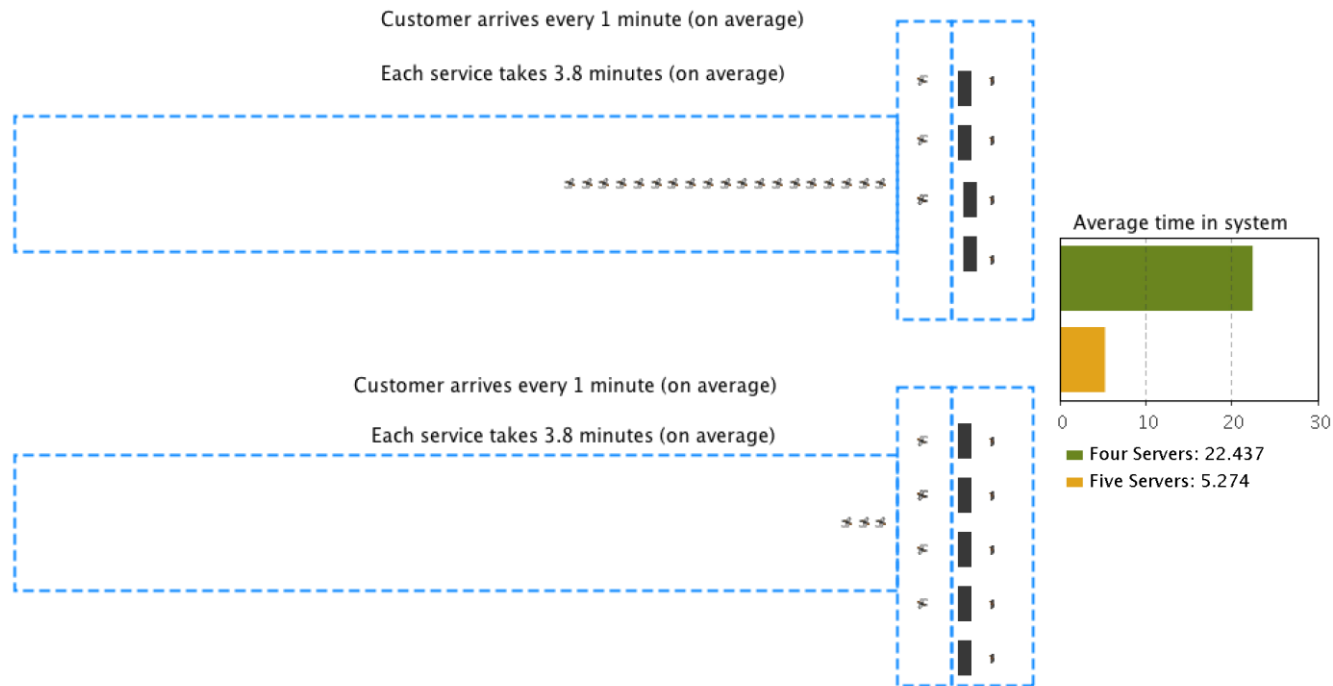
TIP 5: De-mystify the model

- Facilitate interaction with simple and more complex versions of the model

- Be clear about the parts of the model (high level)
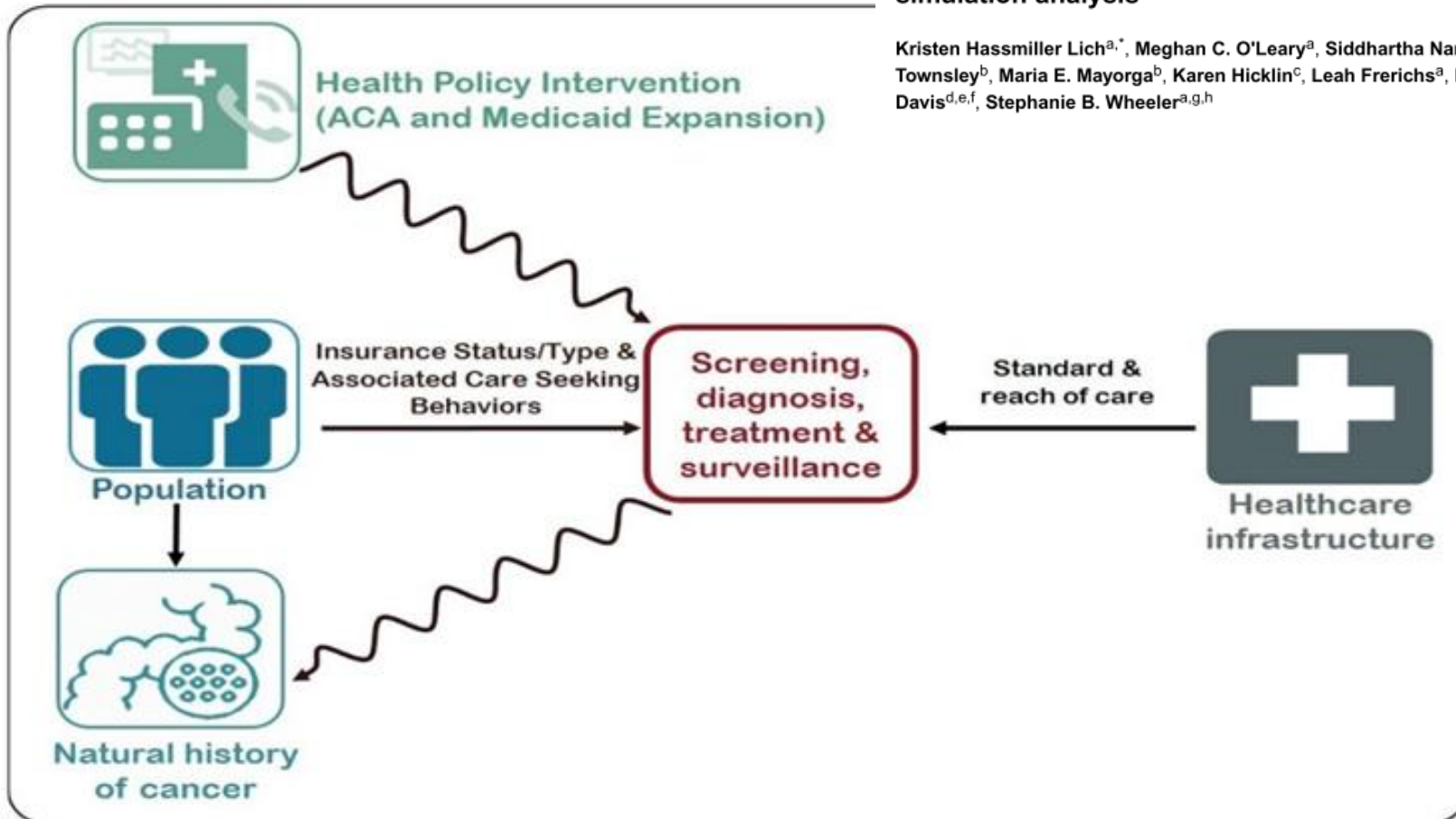
- Layered documentation

TIP 6: Bring structured approaches to your systems inquiry

Health Policy Intervention (ACA and Medicaid Expansion)

Population

Insurance Status/Type & Associated Care Seeking Behaviors

Screening, diagnosis, treatment & surveillance

Standard & reach of care

Healthcare infrastructure

Natural history of cancer

http://crcsim.web.unc.edu/

alcohol outlets

B4 — Availability, intoxication, and crime

B3 — Social disorganization and crime

intoxication

S

pressure to reduce crime

S

S

social disorganization

crime

S

police encounters

S

B = balancing loop
S = same direction
O = opposite direction

RESOURCES

NEEDS

RESPONSIBILITIES

ROLE

WISHES

Goal and Action Alignment Synthesis

Feeling unsafe to physically be in schools

Teacher recruitment & preparation

Address the digital divide

Inadequate internet connectivity

Challenges connecting with parents

Provide social & emotional wellness supports

Strong mental health & substance abuse services

Economic opportunity & housing stability

Social support & community connectedness

Enhance capacity of staff to identify & support kids with behavioral health needs

Get kids to meaningfully engage in content

Unstable or threatened funding

Maintain capable & dedicated workforce

Emotional fatigue of faculty & students

Ensure all kids have adequate food during school day

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Simulation to quantify the "wrong pocket" problem and potential overall gains

Estimating the impact of insurance expansion on colorectal cancer and related costs in North Carolina: A population-level simulation analysis

Kristen Hassmiller Lich[a,*], Meghan C. O'Leary[a], Siddhartha Nambiar[b], Rachel M. Townsley[b], Maria E. Mayorga[b], Karen Hicklin[c], Leah Frerichs[a], Paul R. Shafer[a], Melinda M. Davis[d,e,f], Stephanie B. Wheeler[a,g,h]

Health Policy Intervention (ACA and Medicaid Expansion)

Population

Insurance Status/Type & Associated Care Seeking Behaviors

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- Cumulative cost savings (relative to status quo) in NC

- Heavy black line=remove effects of ACA

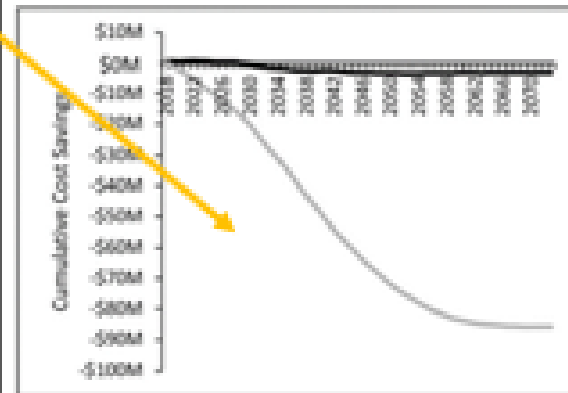- Grey line= Medicaid Expansion

- Dashed lines= Medicare for all
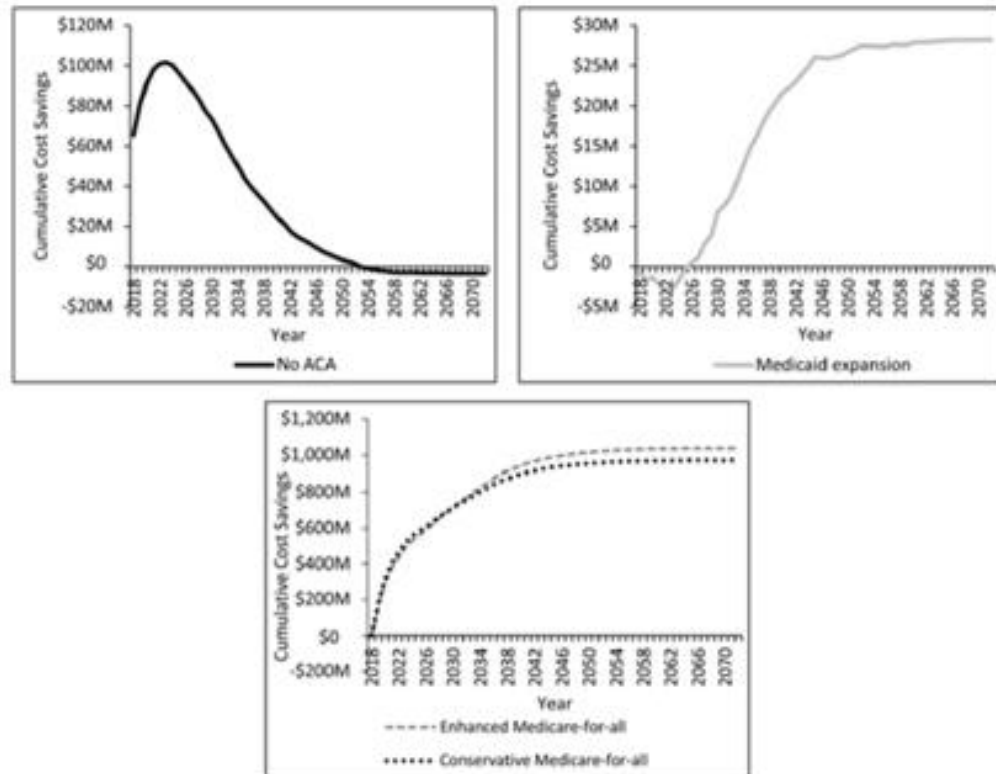
Fig. 2.
Cumulative cost savings across payers discounted at 3% per year, comparing each insurance change scenario to ACA.
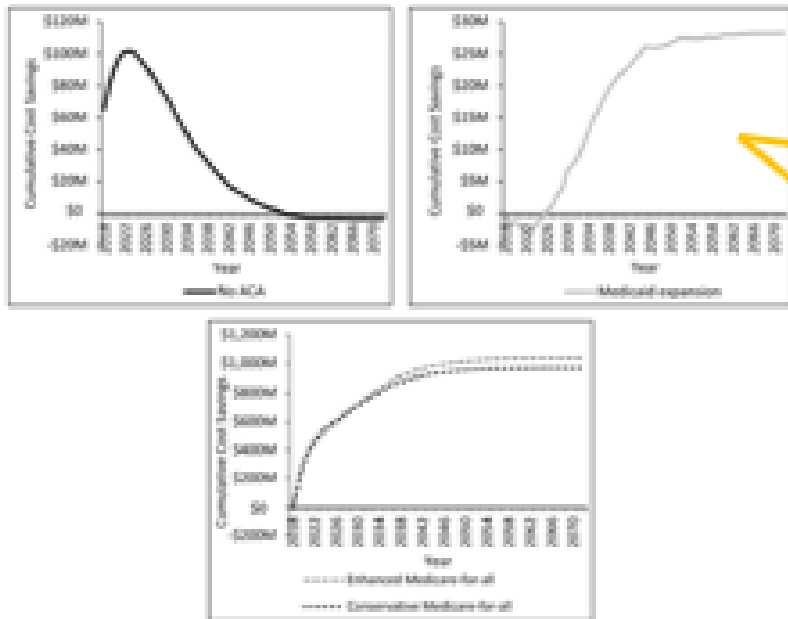
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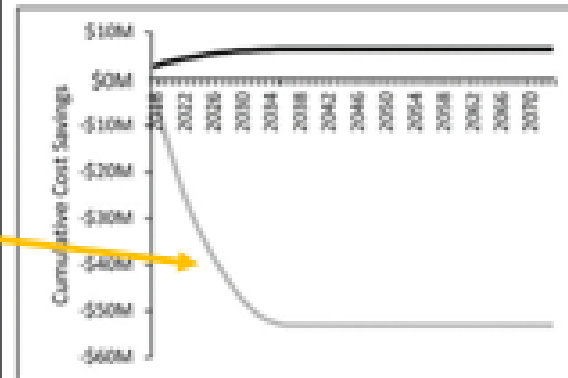
b. Medicaid

d. Dual Insurance (Medicare/Medicaid)

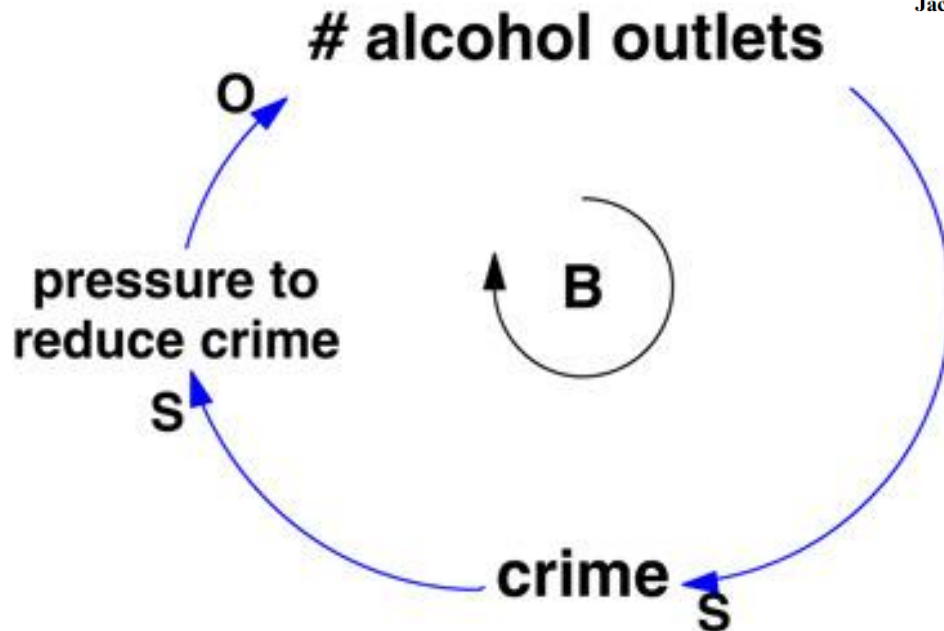# Causal loop diagramming to clarify our "theories of change"

RESEARCH ARTICLE

SCRA
SOCIETY FOR COMMUNITY
RESEARCH AND ACTION

A systems framework depicting how complex neighborhood dynamics and contextual factors could impact the effectiveness of an alcohol outlet zoning policy

Pamela A. Matson[1] | Ivana Stankov[2,3] | Kristen Hassmiller Lich[4] | Sarah Flessa[1] | Jacob Lowy[1] | Rachel L. J. Thornton[1]

alcohol outlets

O

pressure to
reduce crime

S

B

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B = balancing loop
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Academic and government partners' perspective

B4 Availability, intoxication, and crime

B3 Social disorganization and crime

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S pressure to reduce crime

S social disorganization

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S police encounters

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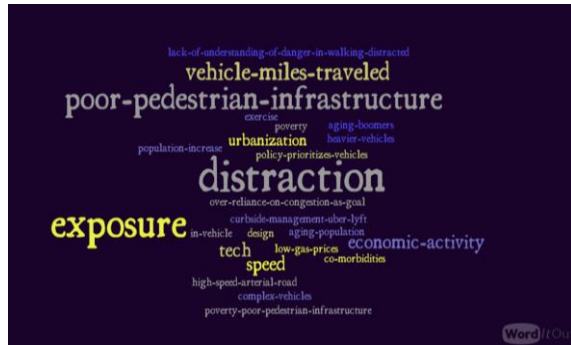
Community-based organizations' perspective

Community perspective
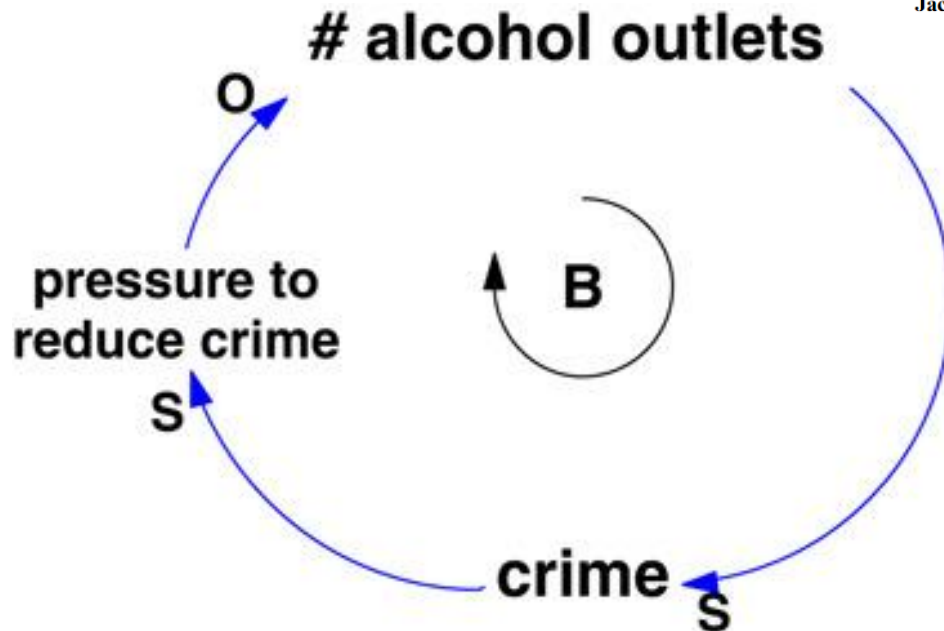
Causal loop diagramming to draw out and compare mental models

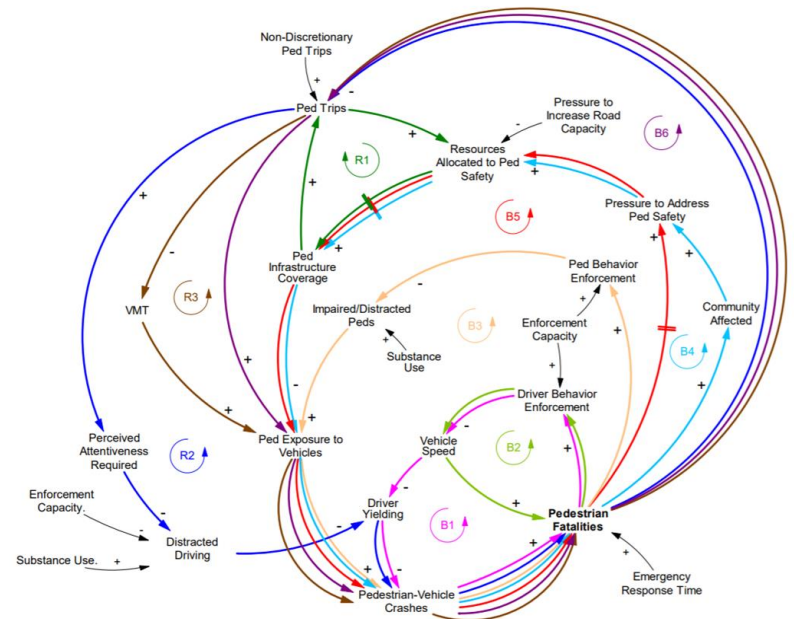# Causal loop diagramming to draw out and compare mental models

Integrating complex systems science into road safety research and practice, Part 2: Applying systems tools to the problem of increasing pedestrian death rates

Rebecca B. Naumann[a,*], Jill Kuhlberg[b], Laura Sandt[c], Stephen Heiny[c], Wesley Kumfer[c], Stephen W. Marshall[a], Kristen Hassmiller Lich[b]

TABLE 1. Reinforcing and balancing feedback loops generated from workshop participants' causal loop diagrams
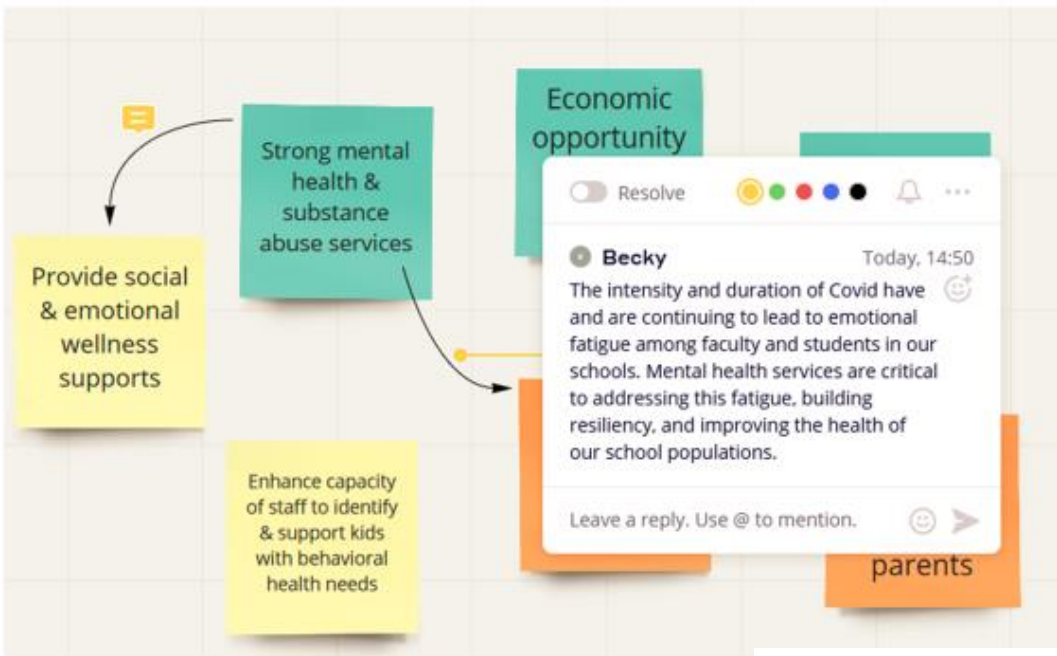
Label[1]	Name	Short Description
Figure 2		
B1& B2	Band Aid Driver Enforcement	Following a fatality, communities respond by increased enforcement of vehicle speed, which decreases crashes and fatalities, limited by enforcement capacity.
B3	Band Aid Ped Enforcement	Following a fatality, communities respond by increased enforcement of pedestrian behaviors which reduces crashes and fatalities but is limited by enforcement capacity.
B4	Community Response	The families and communities of those killed in pedestrian-vehicle crashes can generate support to address pedestrian safety and infrastructure that protects pedestrians and reduces pedestrian deaths.
B5	Data Driven Advocacy	Data on pedestrian fatalities can also generate support for pedestrian safety and infrastructure, reducing pedestrian vulnerability, crashes, and pedestrian deaths.
B6	(Un)safe to walk	The safer walking appears to be, the more pedestrians will be encouraged to walk, which increases pedestrian exposure to vehicles, and probability of crash and fatalities, and reduces the perceived safety of walking.
R1	Walkability	Pedestrian infrastructure encourages use, which generates a base of support which in turn encourages the construction and maintenance of pedestrian infrastructure.

System Support Mapping to delineate roles, responsibilities, supporting resources, and wishes for being supported in a particular scope of work

Contact klich@unc.edu

Supporting children and youth with special health needs in New York

Who does the work?

What is involved?

What is needed to succeed?

What resources are available and used?

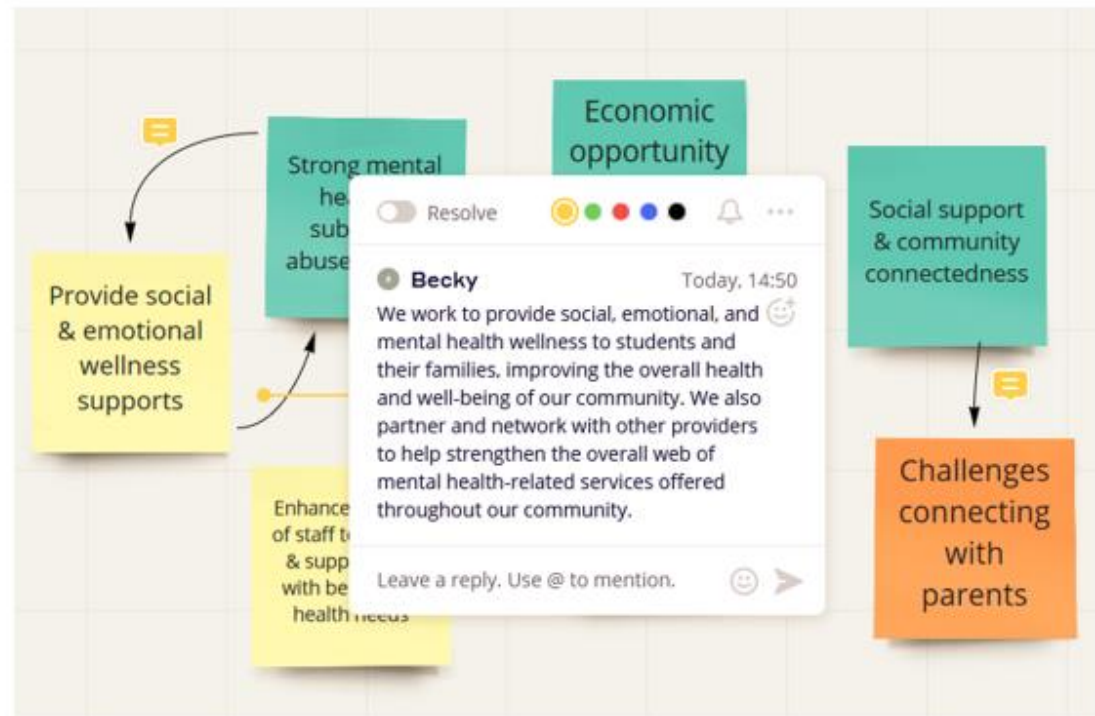What do stakeholders feel is most important to move their work forward?

Goal and Action Alignment mapping

How does change in focal outcomes benefit your organization?
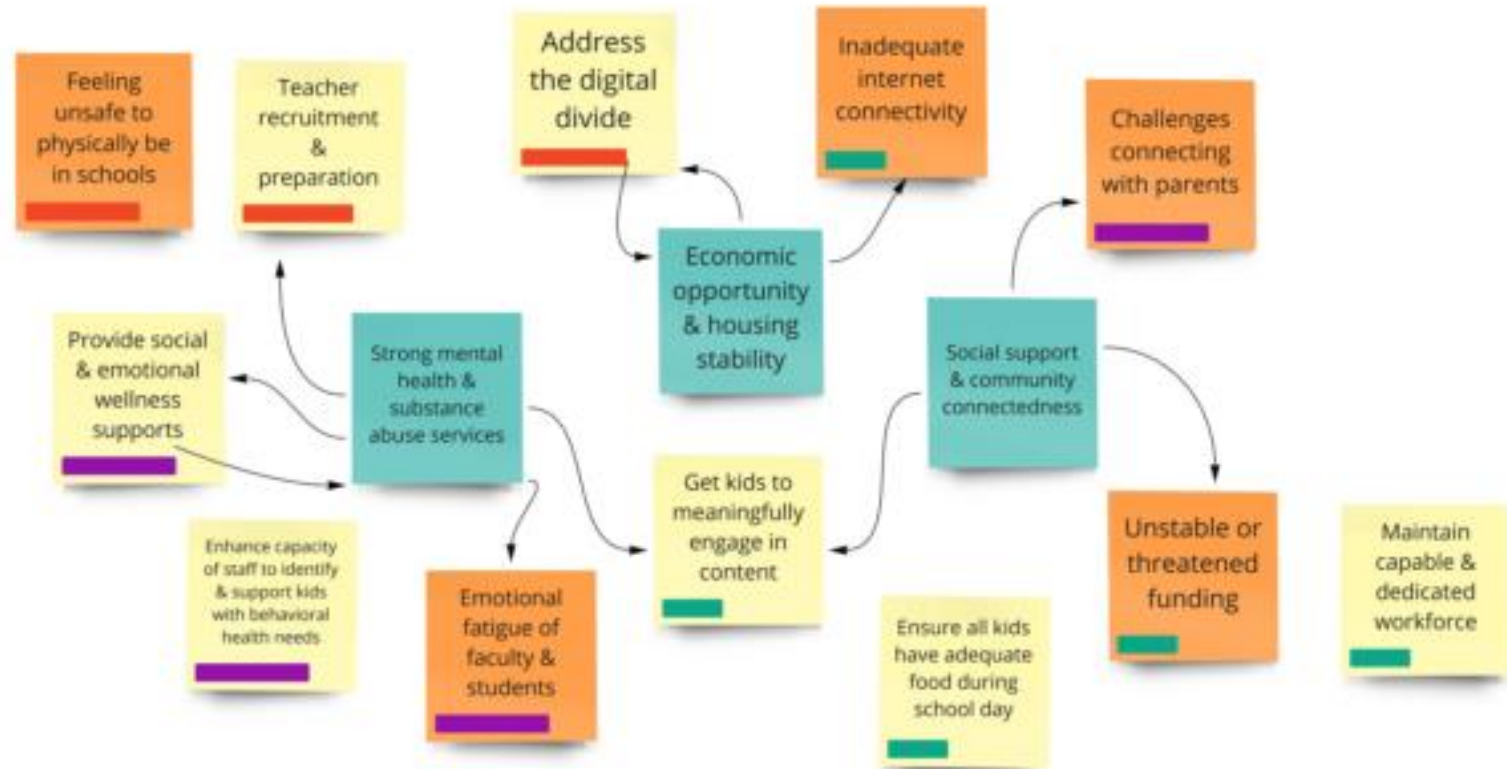
How do/could your organization most easily support the collaboration's work?

Contact klich@unc.edu

Goal and Alignment mapping to clarify partnering organizations' missions, pain points, and connections to shared objectives

Goal and Action Alignment Synthesis

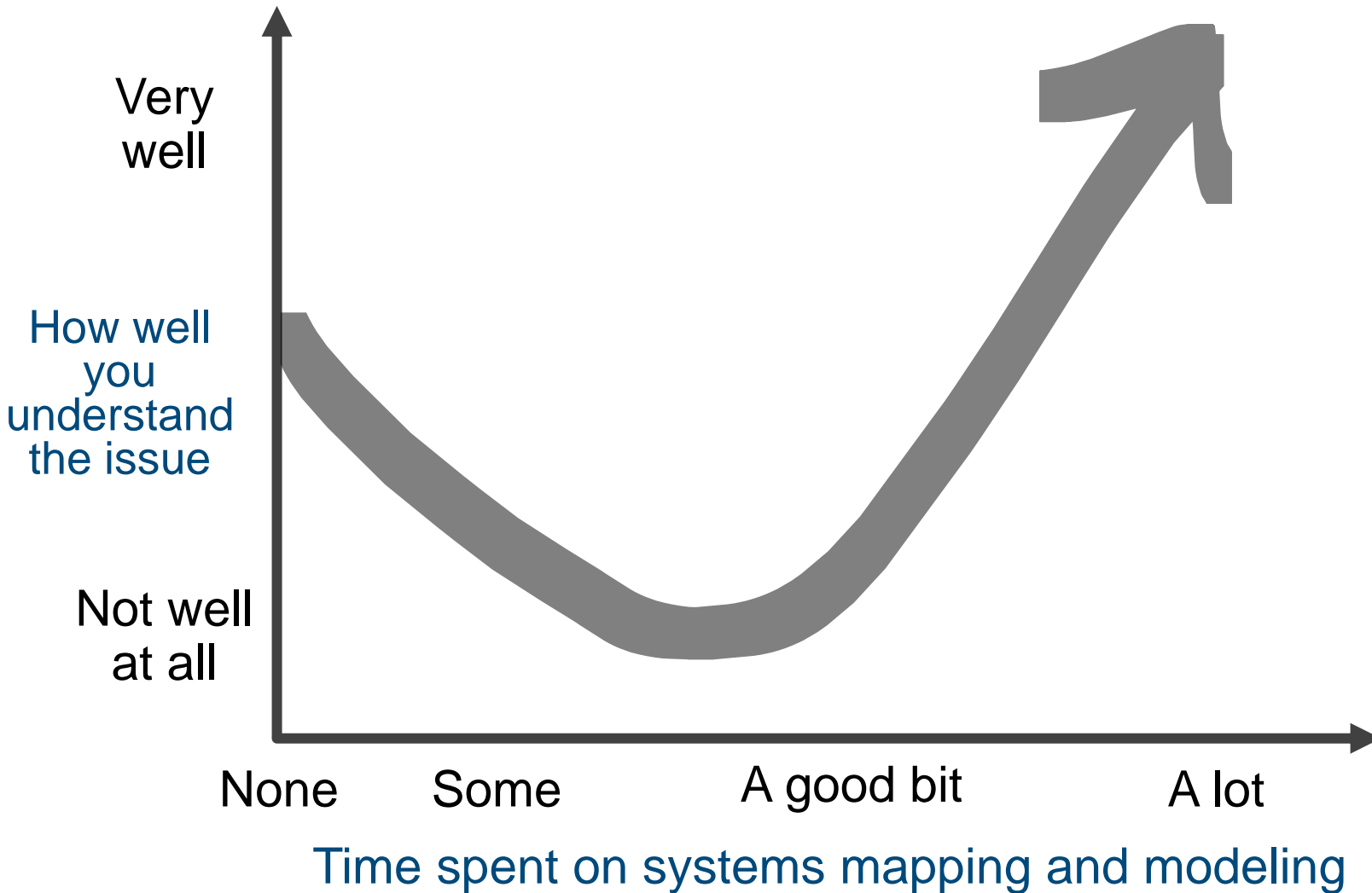# TIP 7: Know your purpose

What do you want to illuminate?

Is your purpose to…

- Define a shared challenge or scope of work to change/ implement

- Develop a shared understanding

- Figure out what you do/don't know and prioritize data collection/hypothesis testing

- Think broadly about possible action/improvement ideas

- Compare/contrast action/improvement ideas

- Formally assess an action/improvement idea (e.g., "business case" or economic evaluation)

- Predict

TIP 8: Get comfortable with this work being iterative, and acknowledge that it's a process and takes different strengths

How well you understand the issue

Very well

Not well at all

None   Some   A good bit   A lot

Time spent on systems mapping and modeling

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TIP 8: Get comfortable with this work being iterative, and acknowledge that it's a process and takes different strengths

How well you understand the issue:
- Very well
- Not well at all

Didn't know how much I didn't know

Time spent on systems mapping and modeling:
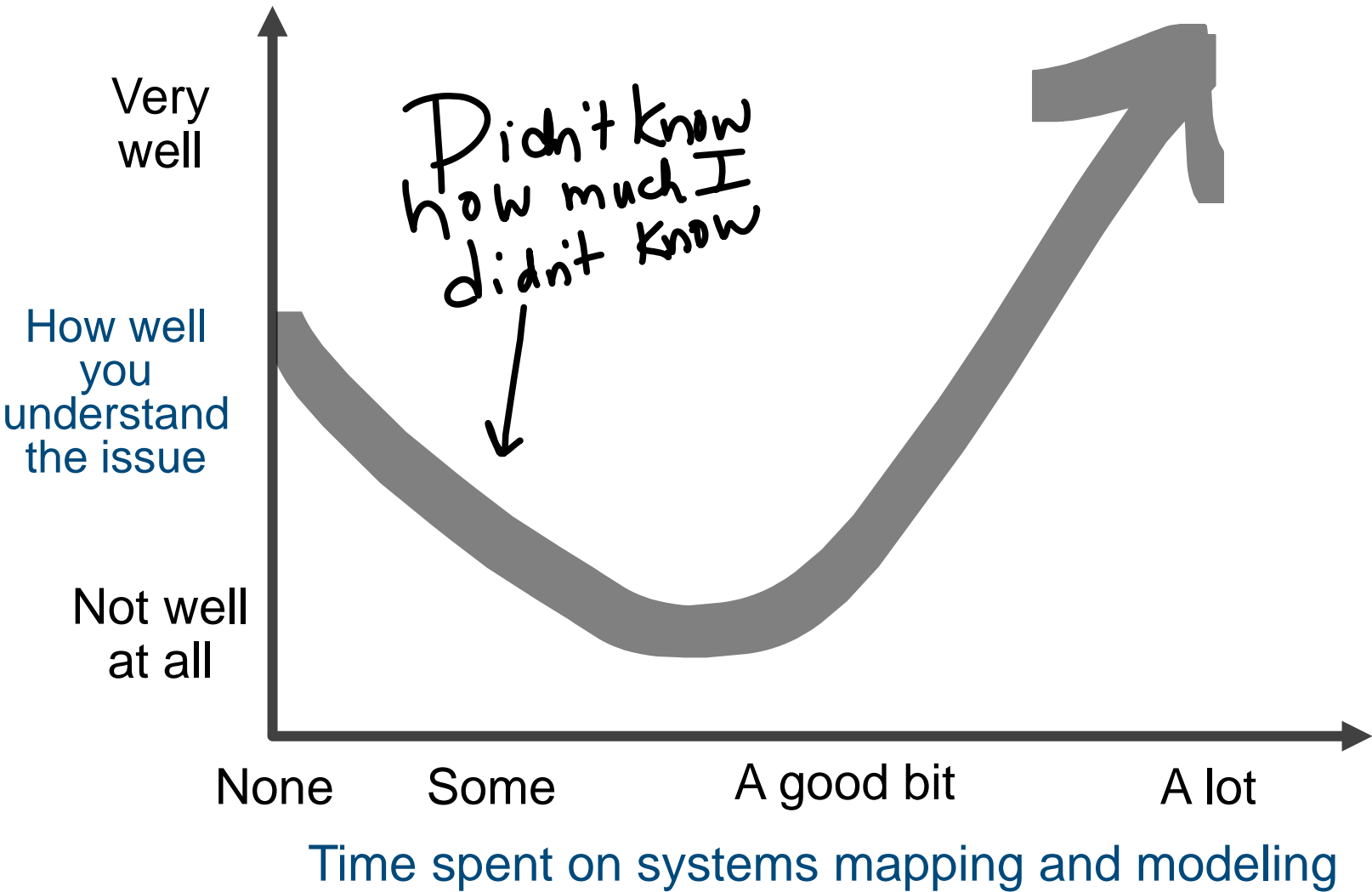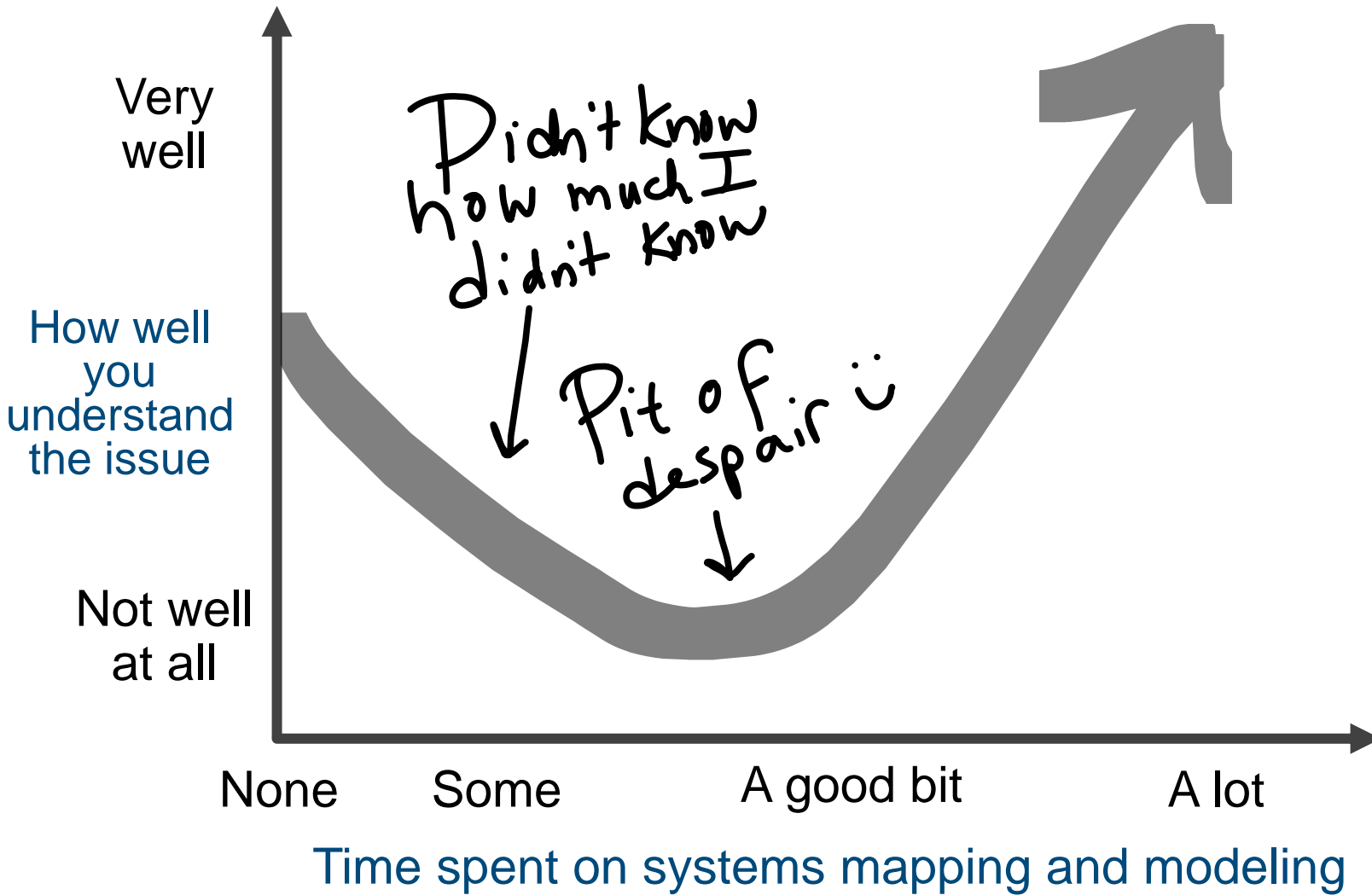- None
- Some
- A good bit
- A lot

TIP 8: Get comfortable with this work being iterative, and acknowledge that it's a process and takes different strengths

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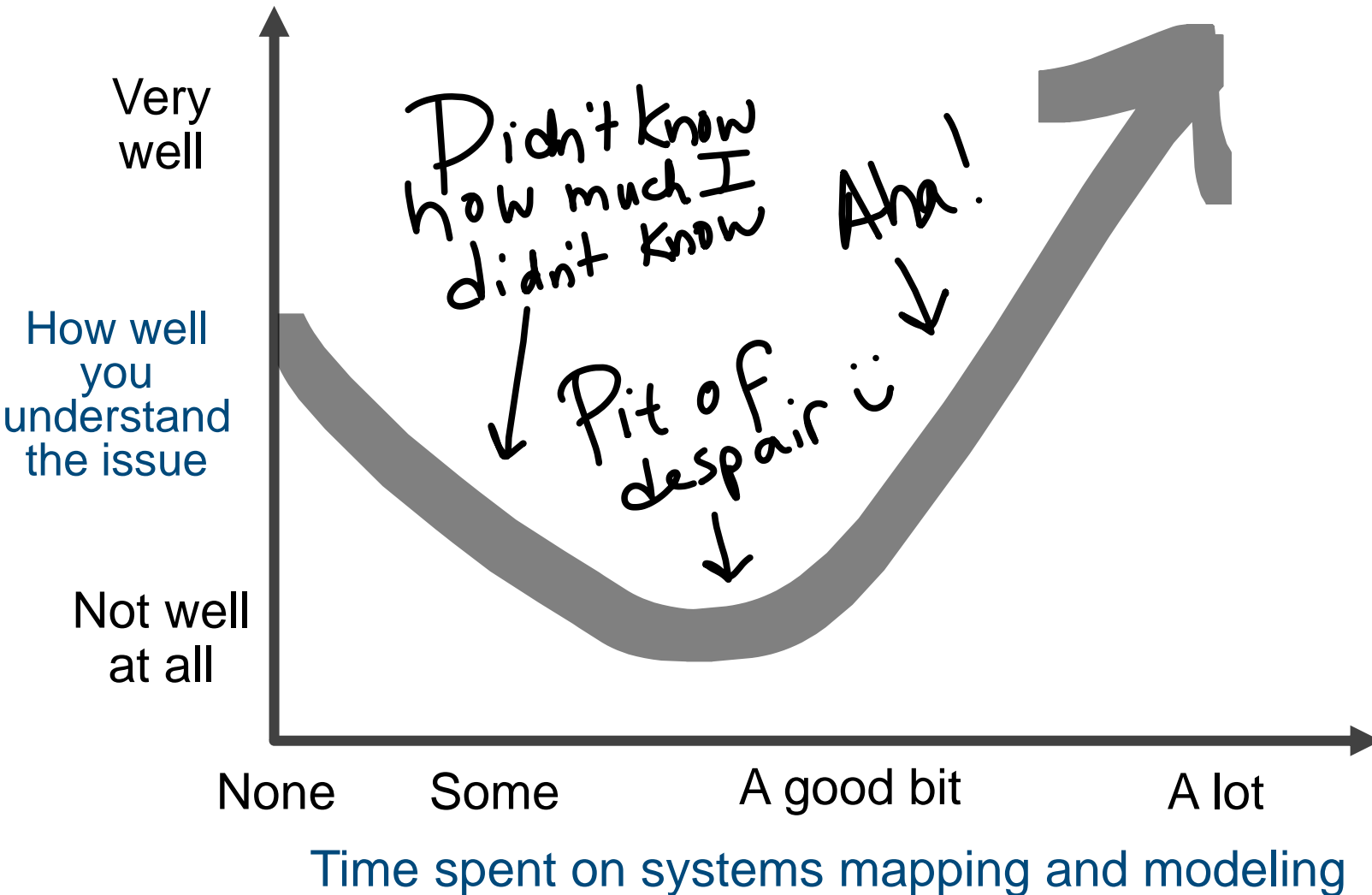
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Pit of despair :(

Aha!

Learning how to talk about the complexity

None   Some   A good bit   A lot

Time spent on systems mapping and modeling

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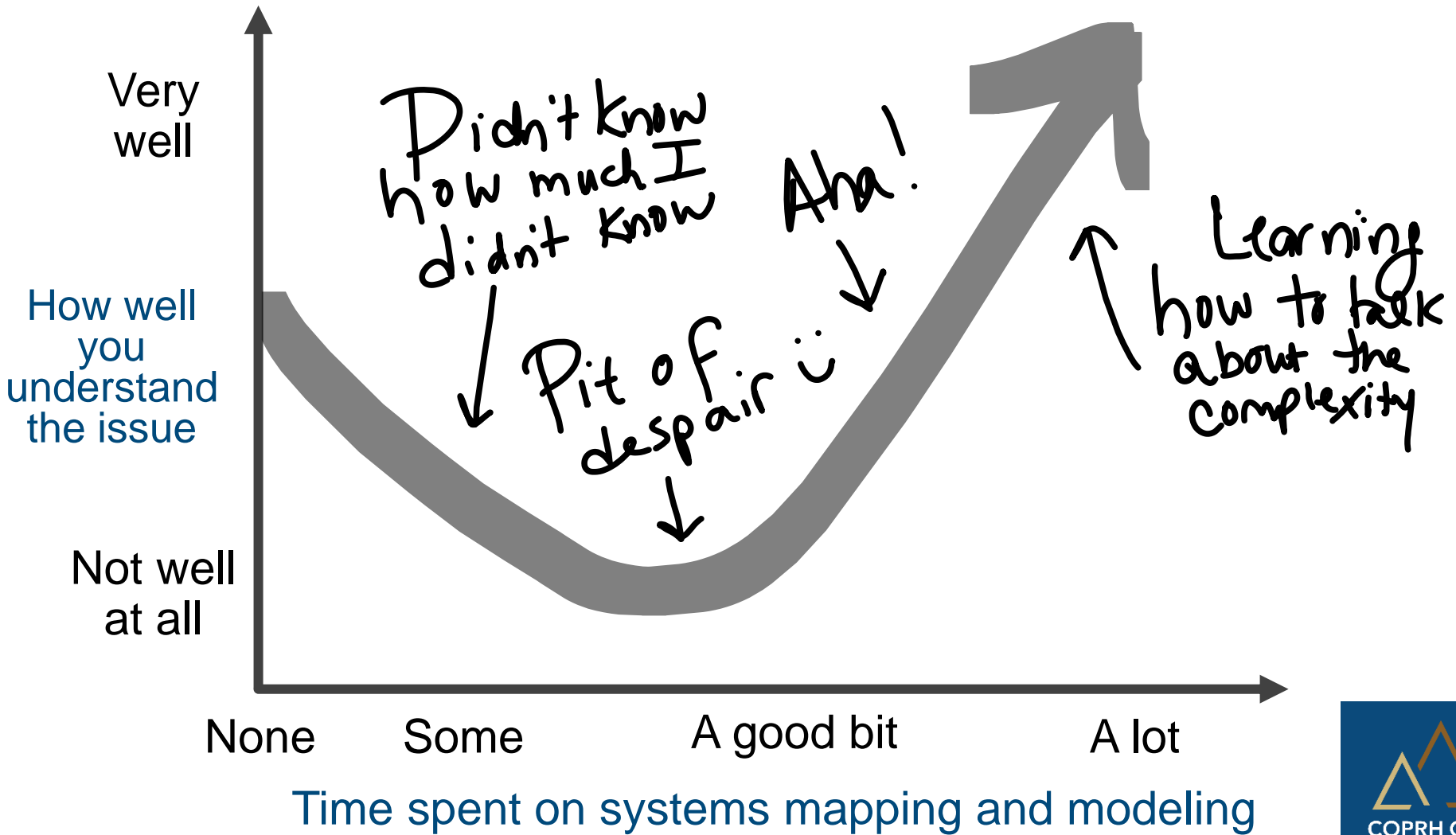
TIP 9: Always have a way to distill your insights

Iceberg model for reproductive intention screening gaps

RH – reproductive health
CD – chronic disease
PCP – primary care provider
MCH – maternal child health
CHW – community health worker
RJ – reproductive justice

Undesirable events

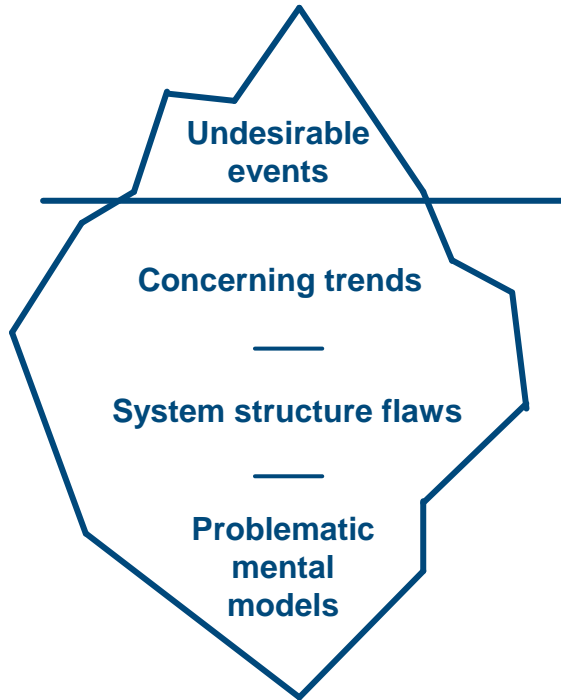|		
- People with chronic health conditions not engaged with RH	- Increased complications for pregnant people with CD	- Poor health outcomes for birthing parents and infants

Concerning trends

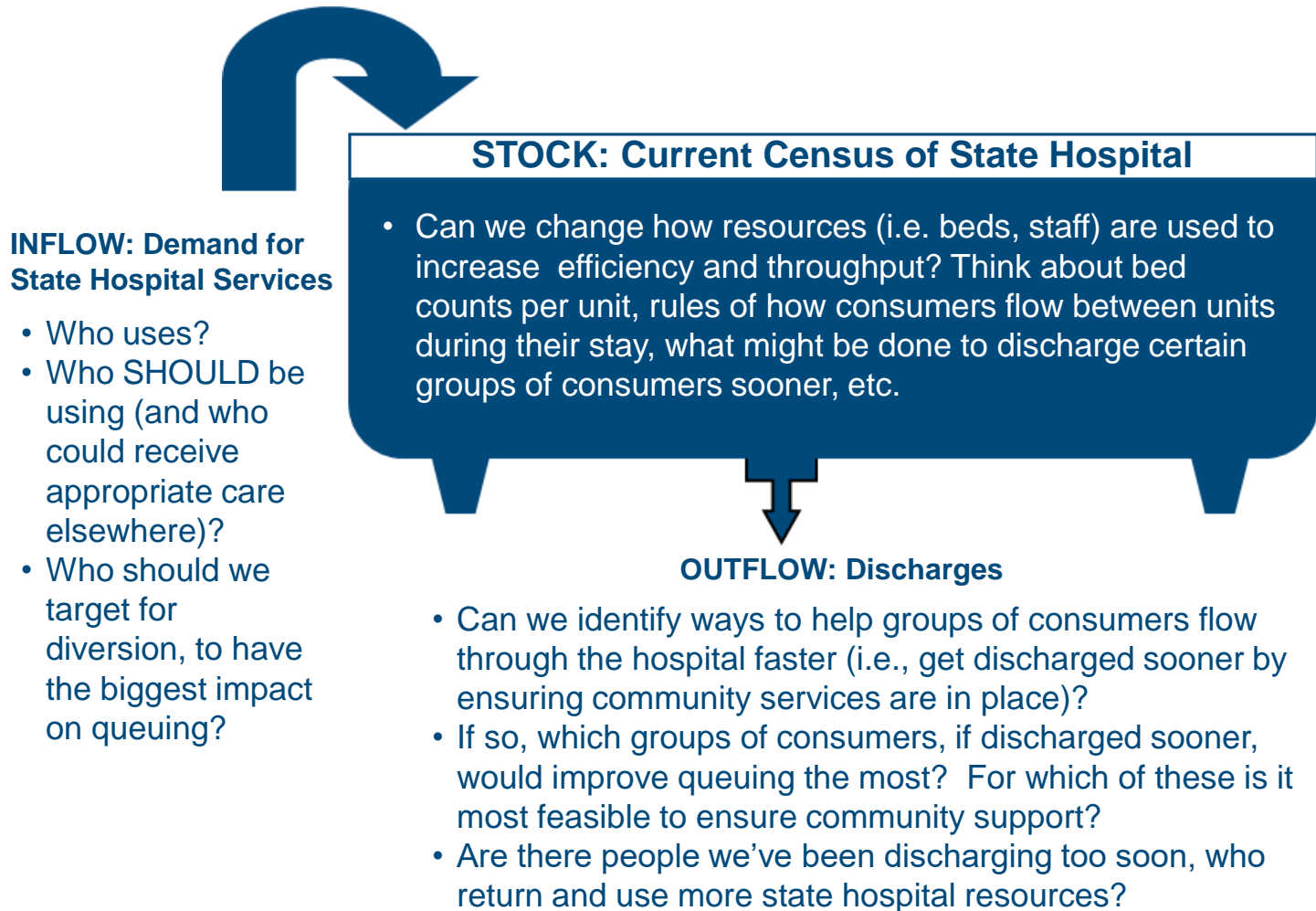|		
- Increased prevalence of CD diagnosed in younger people - Clinician overload and competing health priorities	- Physicians who manage CD not interested in RH and vice versa	- Within sub-specialties, RH issues largely championed by women providers and leaders

System structure flaws

- History of reproductive injustice - Lack of safety net in society - Medicaid funding limited by state and how close people are to pregnancy	- Fragmented funding, programming, reimbursement, and care - Medical training overlooks RH; no quality incentives in practice - Lack of disaggregated data on sex, gender, RH, and CD	- Lack of ways to bill for RH screening and other reimbursement issues - Lack of licensure for CHWs, doulas

Problematic mental models

- RJ not incorporated into care; patients not seen as whole people and RH care seen as outside scope	- When providers uncertain, "do no harm" (don't get pregnant, stop meds)	- Explicit and implicit biases about who should reproduce - Contraception much easier to manage than pregnancy

Work in progress by Fatima, Smith, Verbiest, McClain, et al.

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Improving State Hospital Queuing: Bathtub Logic

STOCK: Current Census of State Hospital

INFLOW: Demand for State Hospital Services

- Who uses?
- Who SHOULD be using (and who could receive appropriate care elsewhere)?
- Who should we target for diversion, to have the biggest impact on queuing?

- Can we change how resources (i.e. beds, staff) are used to increase efficiency and throughput? Think about bed counts per unit, rules of how consumers flow between units during their stay, what might be done to discharge certain groups of consumers sooner, etc.

OUTFLOW: Discharges

- Can we identify ways to help groups of consumers flow through the hospital faster (i.e., get discharged sooner by ensuring community services are in place)?
- If so, which groups of consumers, if discharged sooner, would improve queuing the most? For which of these is it most feasible to ensure community support?
- Are there people we've been discharging too soon, who return and use more state hospital resources?

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Original source unknown (but accessed on 2022 May 2 from: https://psychologycompass.com/blog/point-of-view/

Title and Content Layout with List

- TIP 1: Focus on a problem or desired change, not "the system"
- TIP 2: If you're overwhelmed, zoom in (narrow scope) or out and look at "the big picture" (with less detail!)
- Tip 3: Clarify and structure what you mean by "system"
- TIP 4: Motivate the value of systems inquiry
- TIP 5: De-mystify the model
- TIP 6: Bring structured approaches to your systems inquiry
- TIP 7: Know your purpose
- TIP 8: Get comfortable with this work being iterative, and acknowledge that it's a process and takes different strengths
- TIP 9: Always have a way to distill your insights
- TIP 10: While systems inquiry may not always feel pragmatic, point out how unsatisfactory the alternatives are