Making Smarter Decisions, Faster:

Applied Systems Engineering Approaches for HIV Service Improvement

Module I: SAIA Series

Outline

- Why does it pay to make the right decision earlier?
- What is systems engineering?
- Teaching basic Systems Engineering– group exercise

Group Poll

- Who has experience using QI in a clinic context?
- Who has experience using QI in a research context?

- Who has had experience making a decision about resource allocation where there were 2 or more options to get at the same result?
- Who has worked with a partner (government or NGO) who had to decide how to allocate limited resources?

- Who has had an experience of trying to diagnose and fix a problem in a project or team system?
- Who has chosen their study area or topic based on diagnosing a need versus choosing based on convenience or past experience?

What kind of decisions do we make in public health?

How many people to admit to ED before referring?

Where to provide the flu vaccine?

Where to build new hospital?

How to staff a community outreach team?

How to organize a newly integrated service flow?

Whether to scale up home- or clinic-based sample collection for screening?

How many test machines and cartridges to buy and where to place them?

When to commit to an imperfect vaccine for scale up?

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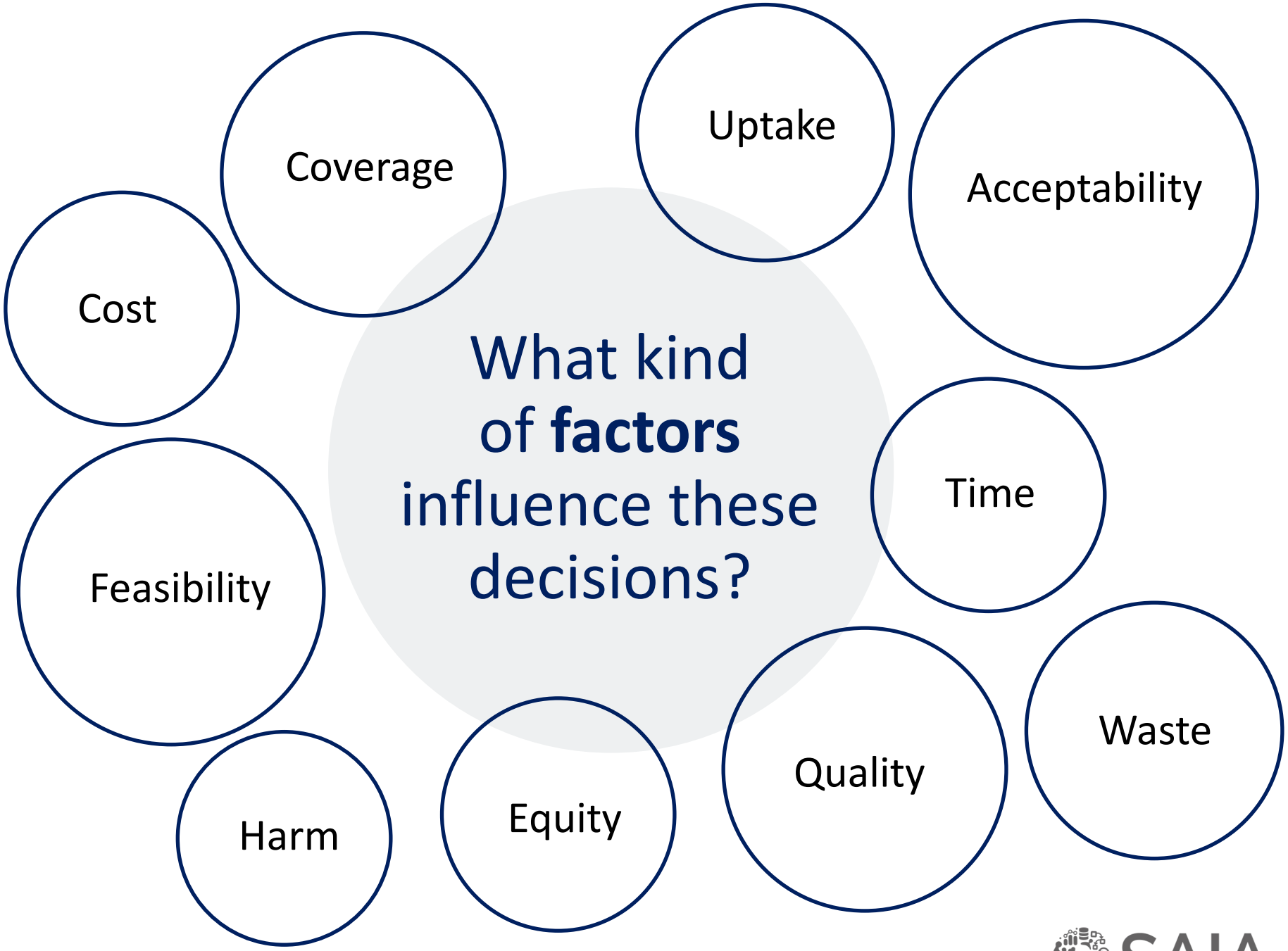
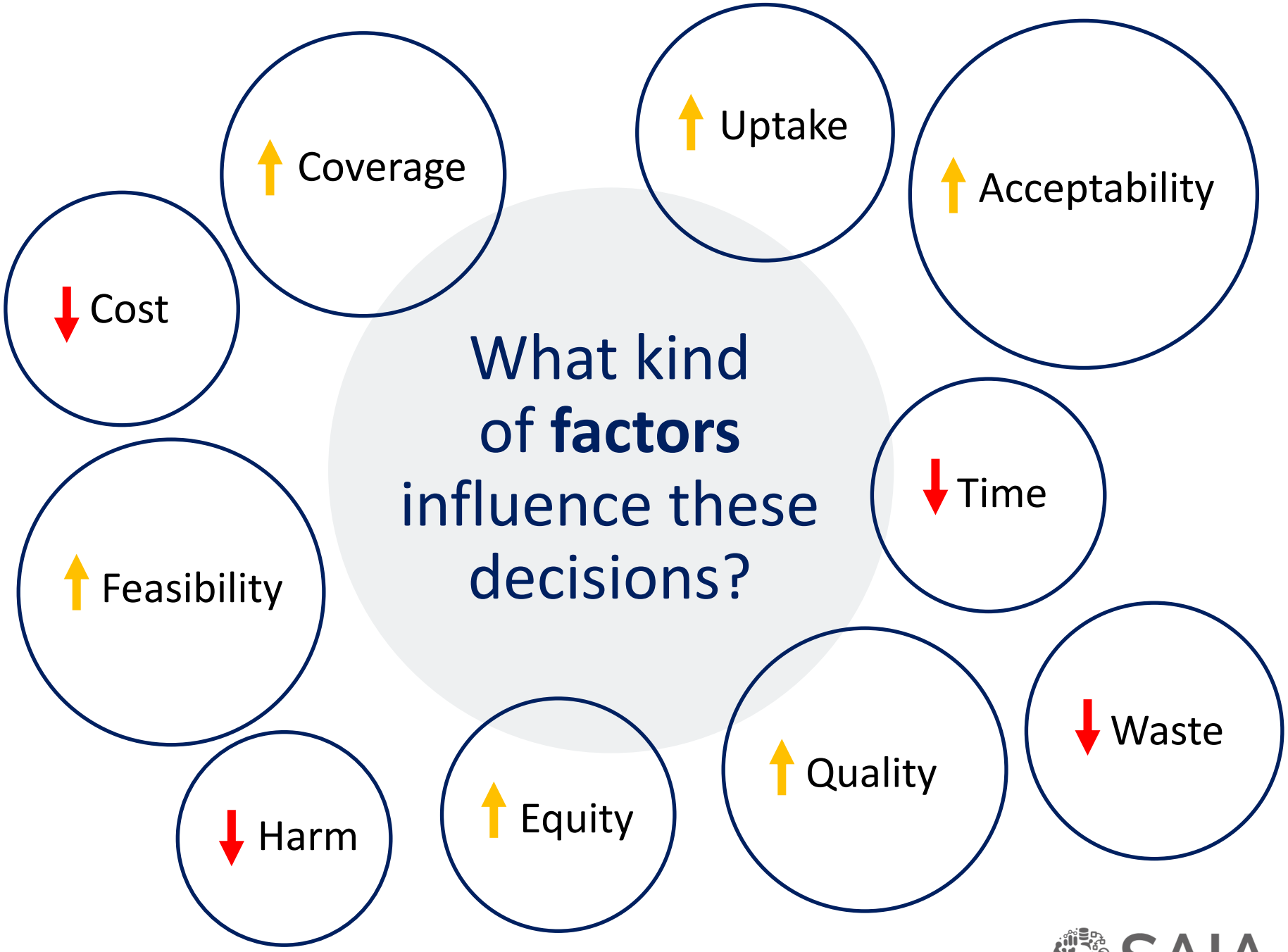

Coverage
Uptake
Acceptability
Cost
What kind of **factors** influence these decisions?
Time
Feasibility
Waste
Quality
Harm
Equity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Why not just **“try and see”?**

- Why not commit to a decision early and change course later?

OR

- Wait until one option is clearly superior and then decide?

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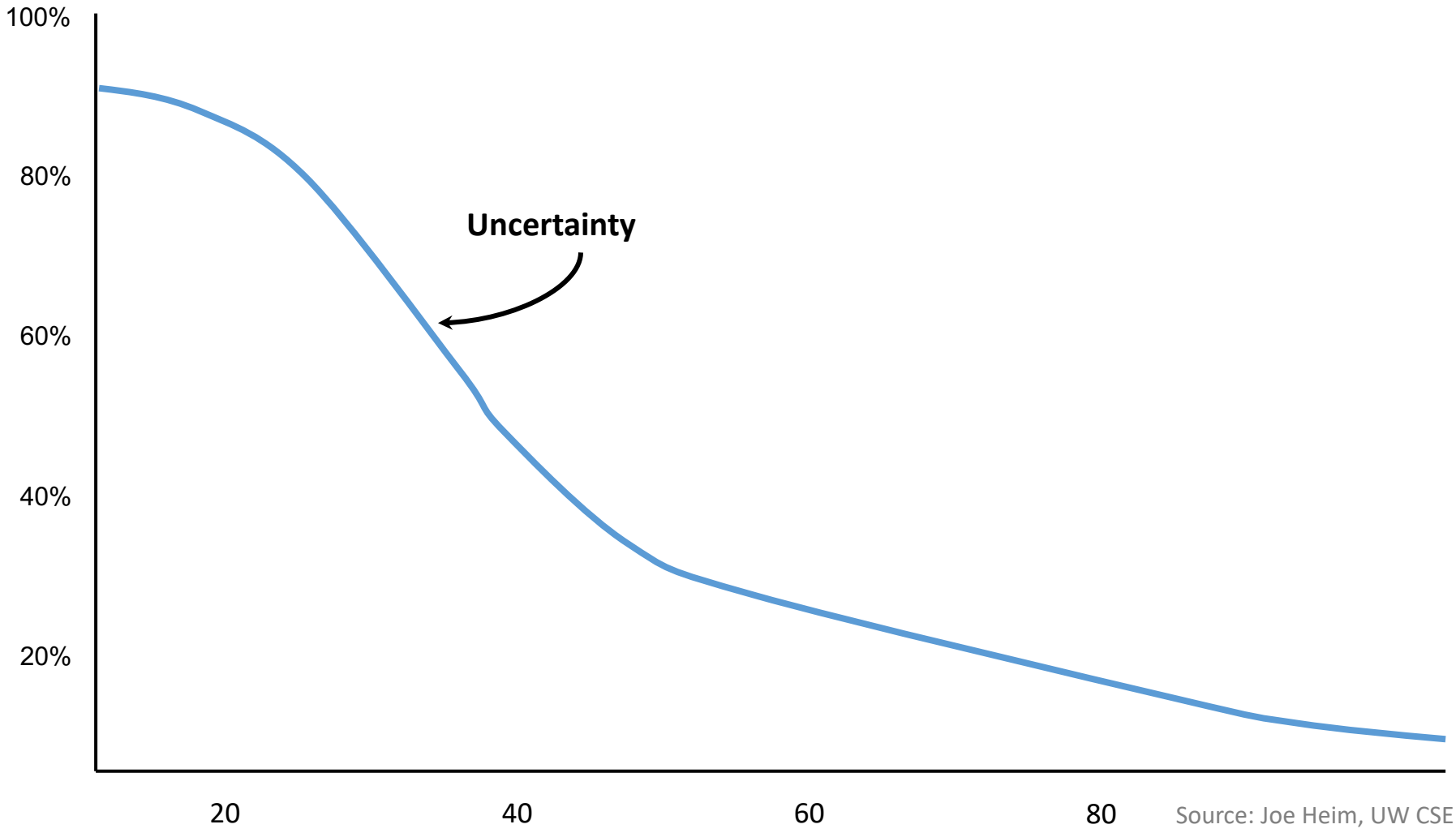
Getting Smarter Faster (Reduce Unknowns)



Source: Joe Heim, UW CSE

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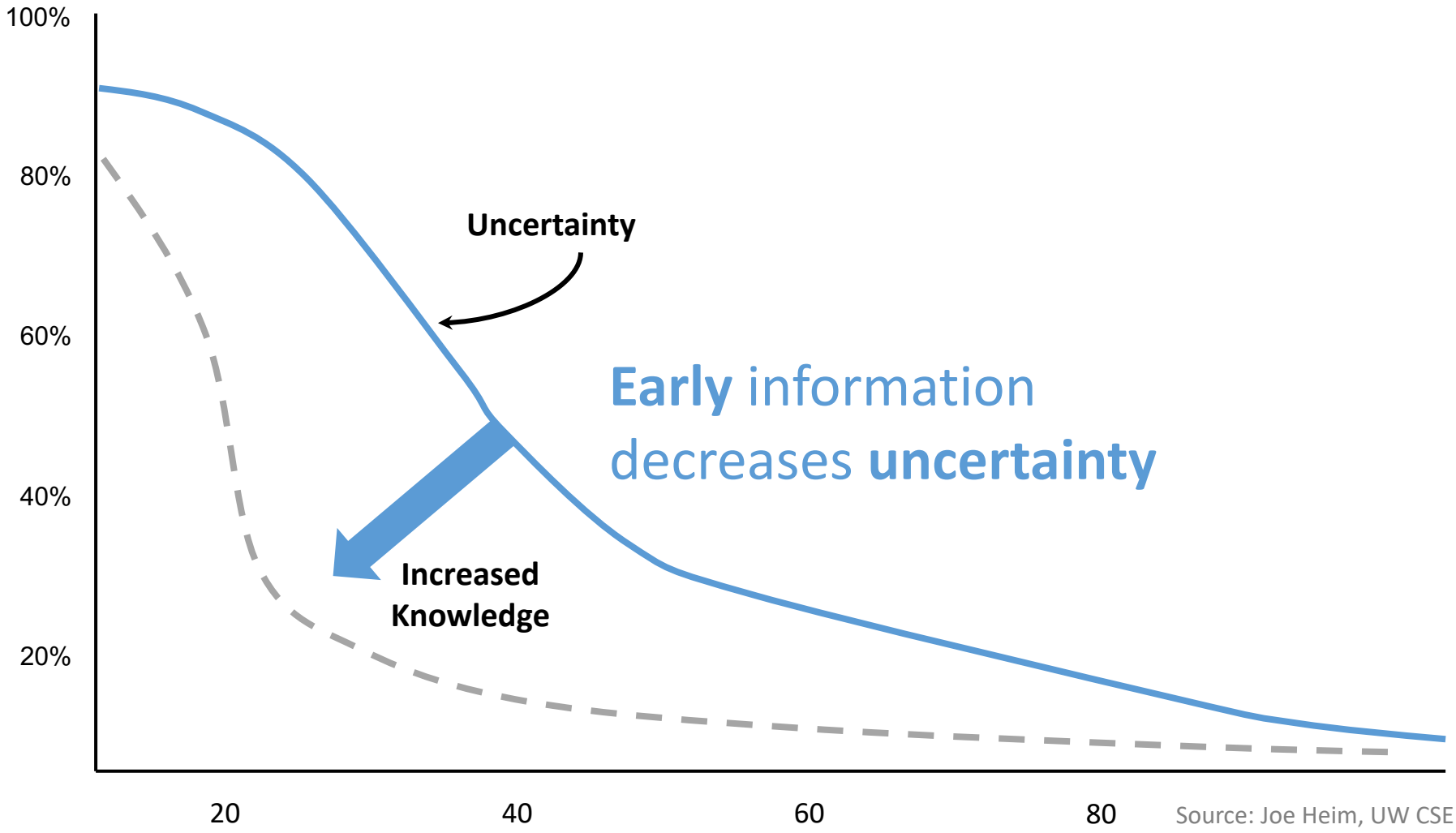
Getting Smarter Faster (Reduce Unknowns)



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Decisions in complex systems are complicated

- “Try and see” approach can waste time, resources, and the will of your teams
- Using tools built to model complexity and facilitate decision-making is useful

What is systems engineering?

Arose in early 1900s in response to complex industrial systems

- Telecommunications
- Military
- Aeronautical industry

Well known example is Toyota Production System (Lean model)

- Reduce error rates within systems
- Identify and eliminate sources of waste

Systems are collections of interdependent elements or components which share, or contribute, to a common purpose

What is systems engineering?

Reviewed definitions have common elements of using structured methods to:

- **Analyze** a complex system
- **Model** and **optimize** potential actions or decision options
- **Choose** an action or decision
- **Make** a change
- **Evaluate** results

Overlaps with operations research; implementation science; quality improvement, statistics and reliability; decision and risk analysis; human factors; operations management; and organizational theories

What is systems engineering?

Proposed definition of SE for global health context:

An approach that uses data to improve decision-making within a given global health system by

1. diagnosing problems and **identifying** needs
2. evaluating **decision options** to address a selected problem or need through **modeling** or **optimization**
3. translating optimized decision options into practical **recommendations** or **actions**

Wagner & Crocker, et al. Making smarter decisions faster: systems engineering to improve the global public health response to HIV. *Current HIV/AIDS Reviews.* 2019 Jun 13. doi: 10.1007/s11904-019-00449-2.

What is systems engineering?

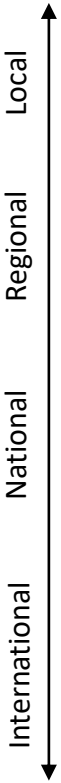
Studies that skip a step may be useful academically, but may not fully realize impact of SE

- skipping **diagnosis** risks focusing effort on low priority issues
- skipping **modeling** or **optimization** risks well-intentioned action not well suited to a health system or not optimally using energy and resources
- skipping **actionable recommendations** risks leaving exercise as purely academic, unlinked to impact

Wagner & Crocker, et al. Making smarter decisions faster: systems engineering to improve the global public health response to HIV. *Current HIV/AIDS Reviews.* 2019 Jun 13. doi: 10.1007/s11904-019-00449-2.

Tools for the 3 steps for Systems Engineering

Diagnose problems and **identify** needs



- Primary data
- Register data
- Electronic Medical Records
- Monthly summaries
- Health Information Systems
- Demographic Health Surveys
- Global estimates of disease

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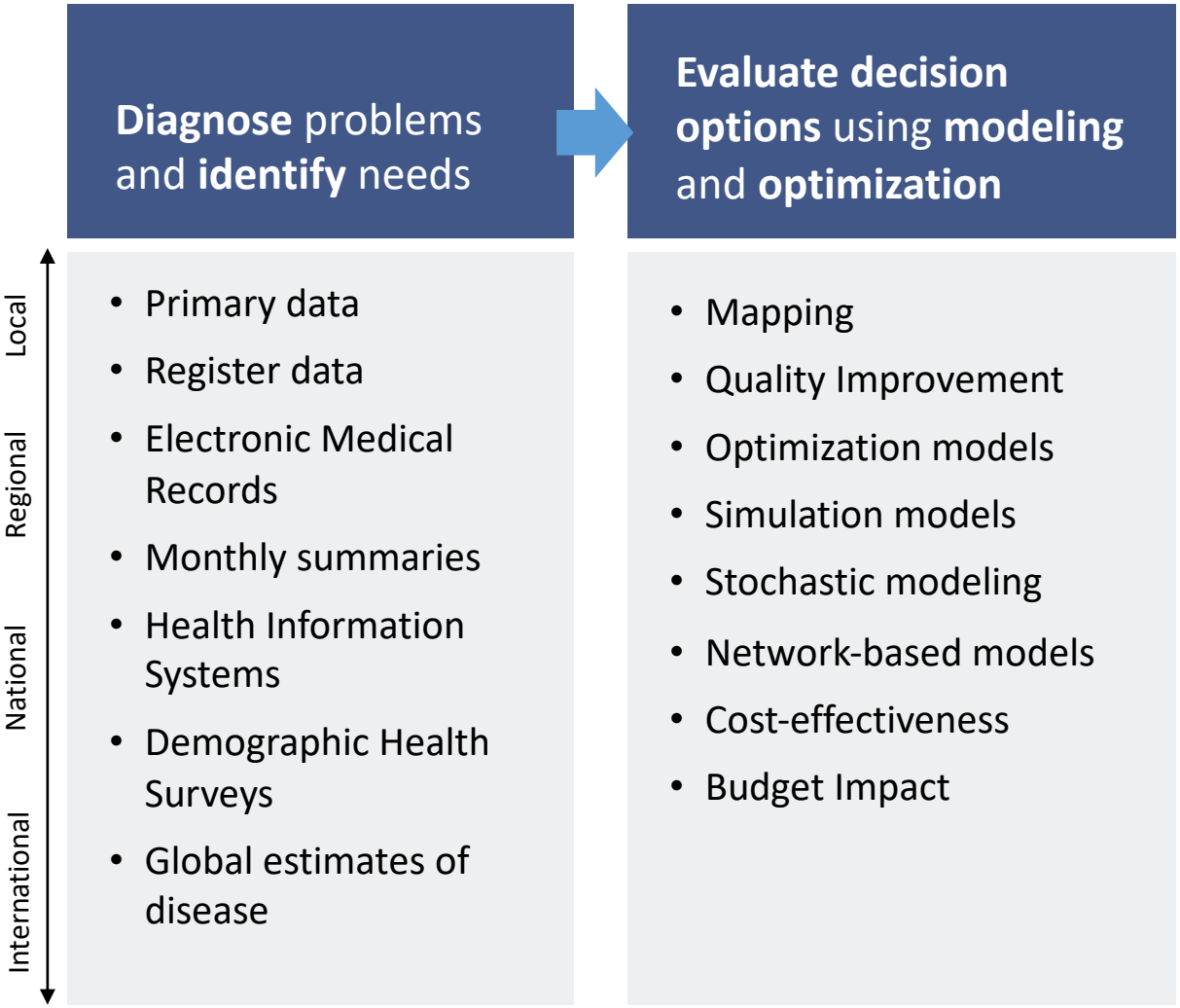
Tools for the 3 steps for Systems Engineering



*Modeling can include **qualitative** and **quantitative** models!*

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Tools for the 3 steps for Systems Engineering

Diagnose problems and **identify** needs	**Evaluate decision options** using **modeling** and **optimization**	Choose, and **recommend** or **implement** actions
• Primary data • Register data • Electronic Medical Records • Monthly summaries • Health Information Systems • Demographic Health Surveys • Global estimates of disease	• Mapping • Quality Improvement • Optimization models • Simulation models • Stochastic modeling • Network-based models • Cost-effectiveness • Budget Impact	• Staffing • Patient flow / service organization / scheduling • Facility design • Procurement • Diagnostic/treatment selection • Development prioritization • Intervention introduction • Resource allocation

Local
Regional
National
International

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Pause for Group Activity

(as feasible)

Training Teams to Use Systems Engineering

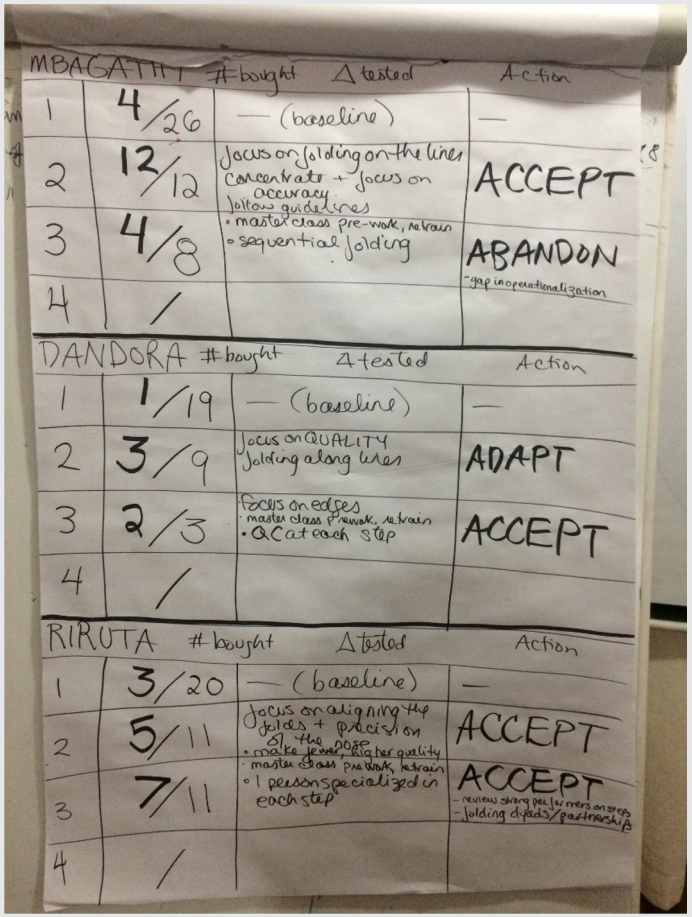
- Hands on Exercise (15 minutes)
- Goal: team members practice making a **plan, doing** it on a "small" scale, **studying** a standard measure that combines quality and quantity, and deciding on an **action**.

Paper Airplane Manufacturing

- 3 rounds of 2 minutes each
- Goal: Build as many standard paper airplanes as your team can that are high quality in 2 minutes
- “Buyer” decides how many planes to “purchase”. Only high-quality planes are bought
- In subsequent rounds: test small changes in your manufacturing process.

THINK OUTSIDE THE BOX!

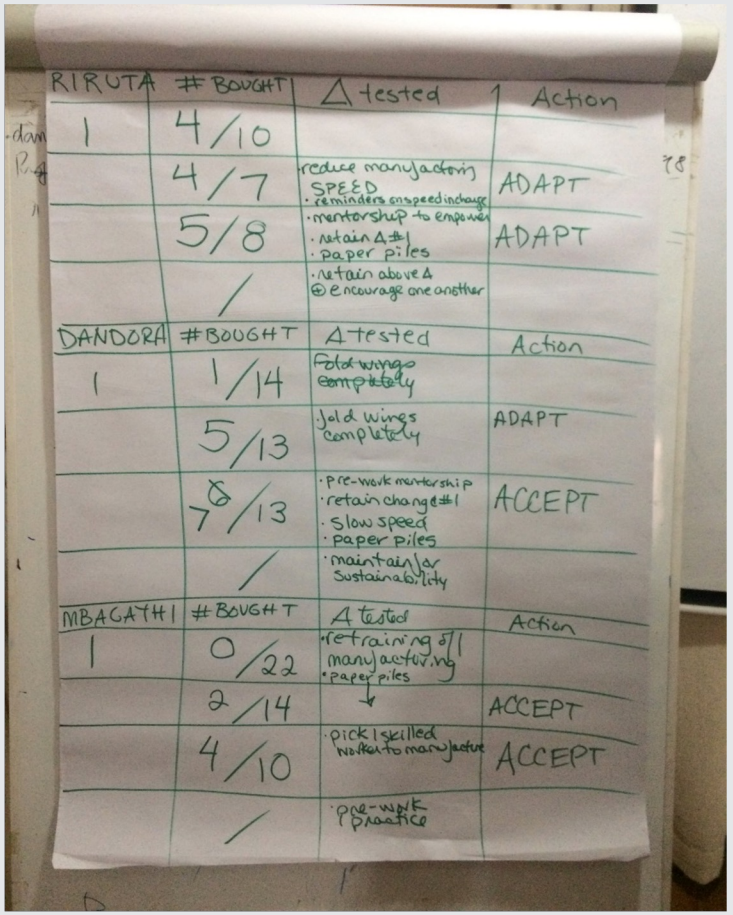
Report Out!



MBAGATHI	# bought	Δ tested	Action
1	4/26	— (baseline)	—
2	12/12	focus on folding on the lines concentrate + focus on accuracy follow guidelines	ACCEPT
3	4/8	• master class pre-work, retrain • sequential folding	ABANDON - gap in operationalization
4	/		

DANDORA	# bought	Δ tested	Action
1	1/19	— (baseline)	—
2	3/9	focus on QUALITY folding along lines	ADAPT
3	2/3	focus on edges master class pre-work, retrain • QC at each step	ACCEPT
4	/		

RIRUTA	# bought	Δ tested	Action
1	3/20	— (baseline)	—
2	5/11	focus on aligning the folds + precision of the page • make fewer, higher quality • master class pre-work, retrain	ACCEPT
3	7/11	• 1 person specialized in each step	ACCEPT - review strong performers on step - folding dyads/partnership
4	/		



RIRUTA	# BOUGHT	Δ tested	Action
1	4/10		
	4/7	reduce manufacturing SPEED • reminders on speed increase	ADAPT
	5/8	• mentorship to empower • retain Δ#1 • paper piles	ADAPT
	/	• retain above Δ ⊕ encourage one another	

DANDORA	# BOUGHT	Δ tested	Action
1	1/14	~~fold wings completely~~	
	5/13	fold wings completely	ADAPT
	7/13	• pre-work mentorship • retain change #1 • slow speed • paper piles	ACCEPT
	/	• maintain for sustainability	

MBAGATHI	# BOUGHT	Δ tested	Action
1	0/22	• retraining of manufacturing • paper piles	
	2/14	↓	ACCEPT
	4/10	• pick 1 skilled worker to manufacture	ACCEPT
	/	• pre-work practice	

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How was this activity received?

- How did it go? What was easy and predictable? What required innovation?
- Quality versus Quantity balance?
- What kinds of change did you try?

Challenges using Systems Engineering in practice

- Choice of tools stems from known experience—not what necessarily will be the best fit
- Data for diagnosing or monitoring often not available
- Competing priorities
  - Medical/nursing care versus systems improvement

In Synthesis

To bend the knowledge curve and bring us closer to the ambitious global HIV targets, we need approaches that:

- Address gaps across complex systems/cascades
- Are user-friendly and engage frontline staff
- Are flexible to context and iteratively address evolving policies and emerging challenges
- Are scalable and reinforce existing health system roles and responsibilities

NOW LET'S LEARN ABOUT THE SYSTEMS ANALYSIS AND IMPROVEMENT APPROACH (SAIA)

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