Cost-Effectiveness of PRSS and Bystander Naloxone: Analysis and a Pilot Calculator

April 2023

Sierra Castedo de Martell, PhD, MPH
Sierra.J.CastedodeMartell@uth.tmc.edu

Margaret Brannon Moore, JD, LLM, MPH, Doctoral Candidate,
Margaret.B.Moore@uth.tmc.edu

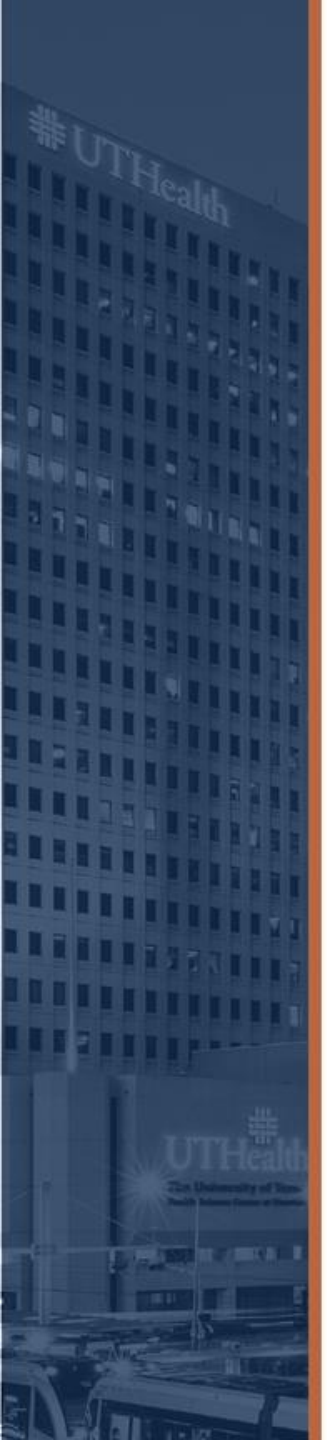
Hannah Wang, PhD, Programmer Analyst IV, Information Technology

H. Shelton Brown, III, PhD, Associate Professor and PI,

The University of Texas Health Science Center at Houston, School of Public Health

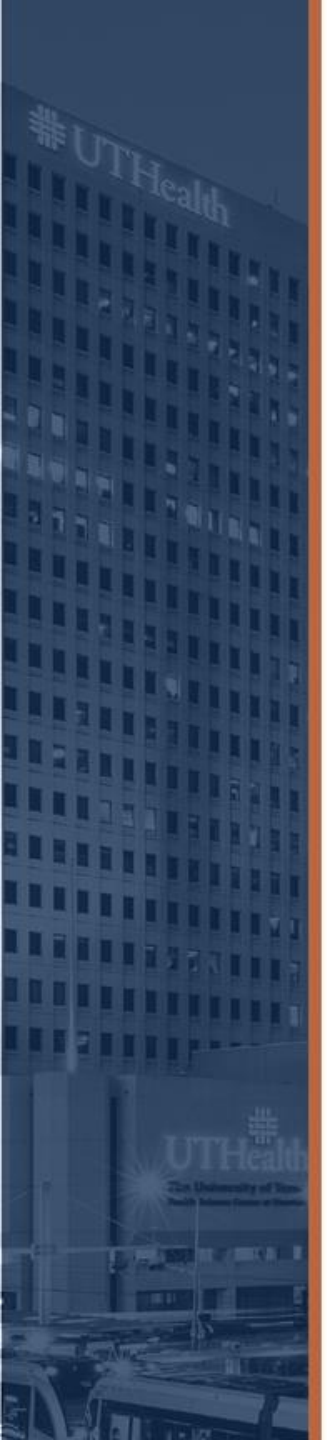
Funding from NIDA R24DA051988 Recovery Research Institute Pilot Grant

UTHealth Houston
School of Public Health



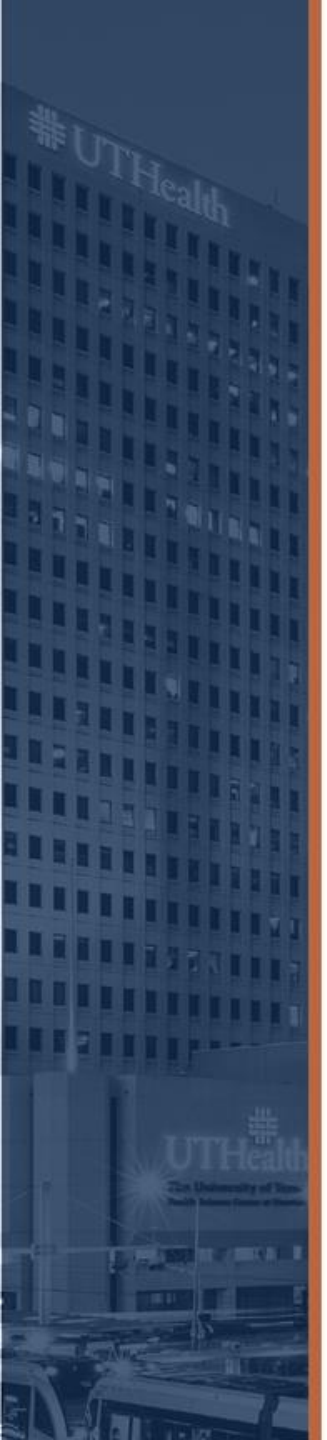
Outline for Today

- Background and goals for the future
- Learn about cost-effectiveness analysis
- PRSS cost-effectiveness analysis results
- Bystander naloxone distribution
- Using the calculator



Background

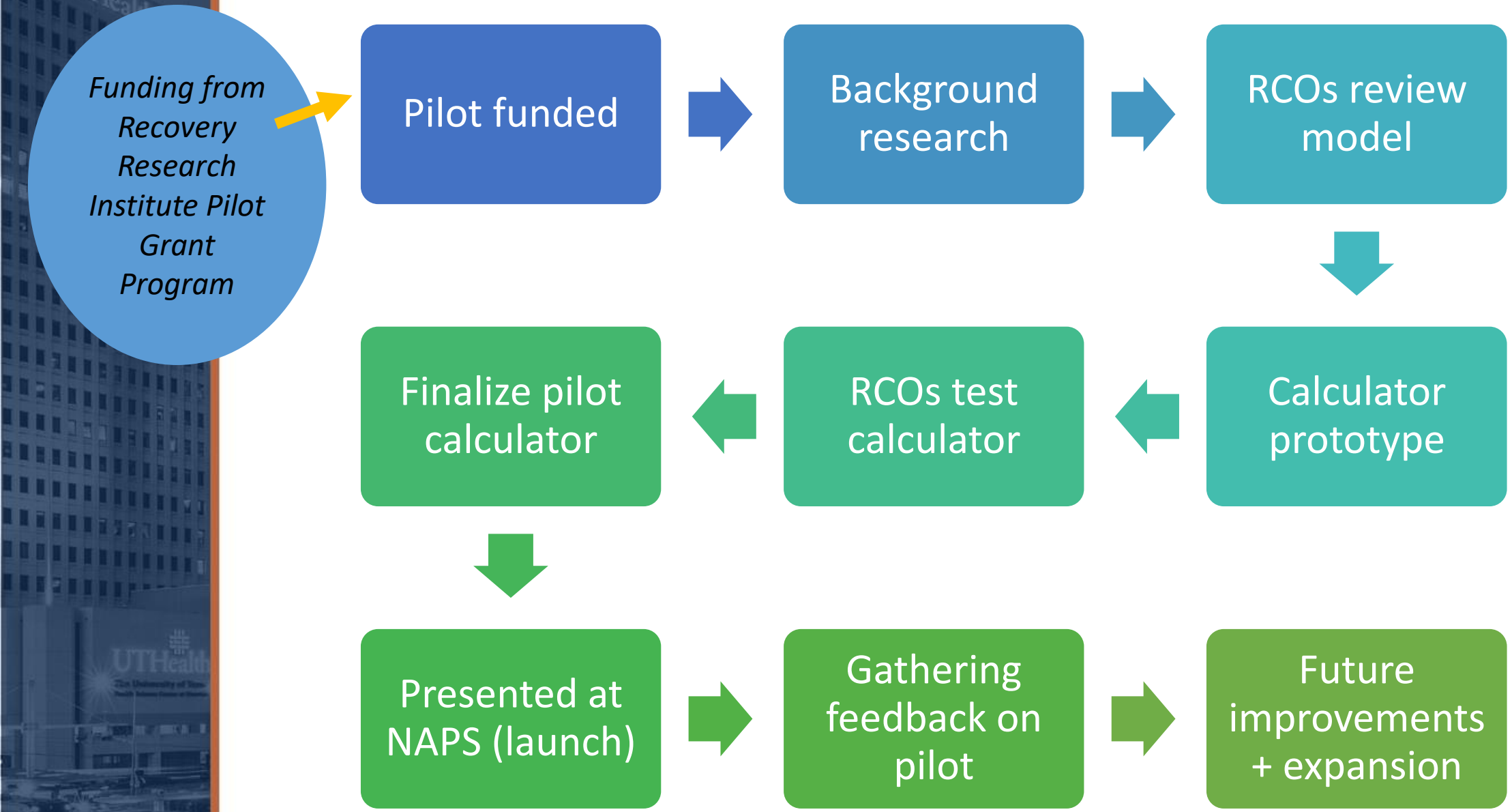
- Our ultimate goal:
  - A free, web-based multi-faceted cost-effectiveness calculator that:
    - Empowers stakeholders (RCOs, advocates, community decision-makers) to use cost-effectiveness information
    - Increases support for existing programs, build support for the adoption of programs
- Bonus goal:
  - Fill in the knowledge gaps – very little economic evaluation research on ***peer-driven*** SUD interventions



Background

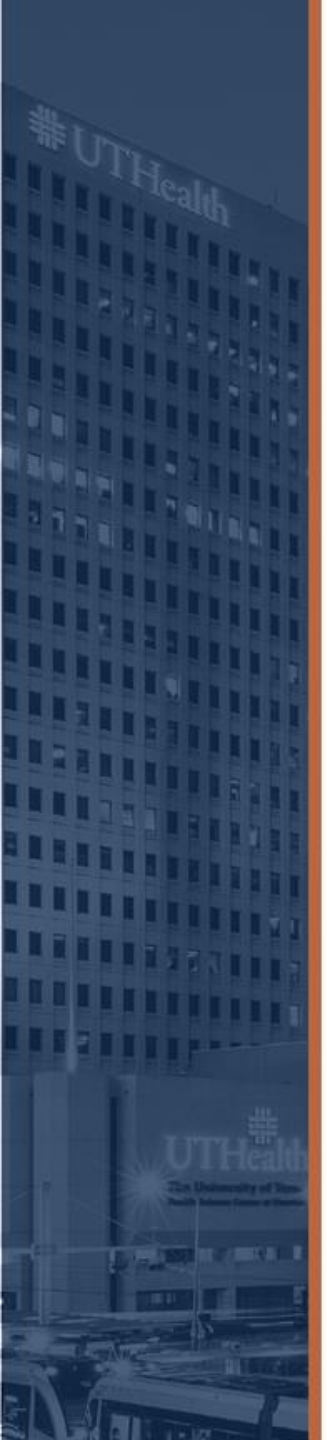
- Lots of work to do!
- Unfunded collegiate recovery program calculator here
- Pilot funding to make today's calculator (NIDA R24DA051988 Recovery Research Institute Pilot Grant):
  - Evaluate cost-effectiveness of long-term PRSS
  - Long-term PRSS + Bystander Naloxone Distribution (Coffin & Sullivan, 2013) cost-effectiveness calculator
  - Free, web-based, more accessible
- + Future funding to build out more pieces of the calculator, publication.

THANK YOU to Communities for Recovery and RecoveryATX for providing critical feedback!



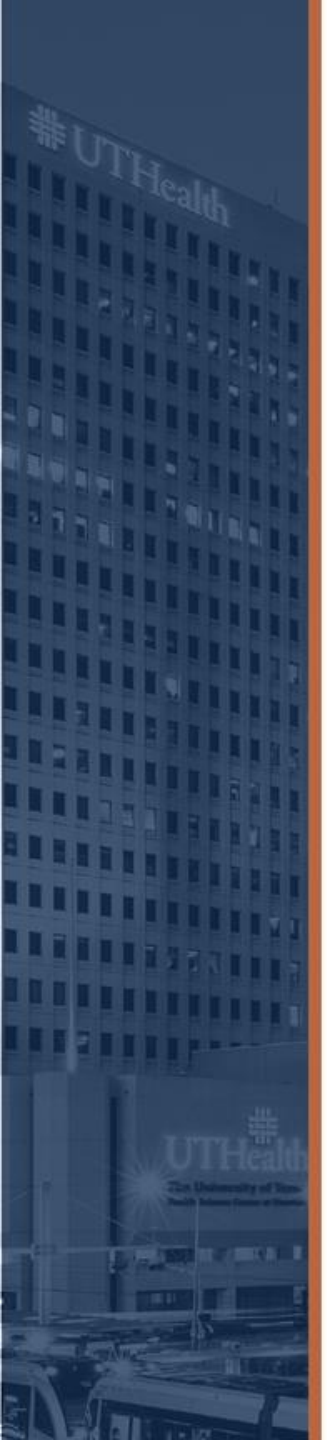
Outline for Today

- ~~Background and goals for the future~~
- Learn about cost-effectiveness analysis
- PRSS cost-effectiveness analysis results
- Bystander naloxone distribution
- Using the calculator

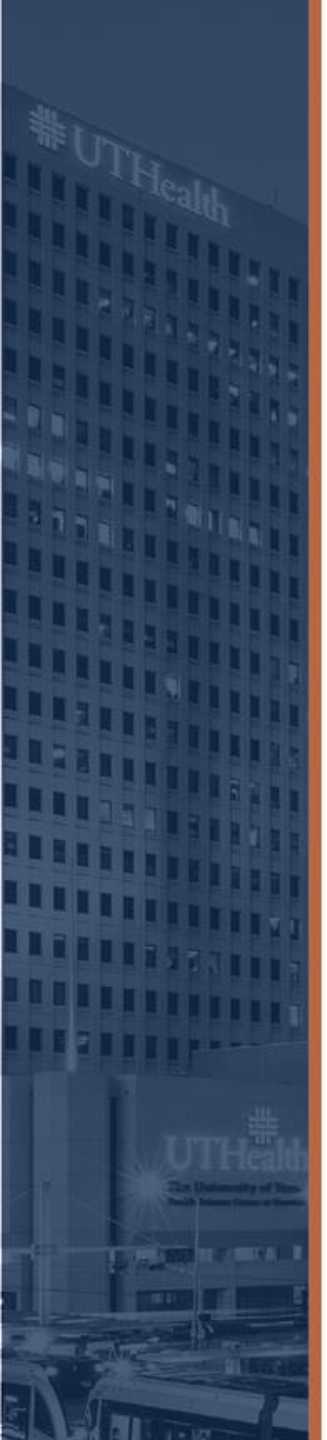


What is Cost-Effectiveness Analysis?

Moving quickly, but you have these slides and a longer version of this presentation is available on the calculator website!



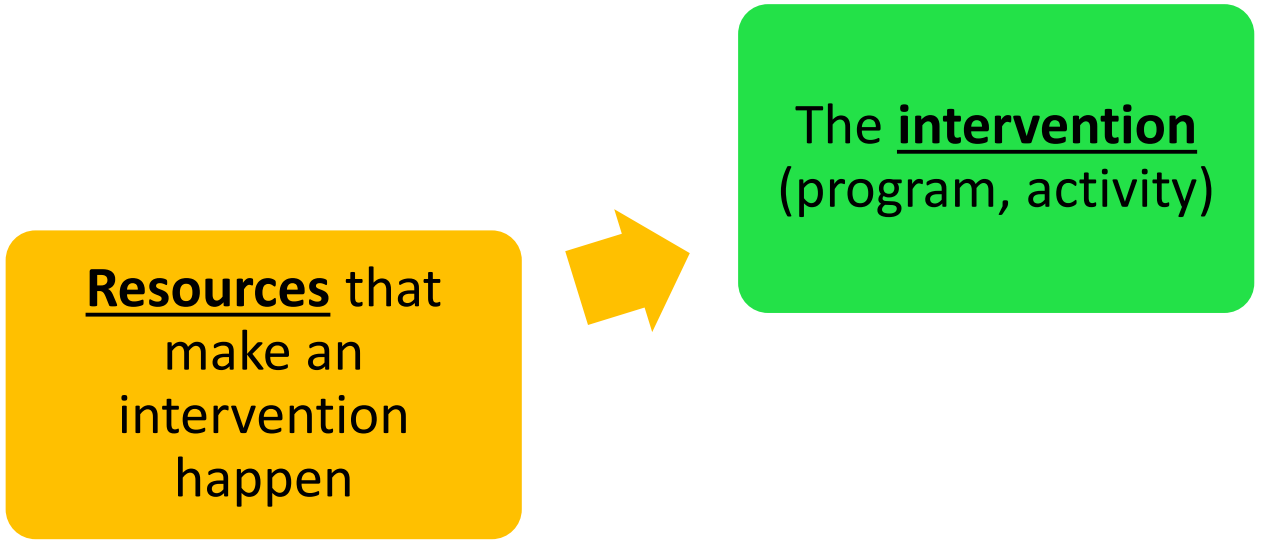
What is Cost-Effectiveness Analysis?



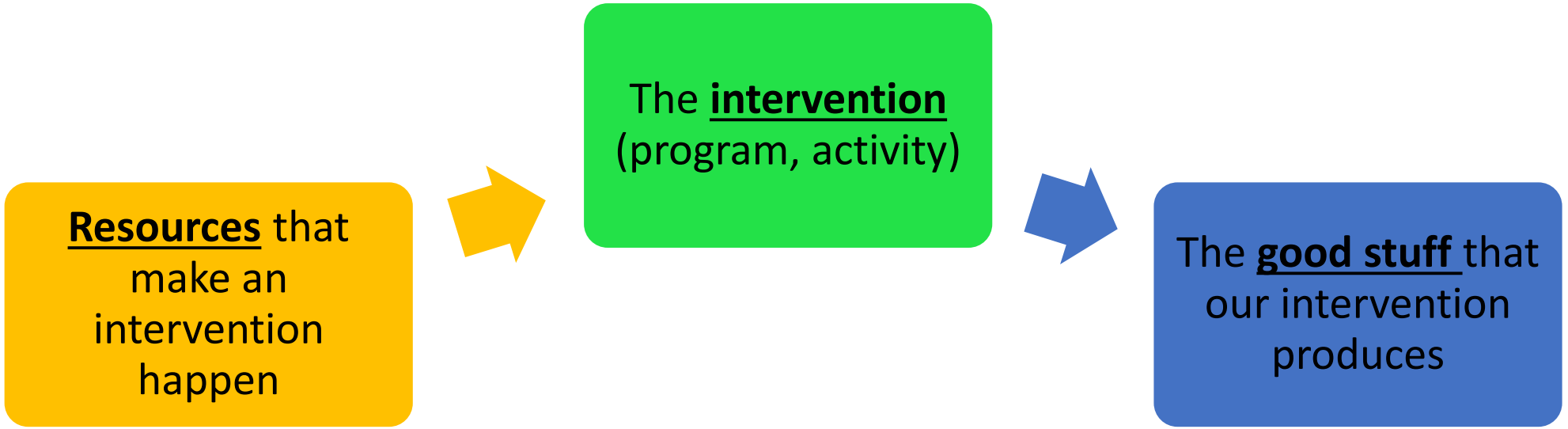
What is Cost-Effectiveness Analysis?

The **intervention**
(program, activity)

What is Cost-Effectiveness Analysis?



What is Cost-Effectiveness Analysis?



What is Cost-Effectiveness Analysis?

Resources that make an intervention happen

The **intervention** (program, activity)

The **good stuff** that our intervention produces

How balanced are resources to good stuff?

What is Cost-Effectiveness Analysis?

Cost-Effectiveness

Cost-Benefit Analysis

Return on Investment

How balanced are resources to good stuff?

What is Cost-Effectiveness Analysis?

Cost-Effectiveness

Resources have $$$, but good stuff doesn't

Cost-Benefit Analysis

Both resources and good stuff have $$$

Return on Investment

How balanced are resources to good stuff?

What is Cost-Effectiveness Analysis?

Cost-Effectiveness

Resources have $$$, but good stuff doesn't

Cost-Benefit Analysis

Both resources and good stuff have $$$

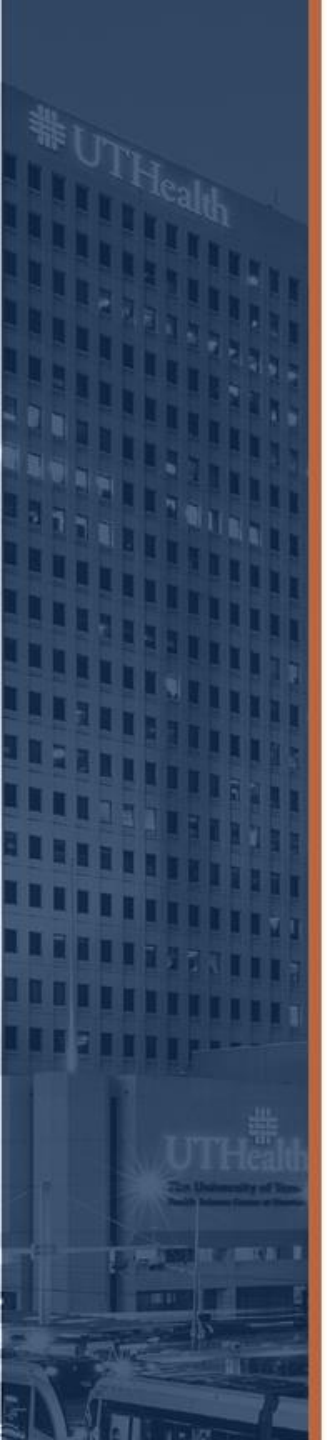
Return on Investment

How balanced are resources to good stuff?

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} =$$

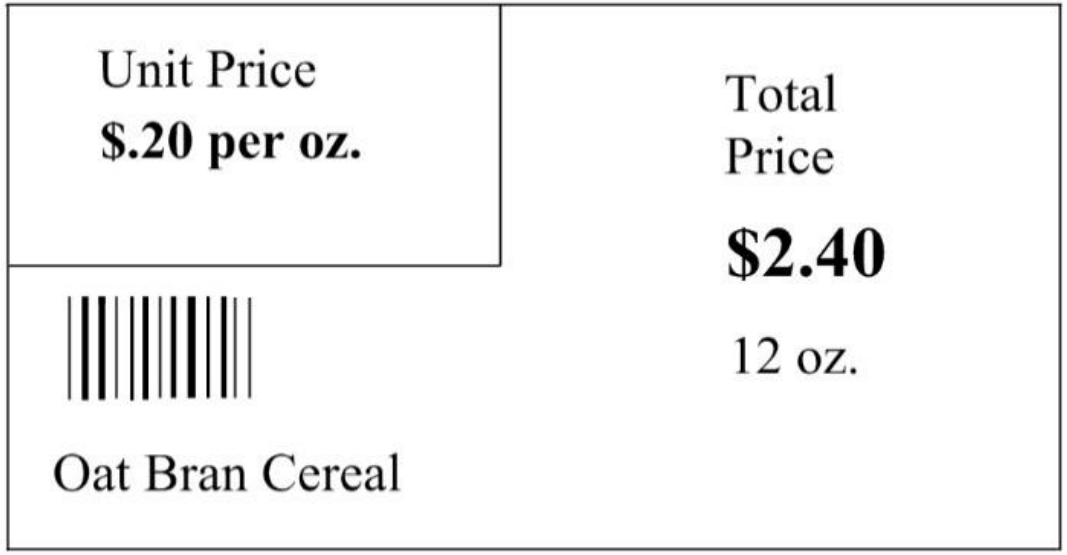
- The result is called an **Incremental Cost-Effectiveness Ratio (ICER)** and represents the cost of the intervention per unit of good stuff produced.

- Let's look at an everyday example!

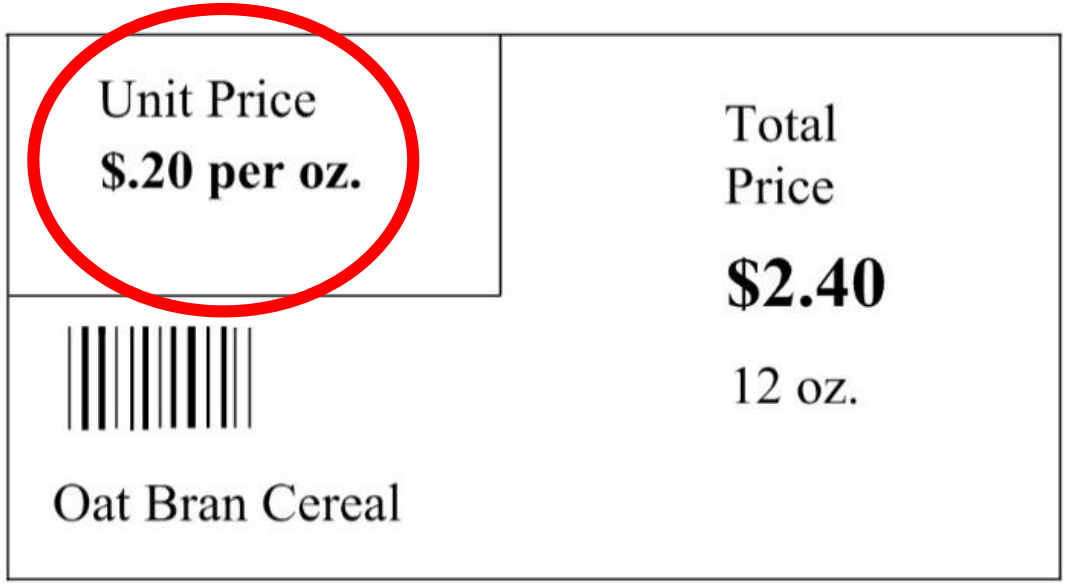


- Grocery store metaphor:
  - Compare sticker prices, but packaging or product is not identical, so we can compare price per ounce (or other unit), instead.

- Grocery store metaphor:
  - Compare sticker prices, but packaging or product is not identical, so we can compare price per ounce (or other unit), instead.
  - **For different types of cereal.**



- Grocery store metaphor:
  - Compare sticker prices, but packaging or product is not identical, so we can compare price per ounce (or other unit), instead.
  - **For different types of cereal.**



- Grocery store metaphor:
  - Compare sticker prices, but packaging or product is not identical, so we can compare price per ounce (or other unit), instead.
  - Or for the exact same product and brand, but different sizes (economies of scale)

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} =$$

- The result is called an **Incremental Cost-Effectiveness Ratio (ICER)** and represents the cost of the intervention per unit of good stuff produced.

- Examples: $100 per person quitting tobacco, $20 per averted sick day, or $500 per quality-adjusted year of life added.

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

- Compare to current standard of care, often called "treatment as usual."
- Example: Intervention is a new vaccine, treatment as usual is the old vaccine.

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

- **Effects (the good stuff)**:
  - Don't assign $$$
  - Always have to do QALYs (quality-adjusted life year)

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

- **Effects (the good stuff)**:
  - Don't assign $$$
  - Always have to do QALYs (quality-adjusted life year)

4 years perfect health
QOL weight = 1
4 x 1 = 4

= 4 QALYs added

4 years at half of perfect health
QOL weight = 0.5
4 x 0.5 = 2

= 2 QALYs added

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

- **Effects (the good stuff)**:
  - Don't assign $$$
  - Always have to do QALYs (quality-adjusted life year)
    - Can compare to past studies – very useful to researchers
  - **Should** also do something useful to stakeholders and people who can use this information most
    - Examples: per additional person in recovery, per life saved, etc.

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

- **Costs:** Two perspectives (at least)
  - Societal

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

- **Costs:** Two perspectives (at least)
  - Societal

  - Health System – flexible, meaningful

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Recap:

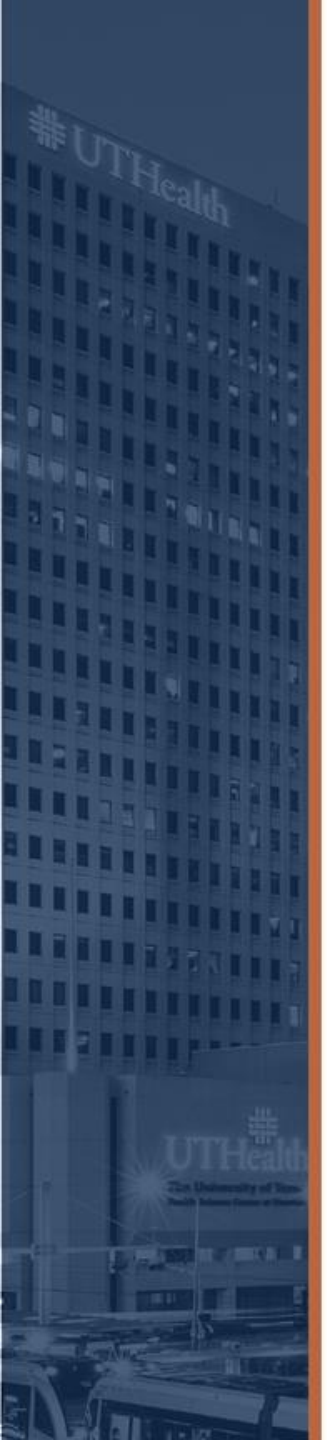
- **Effects:**
  - No $$$
  - QALY and ideally something meaningful
- **Costs:**
  - All $$$
  - Societal and health system perspectives

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Recap:

- **Effects:**
  - No $$$
  - QALY and ideally something meaningful
- **Costs:**
  - All $$$
  - Societal and health system perspectives

So we will have at least 2 ICERs, maybe 4



$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

- It might look like one number (e.g. “$10,000”) but remember that it is actually a ratio ($10,000/1), and that the 1 in the denominator represents **one unit of the good stuff.**
  - Just like the price per ounce in our grocery store example!

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

- Compare to **“willingness to pay”** or to some other threshold.
  - Standard: $50,000; $100,000; $200,000 per QALY
  - + A number that is meaningful in context
    - Example: Cost of specialty SUD treatment, cost of ICU care, etc.

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

- If ICER is **less than** the willingness to pay threshold, then it is **cost-effective!**

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

- If ICER is **less than** the willingness to pay threshold, then it is **cost-effective!**

"Easier to pass" → "Harder to pass"

$200,000 threshold	$100,000 threshold	$50,000 threshold	Smaller, more meaningful threshold (e.g. cost of treatment episode)

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

- If ICER is **less than** the willingness to pay threshold, then it is **cost-effective!**
- Can be cost-effective to one threshold, but not to another (Example: “cost-effective to $50k, but not compared to the cost of ICU care”)

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

- If ICER is **negative** because it costs less and is more effective, then the intervention is BOTH **cost-saving AND cost-effective.**
- Because , $\frac{intervention\ costs\ less,\ so\ negative}{intervention\ does\ more\ good,\ so\ positive} = \text{-ICER}$

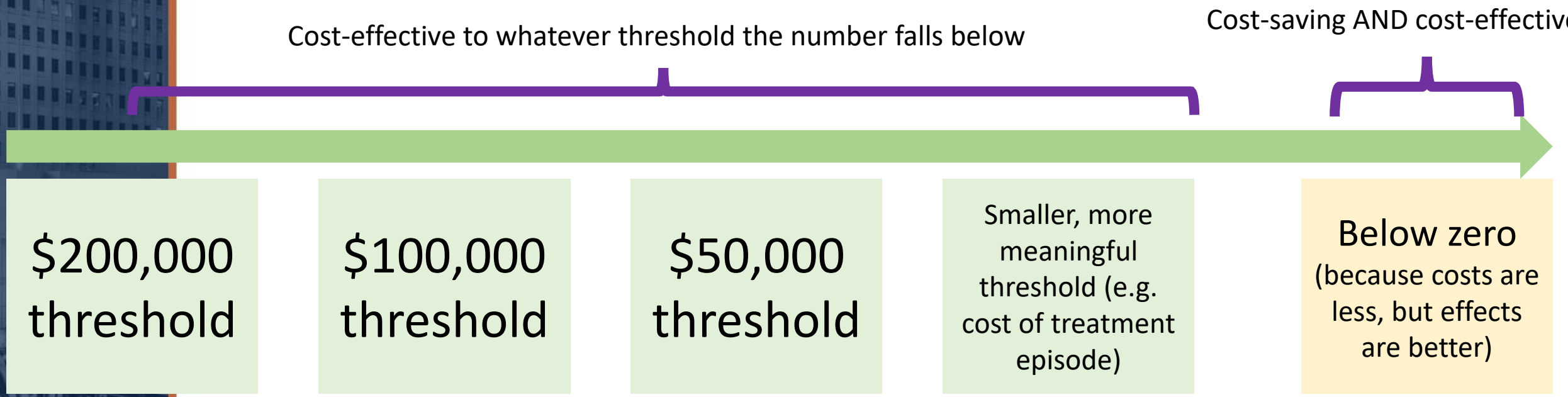
$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

Interpreting ICER (the result)

- The intervention does NOT have to be cost-saving to be cost-effective!

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} = \text{ICER}$$

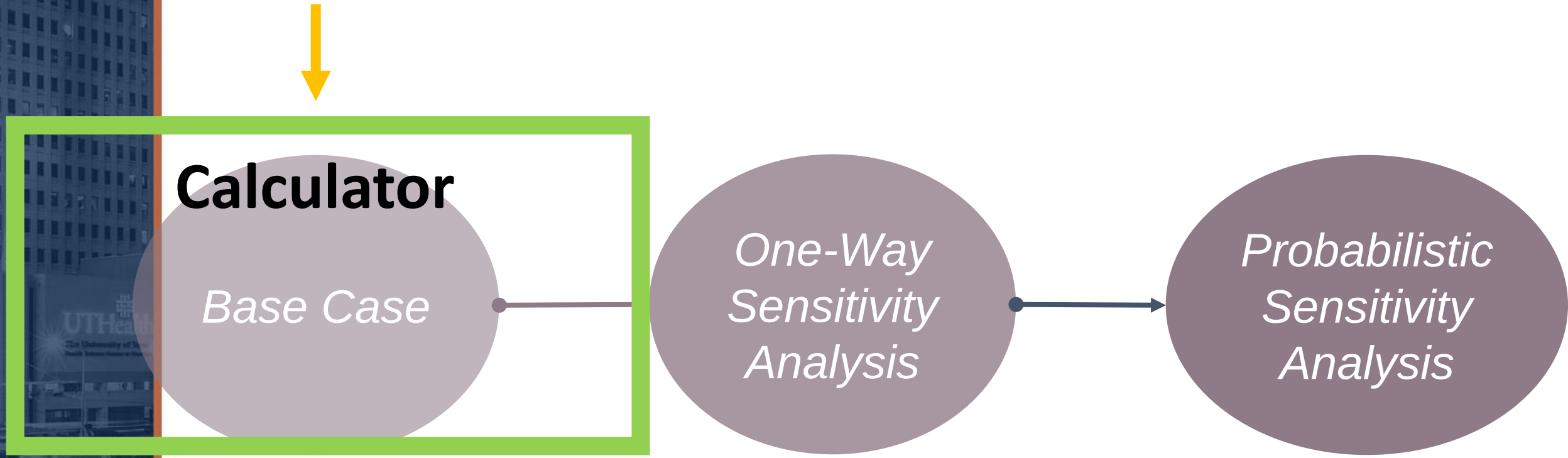
Interpreting ICER (the result)



Dealing with Uncertainty

Dealing with Uncertainty

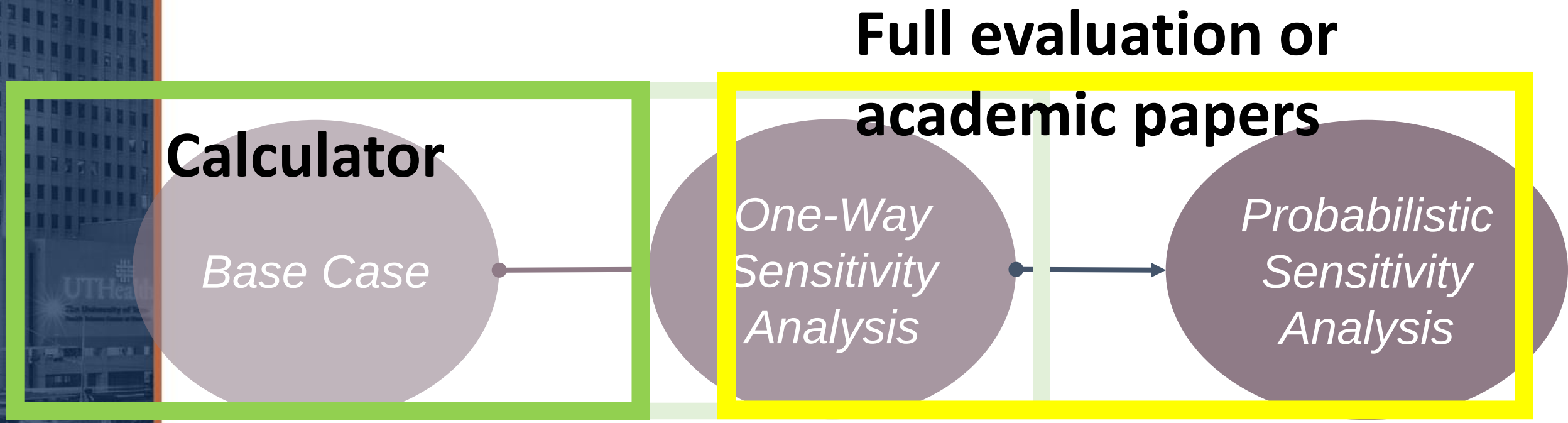
Base Case: Our basic model for a set time period. We're not looking at any uncertainty here, we're just using whatever numbers we have, usually an average or a median.



Dealing with Uncertainty

One-Way Sensitivity Analysis: Change one input at a time: how does cost-effectiveness change when input changed (for example: more participants, higher cost of naloxone, better retention of participants)

Dealing with Uncertainty



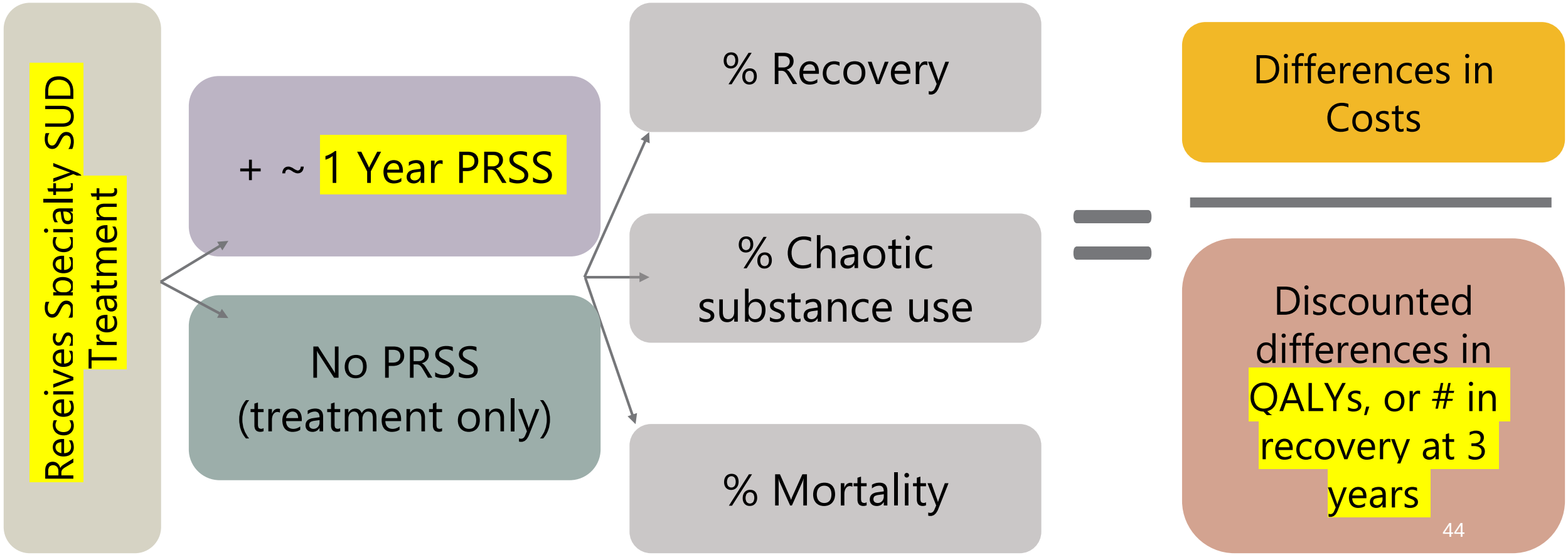
Outline for Today

- ~~Background and goals for the future~~
- ~~Learn about cost-effectiveness analysis~~
- PRSS cost-effectiveness analysis results
- Bystander naloxone distribution
- Using the calculator

PRSS Model

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} =$$

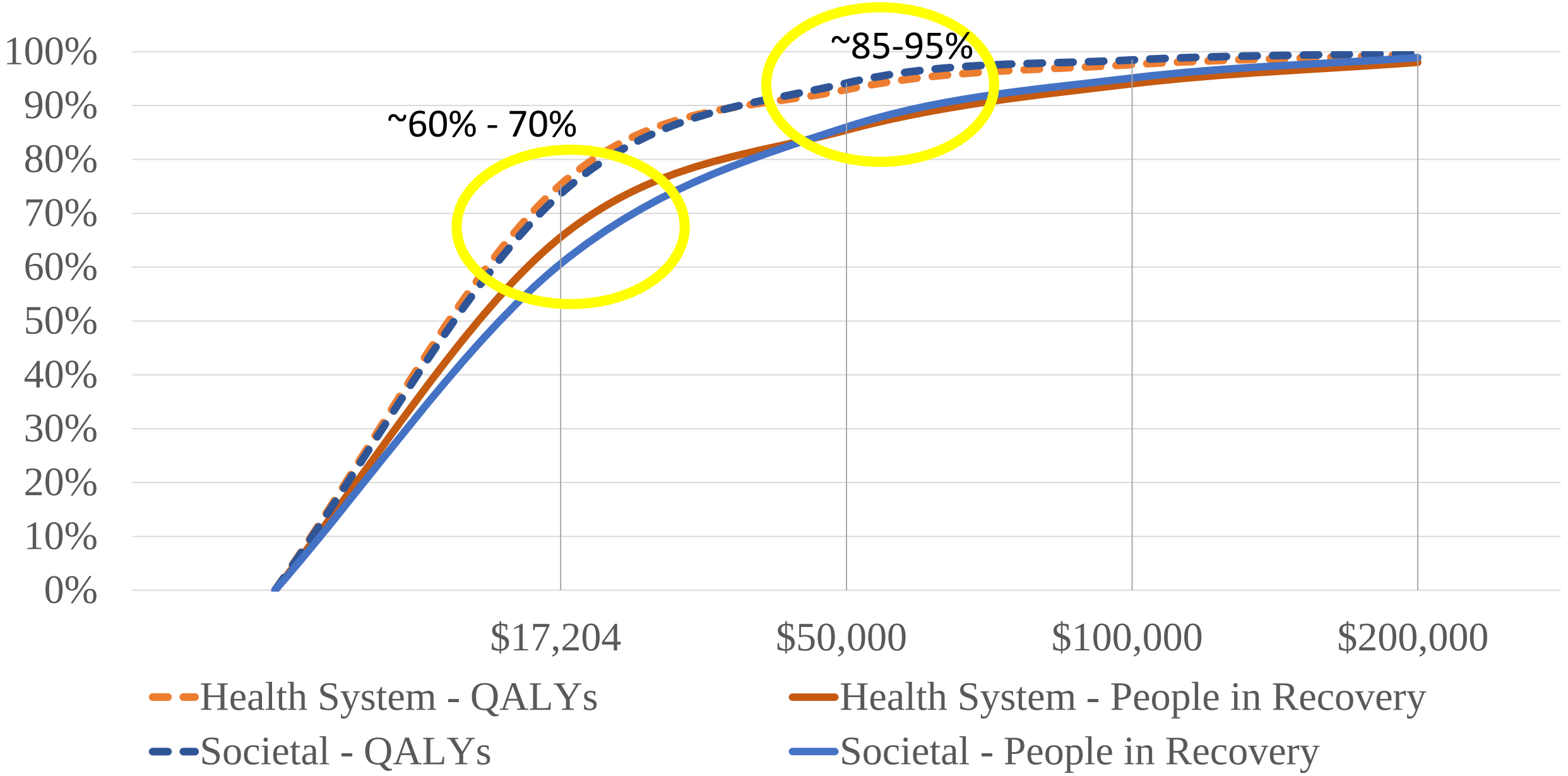
Incremental Cost-Effectiveness Ratio



Results: Base Case – United States

PRSS Effects	**571,927** or 2.25% more QALYs than treatment only	**319,404** or 40.75% more people in recovery than treatment only
Health System Perspective	**Cost-effective to all thresholds**	$5,898.60 per QALY	$10,562.08 per person in recovery
Societal Perspective	**Cost-effective to all thresholds**	$3,421.58 per QALY	$6,126.72 per person in recovery

Results: Probabilistic Sensitivity Analysis



Key Take-Aways

- PRSS are cost-effective across wide variety of circumstances
- One-way sensitivity analysis reveals peer worker pay and service utilization has less effect on cost-effectiveness than factors like PRSS effectiveness and retention.
  - Impact efficiency through program improvement – not through depressing wages or limiting service utilization.

Full results, tables of parameters, and formulas here:

https://bit.ly/SCM12023

Outline for Today

- ~~Background and goals for the future~~
- ~~Learn about cost-effectiveness analysis~~
- ~~PRSS cost-effectiveness analysis results~~
- Bystander naloxone distribution
- Using the calculator

Bystander Naloxone Distribution Model

Coffin & Sullivan, 2013

- Previous cost-effectiveness analysis of bystander naloxone distribution (just give naloxone to anyone who might witness an overdose).
- Updated to 2019 parameters and converted to a component of the calculator.

Bystander Naloxone Distribution Model

$$\frac{Cost\ of\ Intervention - Cost\ of\ Treatment\ as\ Usual}{Intervention\ Effect - Treatment\ as\ Usual\ Effect} =$$

Incremental Cost-Effectiveness Ratio

Experiences an opioid overdose

A bystander gives naloxone they got from your RCO*

EMS gives naloxone

% Survives overdose

% Mortality

=

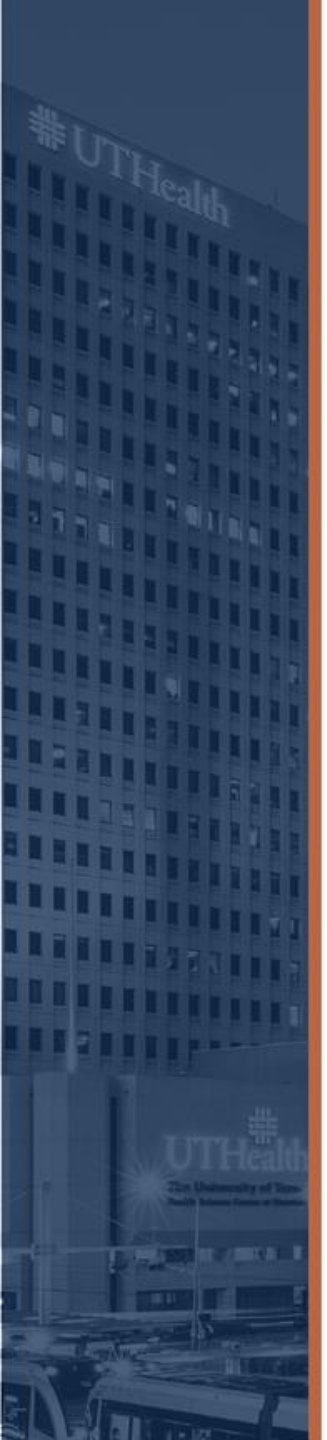
Differences in Costs

Discounted differences in QALYs, or # who survive the overdose

*Model includes probabilities of several factors, including presence of naloxone, administration of naloxone, EMS transport, etc.

Outline for Today

- ~~Background and goals for the future~~
- ~~Learn about cost-effectiveness analysis~~
- ~~PRSS cost-effectiveness analysis results~~
- ~~Bystander naloxone distribution~~
- Using the calculator 



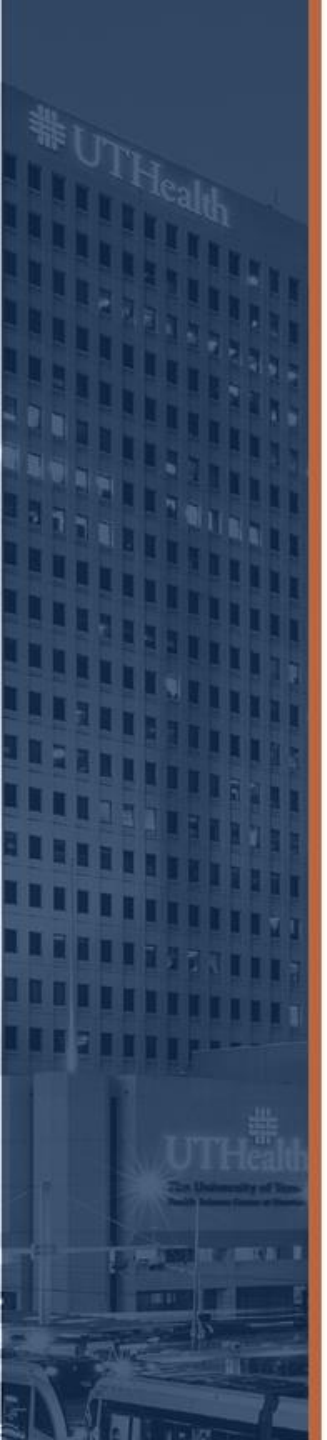
Inputs you will need - PRSS

In line with **Management Systems** CAPRSS Standard.

- When in doubt, assume we are talking about a 1 year period.
- Number of people served (in 1 year: last year, average per year over 5 years, etc.)
- % participants retained in long-term coaching to graduation/completion or 1 year
- Of those retained, % in recovery (calculator based on abstinence AND sustained reduced use), will work for stricter or slightly more permissive definitions, as long as recovery is something different from chaotic substance use.
- Average age of participants
- Average number of engagements during the course of long-term PRSS (number of times they met with their peer worker 1:1, include brief engagements and longer ones, each time = 1).
- Then tell us the average length of each of those engagements. If there's paperwork after each engagement, include that in the average length of time. Report in minutes.
- Hourly pay for peer workers delivering long-term PRSS.
    - Annual salary / 52 / 40. Add fringe if appropriate. If it's a flat amount, add it to the salary. If it's a percentage, you can do: Hourly pay x (1 + fringe percent as a proportion). So if fringe is 35%, and my hourly pay is $22, then $22 x (1+0.35) = hourly pay with fringe.

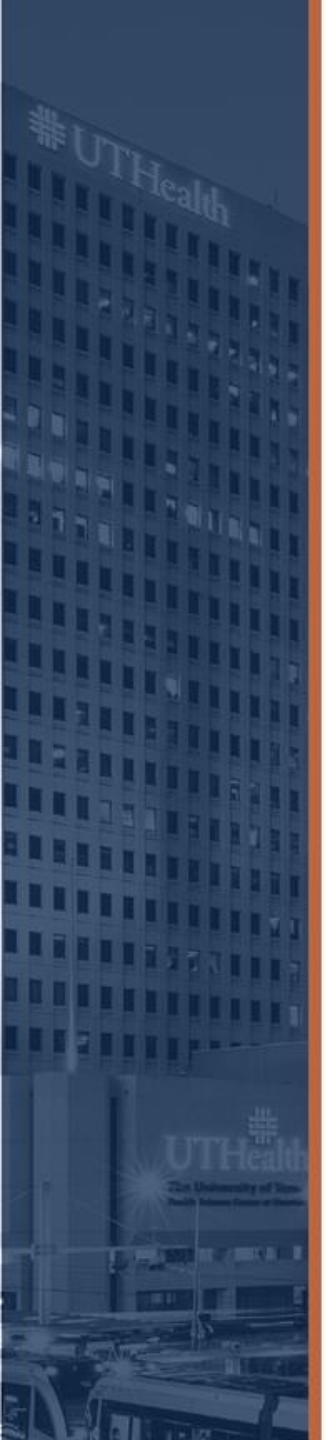
Inputs you will need - Naloxone

- We’re working on changing the first input. As of today (2/8/23): Percentage of your participants you want to give naloxone to. (Assumes that 20% already have it, so if you want to give it to every participant, enter 80%).
  - Changing to: Enter the number of naloxone kits you wish to distribute.
- The cost of naloxone (nasal spray)
  - Allows you to account for any special deals you may have arranged, if the naloxone was donated and thus free to you, if naloxone price increases, etc.
  - If you don’t know, just use the default values.



Let’s look at the calculator!

https://go.uth.edu/cea



Coming Changes

- Pilot calculator, so a work in progress – please excuse our dust (and any typos you might find!)
- Will update how the calculator works as new information becomes available and as we get feedback.
- Working on tackling more pieces of the calculator, and adding other kinds of interventions that may or may not be relevant to your RCO or RCC.
- Hope to add more real-world scenarios: % who came to you from treatment, % who go to treatment because of engagement with PRSS, % who bypass treatment because of PRSS. (For now, post-treatment PRSS is a **very conservative** estimate: real cost-effectiveness is likely even better.)

Additional feedback or questions?

Please take our feedback survey!

https://redcap.link/calculator

H.Shelton.Brown@uth.tmc.edu
Sierra.J.CastedodeMartell@uth.tmc.edu
Margaret.B.Moore@uth.tmc.edu