Economic Analysis for Adding Newborn Screening for GAMT deficiency

Washington State Board of Health

September 8, 2023

Background

- The Board creates a technical advisory committee (TAC), which then reviews available information and research to evaluate a candidate condition and compare to a set of criteria established by the Board

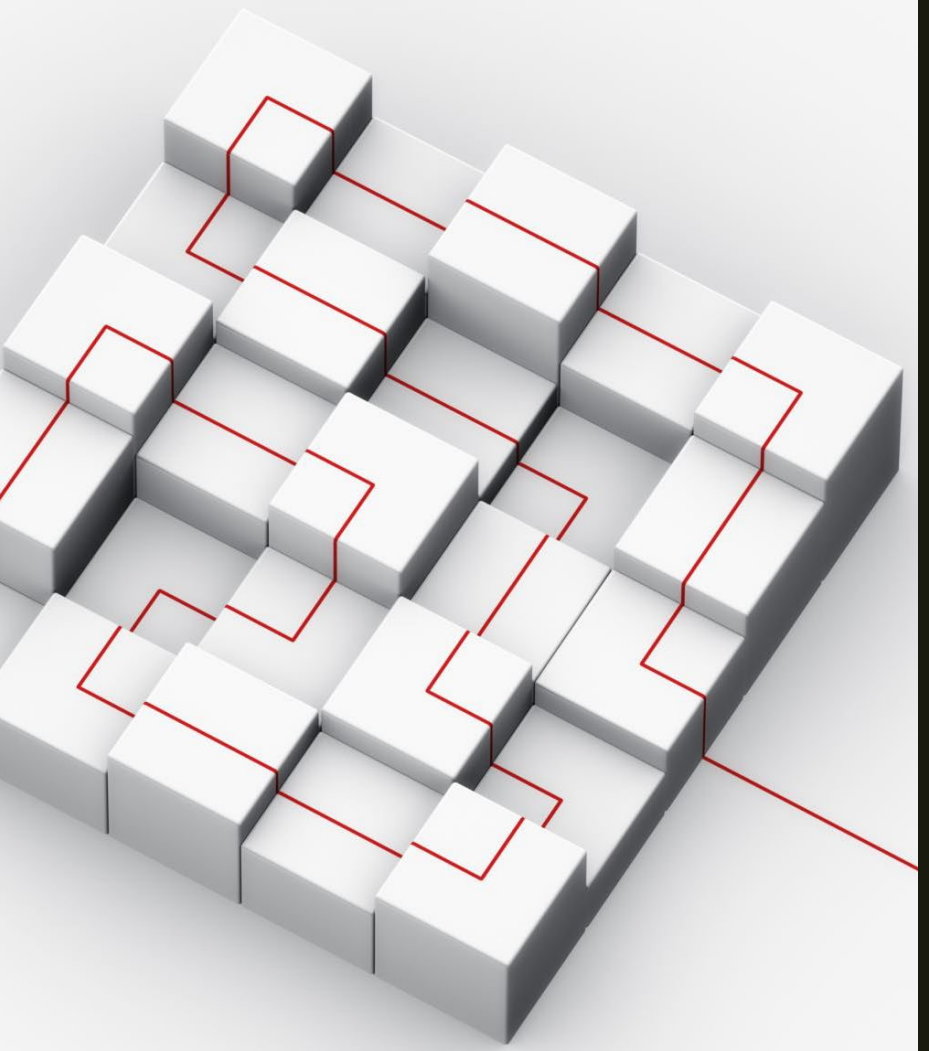
- **Criterion #5:**
  - **Cost-benefit/Cost-effectiveness:** The outcomes outweigh the costs of screening
  - All outcomes, both positive and negative, need to be considered for analysis

Criterion #5

- Important considerations for economic analysis:
  - The prevalence of the condition among newborns
  - The positive and negative predictive values of the screening and diagnostic tests
  - Variability of clinical presentation by those who have the condition
  - The impact of ambiguous results: for example, the impact on families and caregivers
  - Adverse effects of screening

Guanidinoacetate methyltransferase (GAMT) deficiency

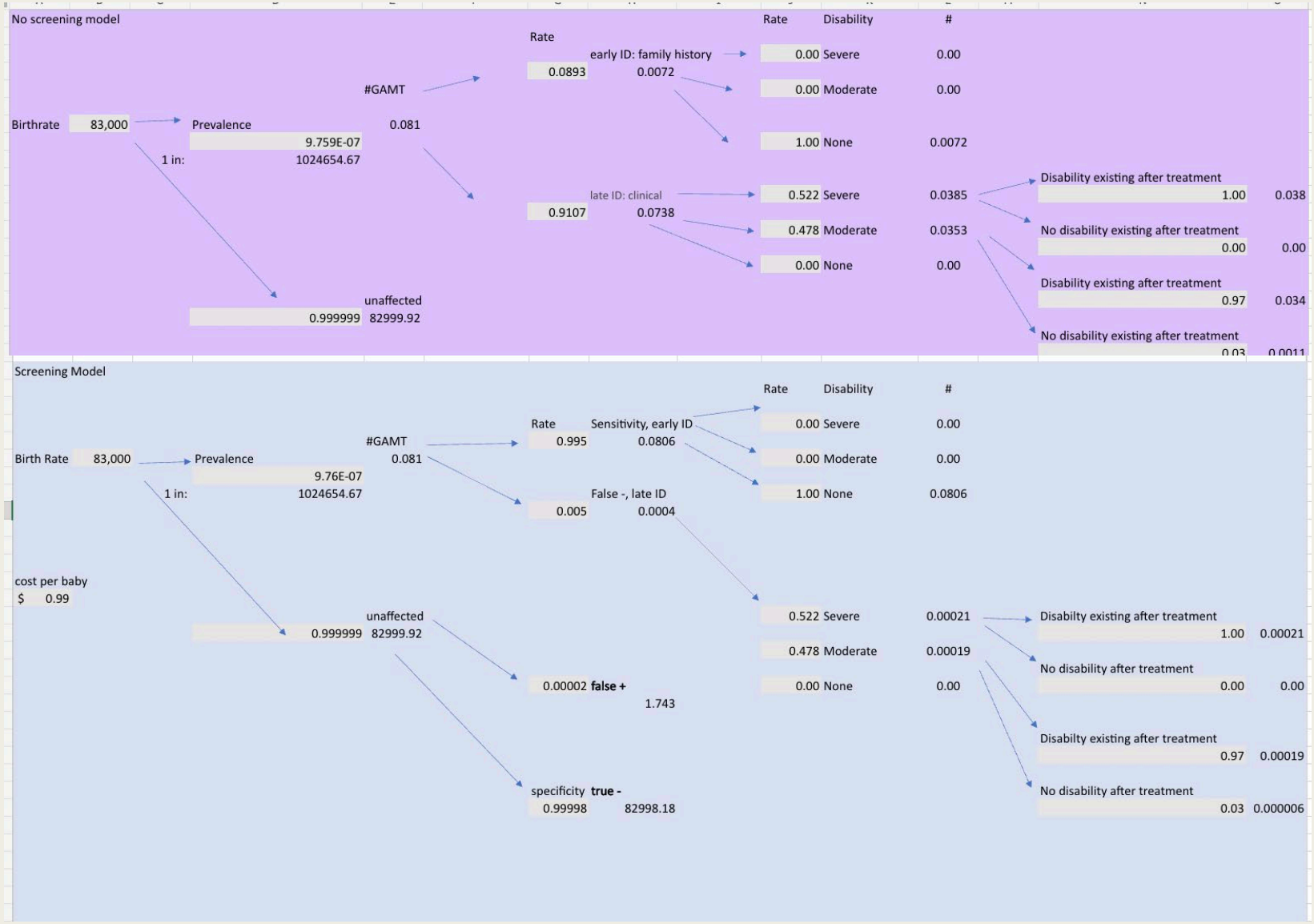
- A rare, autosomal recessive disorder
- Inhibits the production of creatine, along with elevated levels of guanidinoacetate (GUAC)
- Leads to disability:
  - Intellectual disability, seizures, motor defects
  - Can be severe or moderate
- Signs usually do not present until at least 3 months of age: newborns asymptomatic



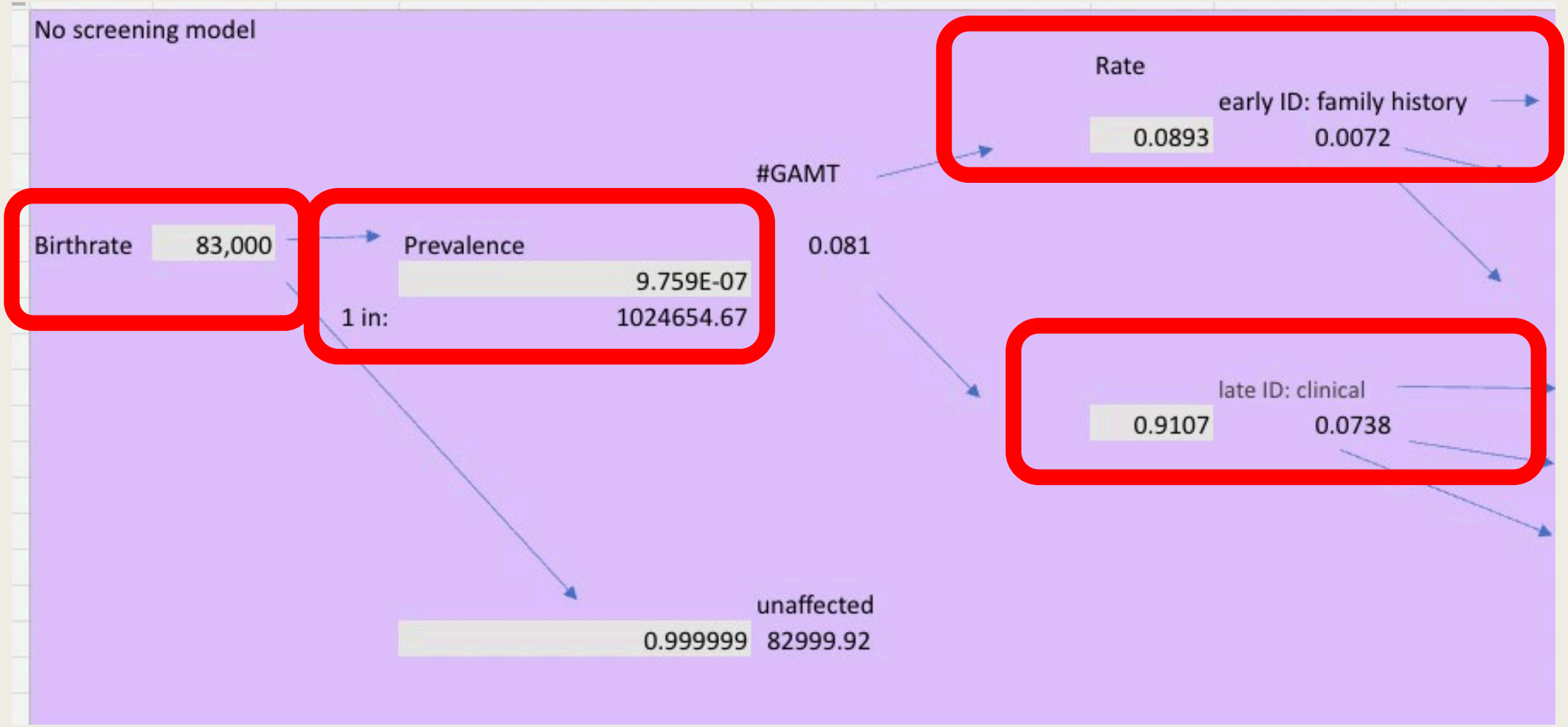
Overview of Benefit-Cost Analysis

- Decision tree construction: comparison of the current, No Screening Model and a new, Screening Model
- Data:
  - Existing, published literature
  - States that currently screen for GAMT deficiency
  - Expert, clinical opinion
- Sensitivity Analysis: comparing to higher and lower parameters to challenge the model

Decision Tree Model



No Screening Model



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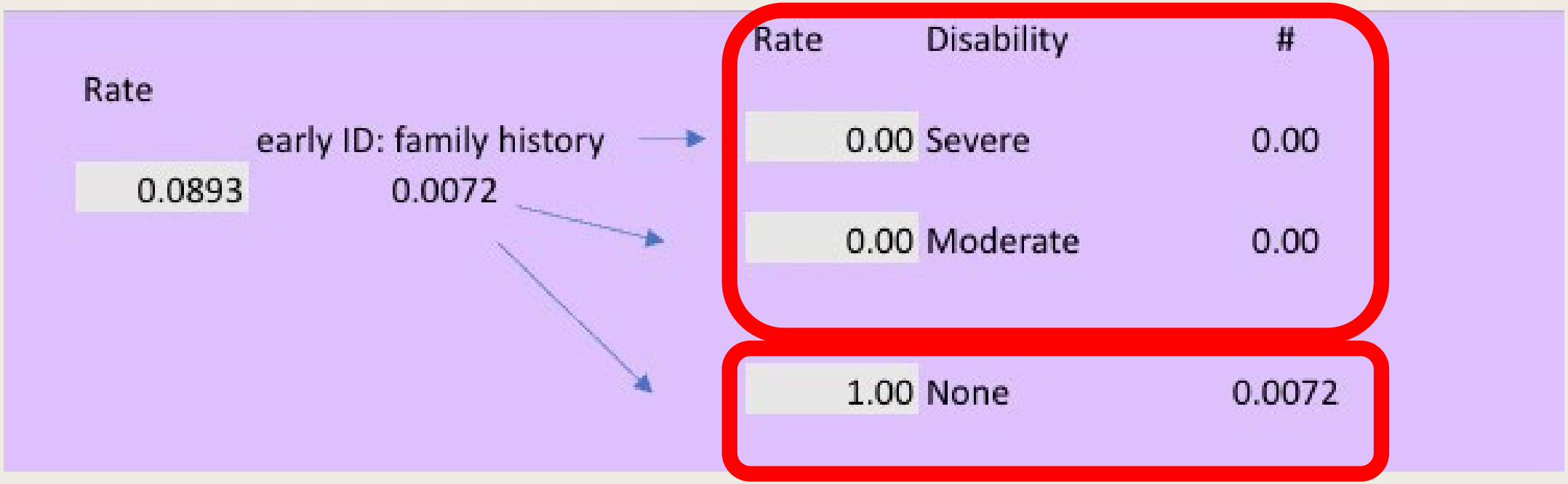

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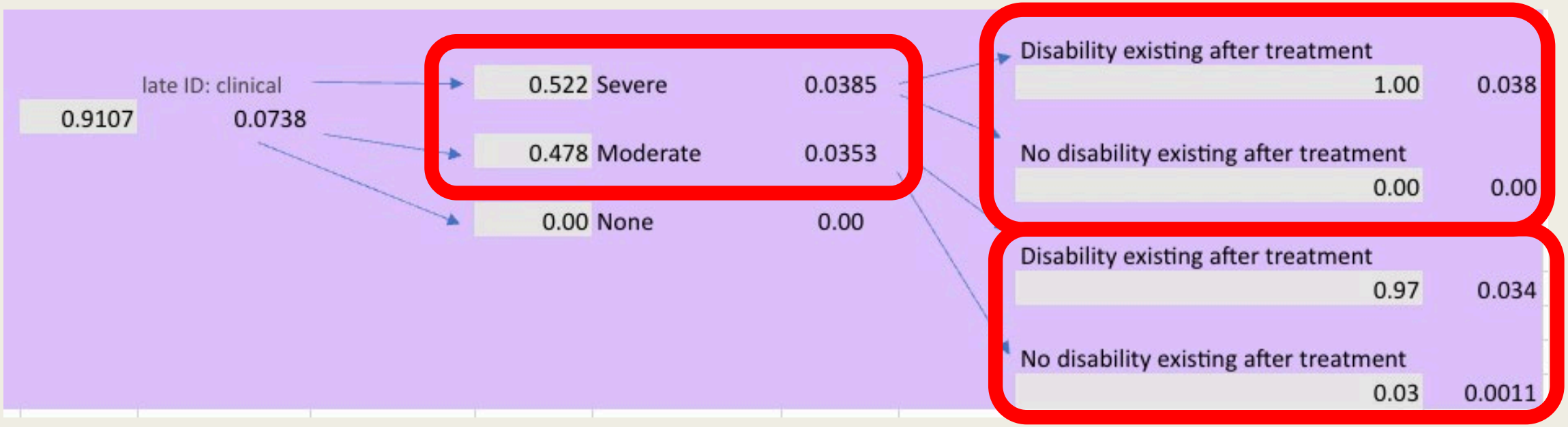
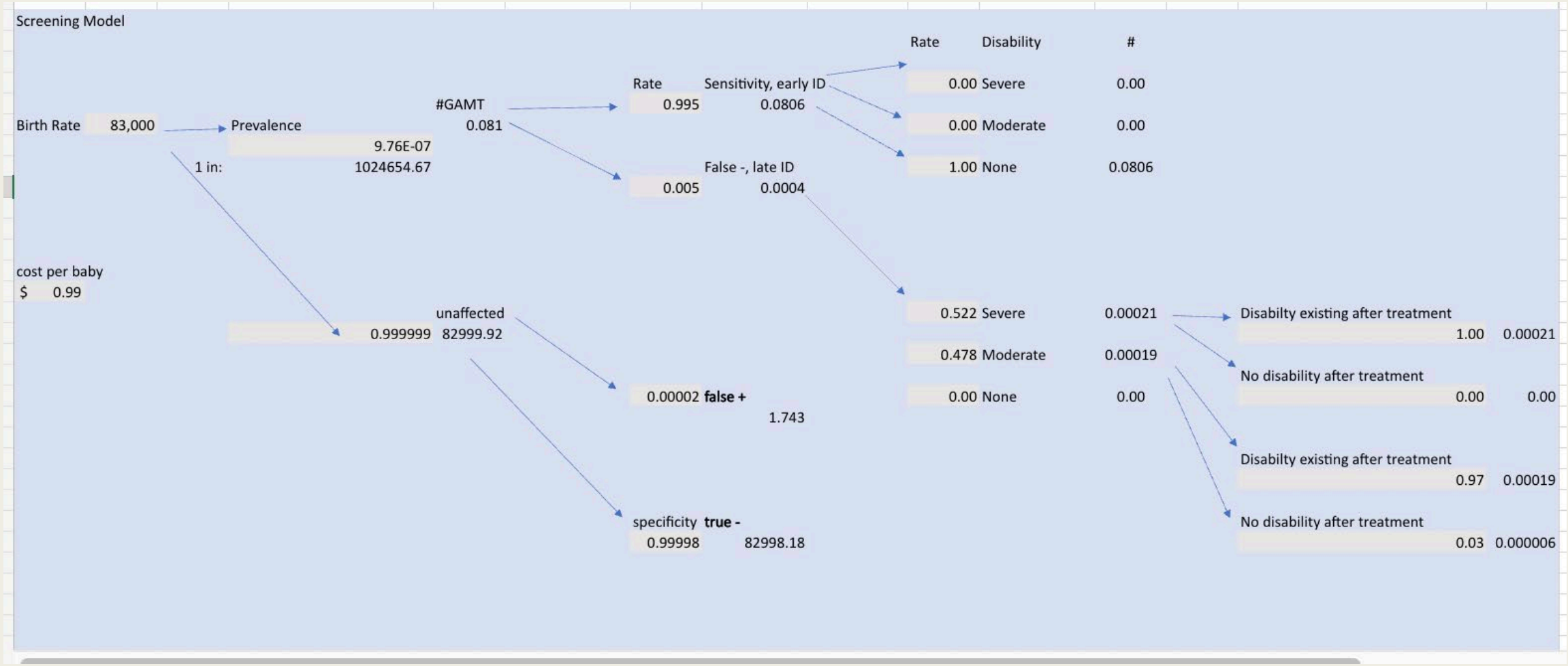


Newborn Screening Model



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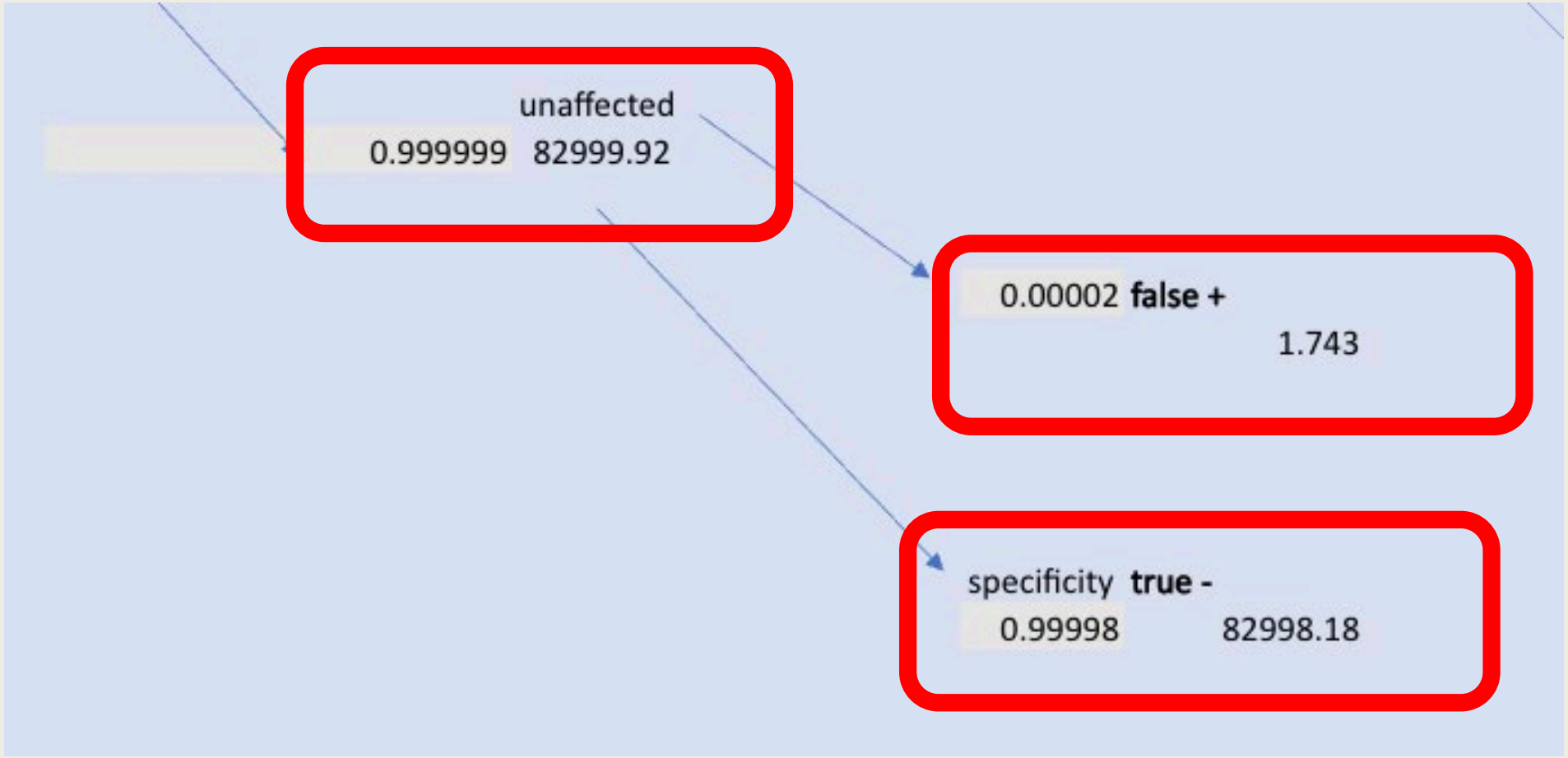

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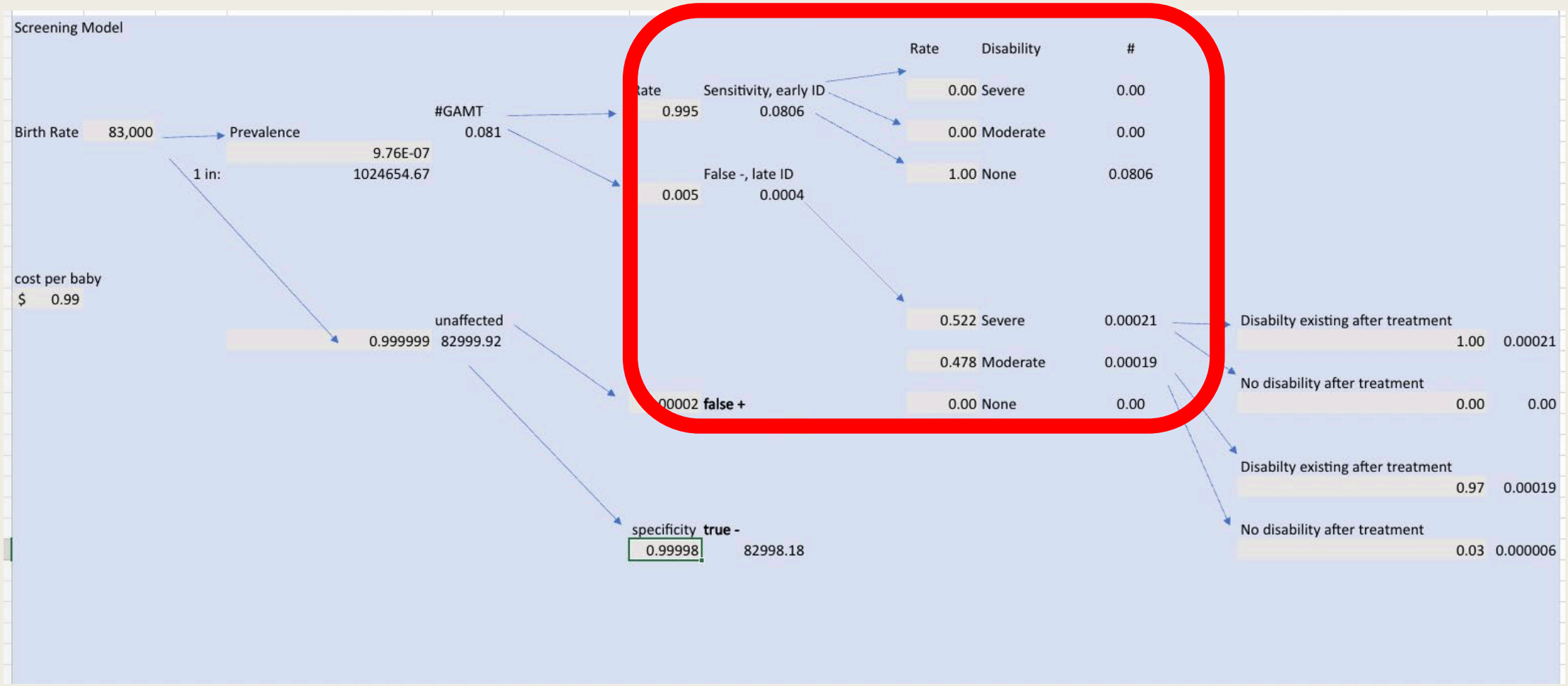

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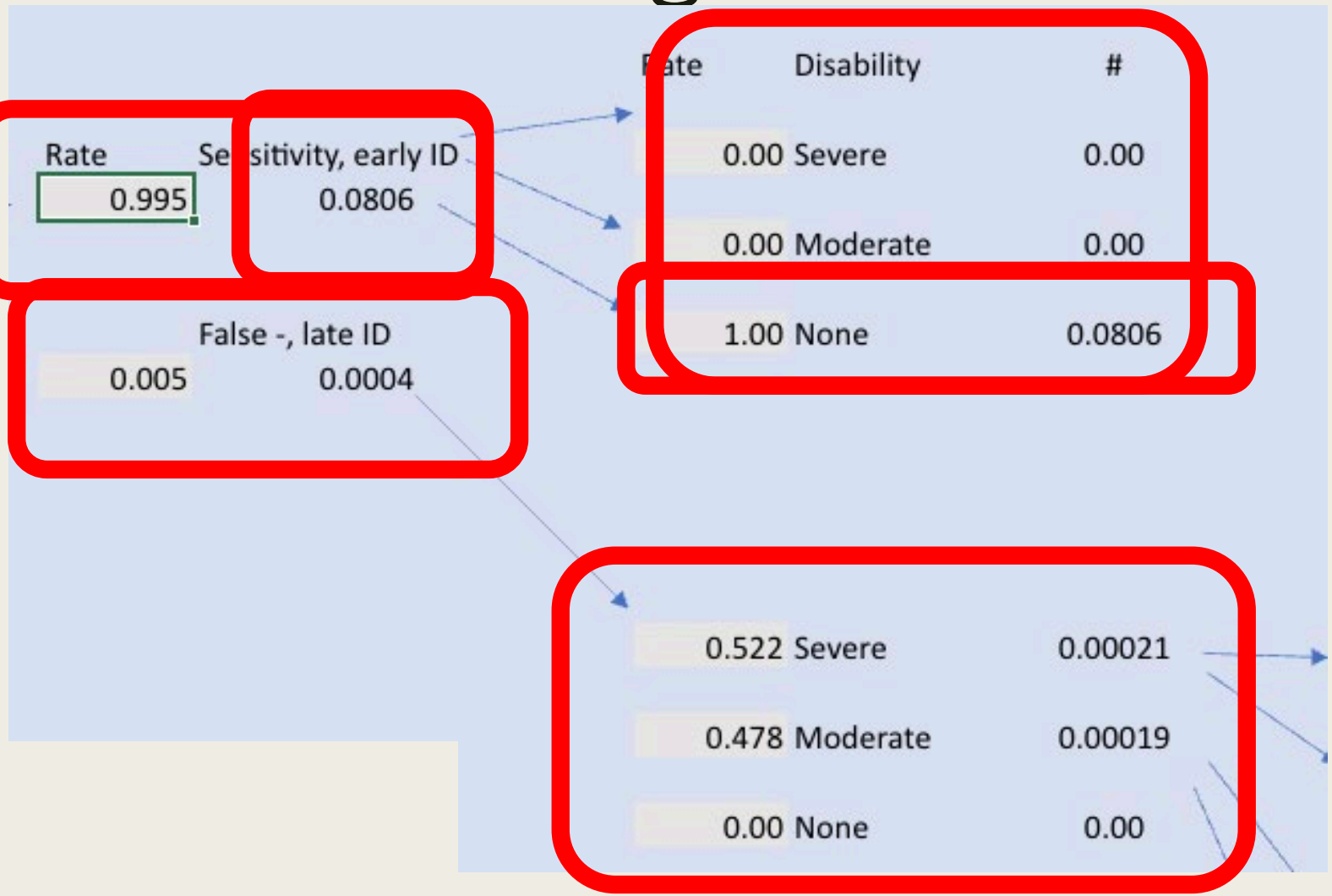

Newborn Screening Model

No Screening vs. Screening

No Screening	Severe Disability	0.0385
	Moderate Disability	0.0342
	No Disability	0.0083
	Early tx costs	$83.85
	Late tx (severe) costs	$68,495.18
	Late tx (moderate) costs	$55,443.93
	Total costs	$124,032.96

Screen	Severe disabilty	0.00021
	Moderate Disability	0.00019
	No Disability	0.0806
	Early costs	$1,045.88
	Late tx (severe) costs	$376.05
	Late tx (moderate) costs	$304.40
	Total costs	$1,726.33

Estimated Treatment Costs

Early ID costs (Years 0-11)	$12,976.50
Late ID costs, Severe (Years 0-11)	$1,779,606.10
Late ID costs, Moderate (Years 0-11)	$1,371,471.30

Shift: Benefits vs. Costs

Benefits	Shift in early tx costs	-$952.03
	Shift in late tx (severe) costs	$68,119.13
	Shift in late tx (moderate) costs	$55,139.53
	Total benefits	$122,306.64

Costs

Costs	Cost of screening	$82,008.19
	Cost of false positives	$2,178.75
	Total costs	$84,186.94

Cost per baby: **$0.99**
Includes startup lab costs, laboratory staffing and supplies

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Diagnostic testing

Creatine/GAA anlysis (urine)
$200.00 A test of the urine or blood plasma may be done to see if there are high levels of guanidinoacetate

Molecular genetic testing A diagnosis can be confirmed by molecular genetic testing. These tests involve studying the GAMT gene

high	low	average
$2,000.00	$100.00	$1,050.00

Cost of diagnostics: $1,250.00

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Costs	Cost of screening	$82,008.19
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	Benefit/Cost ratio	1.453
	Net Benefit	$38,119.70

Sensitivity Analysis

Parameter	base
birthrate	83,000
birth prevalence - 1 in:	1,024,654.67
% w/ GAMT family hx	0.0893
sensitivity	99.50%
specificity	99.9979%
tx cost, early ID	$12,976.50
tx cost, late ID, severe	$1,779,606.10
tx cost, late ID, moderate	$1,571,471.30
cost of NBS test	$0.99
cost of false +	$1,250.00

Sensitivity Analysis

			B/C ratio		
	B/C ratio swing		1.453		B/C ratio swing
Parameter		low/conservative estimate	base	high/liberal estimate	
birthrate	1.453	62,250	83,000	103,750	1.453
birth prevalence - 1 in:	1.063	1,400,000	1,024,654.67	273,902	5.435
% w/ GAMT family hx	1.496	0.0625	0.0893	0.333	1.061
sensitivity	1.421	97.50%	99.50%	100%	1.461
specificity	0.422	99.80%	99.9979%	100.00%	1.462
tx cost, early ID	1.458	$6,488.25	$12,976.50	$25,953.00	1.441
tx cost, late ID, severe	1.048	$889,803.05	$1,779,606.10	$3,559,212.20	2.262
tx cost, late ID, moderate	1.125	$785,735.65	$1,571,471.30	$3,142,942.60	2.108
cost of NBS test	2.827	$0.50	$0.99	$1.48	0.978
cost of false +	1.472	$625.00	$1,250.00	$5,000.00	1.348

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  - The prevalence of the condition among newborns
  - The positive and negative predictive values of the screening and diagnostic tests
  - Variability of clinical presentation by those who have the condition
  - The impact of ambiguous results: for example, the impact on families and caregivers
  - Adverse effects of screening

Final Notes

Literature suggests no false negatives

The false positive rate is likely to be low

The assumption of compliance with treatment

Acknowledgements

Thank you to:

- Sarah Bradley, MS, CGC, New York State Newborn Screening Program
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- WA Newborn Screening