Cost-Effectiveness of Assigning Early Interventions to Infants at High Risk for Autism Spectrum Disorder Using MRI Screening

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BACKGROUND

- Autism Spectrum Disorder (ASD) is a developmental disorder that may result in differences in the way someone thinks, socializes, and processes sensory information. Autism often also includes repetitive behavior and restricted interests [1].
- Studies have shown that interventions for ASD are most effective when they are implemented as early in a person's life as possible. This presents the issue of how to identify children with ASD as early as possible [2].
- Although the genetics of ASD are not completely understood, it is known that siblings of children who have been diagnosed are at a higher risk for diagnosis of ASD [2].
- MRIs using machine learning techniques have been shown to identify ASD in patients as young as 6 months old [3]. Using this MRI screening to assign early intervention treatment to high-risk infant siblings of children with ASD has been shown to be cost effective [4]. However, it is unknown which intervention is most cost effective following this screening.

OBJECTIVE

This study sought to investigate the cost-effectiveness of MRI screening strategies when paired with one of two ASD interventions; the Early Start Denver Model (ESDM) and Pivotal Response Treatment (PRT).

METHODS

Population of Interest

- This study simulated a cohort of high-risk infant siblings of children diagnosed with ASD.

Data Source and Selection:

- Data was taken from clinical trials of early interventions and MRI screening using VABS composite score as an intermediate endpoint. Costs were taken from a cost study from 2011 and adjusted to 2018 dollars. Costs and utilities were adjusted based on the VABS score using data from regression studies.

Decision Tree

- A decision tree combined with a two state Markov model was developed in Tree Age to model costs and utilities.
  - Costs were reported in 2018 US dollars, and utilities were reported as Quality Adjusted Life Years (QALYs).
  - A diagnosis before the age of 4 was considered an opportunity for early intervention.
- Four screening strategies were developed (treating all siblings, MRI screening at 6 months, at 12 months, and no MRI screening) for both the ESDM and PRT interventions resulting in eight unique strategies.
- The two state Markov model had states of Alive and Deceased. It was run with an annual cycle length for 96 cycles to calculate lifetime costs and utilities.

Analysis

- Societal, healthcare, and educational perspectives were adopted and discounted at a rate of 3%. The strategies were analyzed using a Willingness to Pay Threshold was $100,000/QALY.
- One way and probabilistic sensitivity analyses were performed.

RESULTS

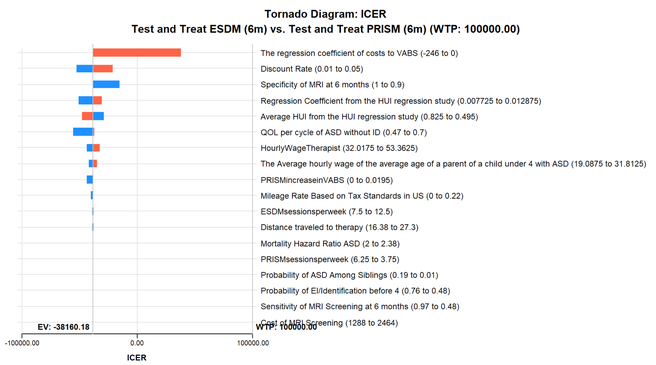
Key Findings

- Treating all with ESDM was most effective (28.08 QALYs) strategy and the least effective was status quo using PRT (27.66 QALYs).
- Using a societal perspective, all the strategies involving PRT were dominated by the treat all ESDM strategy in the base case analysis and MRI screening at 6 months with ESDM was the preferred strategy at a WTP threshold of 100,000/QALY.
- The probabilistic sensitivity analysis showed that MRI screening at 6 months with ESDM was the optimal strategy 4.00% of time at the WTP threshold.

ICER Table

Strategy	Cost ($)	Effect (QALYs)	ICER ($/QALY)
Test and Treat ESDM (6m)	139,399	28.05	
Status Quo (ESDM)	143,173	27.90	-26423
Test and Treat ESDM(12m)	143,780	28.06	419150
Status Quo (PRISM)	152,550	27.66	-33845
Test and Treat PRISM (6m)	153,488	27.68	-38160
Test and Treat PRISM (12m)	153,965	27.68	-39604
Treat All (PRISM), No MRI	162,305	27.68	-62761
Treat All (ESDM), No MRI	232,154	28.08	2,958,177

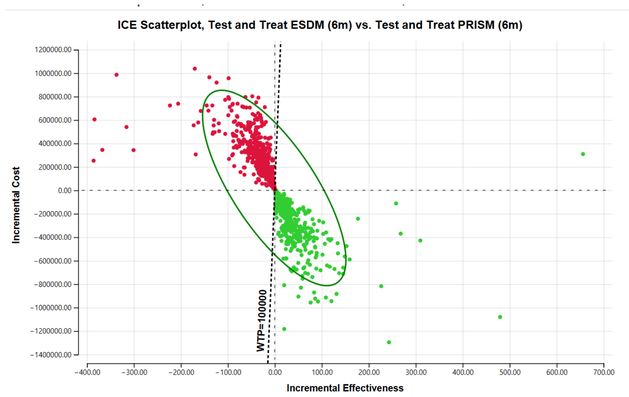
Deterministic Sensitivity Analysis



- The results of the model were most affected by the relationship between costs and VABS score, the discount rate, the specificity of the MRI at 6 months, and the relationship between QALYs and VABS score.
- The results of the model were found not to be greatly affected by the probability of ASD among siblings, the sensitivity of the MRI screening, or the cost of the MRI screening.

Probabilistic Sensitivity Analysis

Strategy	Optimal (%)
Test and Treat ESDM (6m)	4.00
Status Quo (ESDM)	21.25
Test and Treat ESDM(12m)	19.61
Status Quo (PRISM)	2.71
Test and Treat PRISM (6m)	0.07
Test and Treat PRISM (12m)	1.02
Treat All (PRISM), No MRI	45.66
Treat All (ESDM), No MRI	5.68



CONCLUSIONS

This analysis found that using MRI screening to assign treatment for high-risk infant siblings of children diagnosed with ASD is cost effective when using an ESDM intervention.

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