

The Effect of Sleep Hours on Internalizing Symptoms Differs By Children With Versus Without Prenatal Cannabis Exposure: A Causal Inference Analysis of ABCD Data

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Introduction

- Causal inference seeks to explain the effect of an ‘exposure’ or ‘treatment’ measure on an outcome measure of interest.
- Previous association studies have found that prenatal cannabis exposure is related to both poor sleep and internalizing symptoms.
- In this study, it was hypothesized that a change in sleep hours would cause a change in internalizing symptoms in children, and that this effect would be moderated by prenatal cannabis exposure.

Methods

- Data were drawn from baseline (ages 9-10) and 1-year follow assessments of the ABCD study (N=9,826)
- A causal random forest model estimated the effect of changing sleep hours on changing internalizing symptoms, while accounting for confounding variables (sociodemographics, other drug exposures).
- Prenatal cannabis exposure was selected *a priori* as a potential moderator of the treatment effect (heterogeneity in treatment effect).

Table1: Sample Characteristics Split by Prenatal Cannabis Exposure Status

	No Exposure (n=9,221)	CB Exposure (n=605)
Sex (Female, %)	4360 (47.3)	303 (50.1)
Body Mass Index (mean (SD))	18.69 (3.95)	19.82 (4.18)
Race/Ethnicity (White (%))	4969 (53.9)	227 (37.5)
Maternal Age of Pregnancy (mean ((SD))	29.70 (6.11)	25.32 (6.07)
Parents Married or Living Together (%)	6978 (76.2)	303 (50.6)
Any Prenatal Alcohol Exposure (%)	2115 (22.9)	374 (61.8)
Any Prenatal Cigarette Exposure (%)	920 (10.0)	362 (59.8)
Maternal Depression (%)	185 (2.0)	137 (23.4)
Household Income (%)		
	<\$50k	2345 (27.7)
	>\$50k & <\$100k	2421 (28.6)
	>\$100k	3693 (43.7)
Parental Highest Education (%)		
	<HS Diploma	461 (5.0)
	HS Diploma/GED	799 (8.7)
	Some College	2227 (24.2)
	Bachelors	2386 (25.9)
	Post-Grad Degree	3337 (36.2)
BSL Internalizing Symptoms (mean (SD))	48.29 (10.47)	52.28 (11.23)
BSL Sleep Hours (mean (SD))	8.9 (1.1)	8.5 (1.3)

Methods & Results

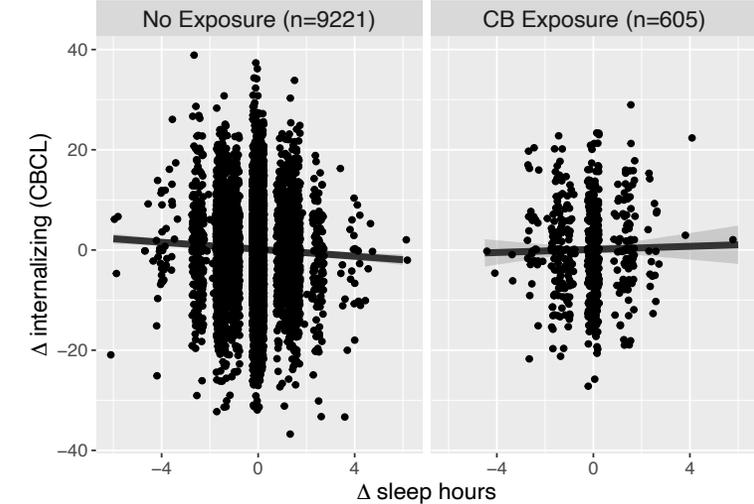
Figure 1: Causal diagram

**Figure 2: Distribution of treatment effect of Δsleep on Δinternalizing symptoms (Year1 – Baseline)
 Average Treatment Effect = -0.36, Std.Err =.08**

Distribution depicts heterogeneity in the treatment effect

Results & Conclusions

Figure 3: Treatment Effect by Prenatal Cannabis Status



- An average treatment effect was found, such that increasing sleep hours was linked to a lowering of internalizing symptoms over time.
- A heterogeneous treatment effect was also found, such that children with prenatal cannabis exposure exhibited divergent treatment effects relative to non-cannabis-exposed peers.
- Future studies will examine biological data and other features that might contribute to the divergent effects observed in children with prenatal cannabis exposure.
- Heterogeneous treatment effects can help identify for whom a drug exposure or treatment is most impactful.

Acknowledgements

The research conducted at the Laureate Institute for Brain Research was supported by the William K. Warren Foundation. The ABCD Study is supported by the National Institutes of Health and additional federal partners under award numbers U01DA041022, U01DA041025, U01DA041028, U01DA041048, U01DA041089, U01DA041093, U01DA041106, U01DA041117, U01DA041120, U01DA041134, U01DA041148, U01DA041156, U01DA041174, U24DA041123, and U24DA041147, and the National Institute of General Medical Sciences Center Grant Award Number 1P20GM121312. The content is solely the responsibility of the authors and does not necessarily represent the views of the NIH.