

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

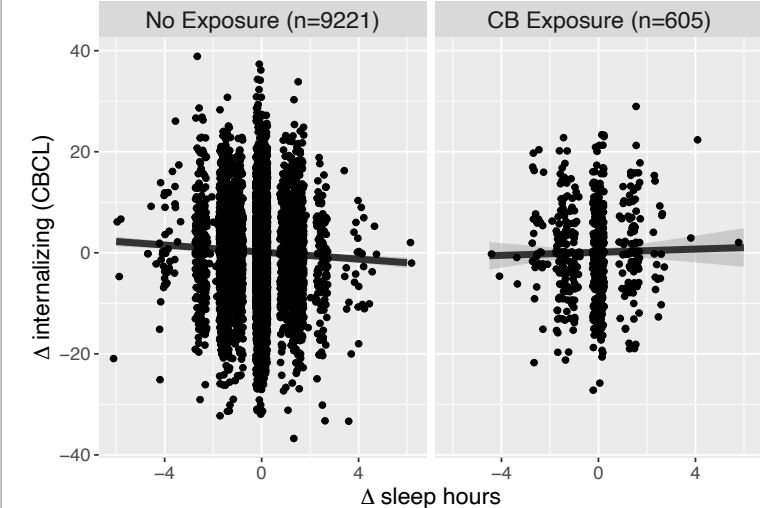
Figure 1: Causal diagram

**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.

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