Children's Outcomes Research Program

Sleep Problems, Gastrointestinal Problems, and Anxiety: Which Comes First?

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Conflict of Interest

- No Relevant Financial Relationships
Learning Objectives

• Learners will become familiar with issues associated with sleep problems in children 2 to 5 years of age
Prevalence of Sleep Problems

- **ASD**: 50-80%
- **DD**: 30-80%
- **Typical Development:**
  - 1-5 years: 25-50%
  - School age: 10-12%
<table>
<thead>
<tr>
<th>CSHQ Total</th>
<th>ASD</th>
<th>DD</th>
<th>POP</th>
<th>ASD vs. DD</th>
<th>ASD vs. POP</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;41</td>
<td>70.62%</td>
<td>62.76%</td>
<td>50.17%</td>
<td>OR=1.67, 95% CI=1.15, 1.77*</td>
<td>OR= 2.38, 95% CI= 1.93, 2.96**</td>
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<tr>
<td>&gt;47</td>
<td>50.23%</td>
<td>39.66%</td>
<td>27.29%</td>
<td>OR=1.54, 95% CI=1.25, 1.88**</td>
<td>OR= 2.69, 95% CI= 2.17, 3.34**</td>
</tr>
</tbody>
</table>

* p=0.0012, ** p<0.0001
Behavioral Impact of Poor Sleep

All Children
- Decreased Attention
- Irritability

Children with Autism
- Self injury
- Repetitive Behaviors
- Aggression

Parents of Children with Autism
- Greater Stress
Physical Impact of Poor Sleep

- Neural Plasticity (Picchioni 2014)
- Memory Consolidation
- Obesity (Hill 2015, Dreyer 2015)
- Cardio-metabolic (Quist 2015)
  - Cortisol
  - Insulin resistance
  - Sympathetic tone
- Immune Function (Careaga, 2015)
Sleep is Complex

Primary Sleep Disorders
- Obstructive Sleep Apnea
- Restless Sleep

Psychiatric
- ASD: ~40% ADHD
- ASD: ~40% Anxiety

Medical Conditions
- Pain/Discomfort GI: 50-80%
- Dental
- Low Iron Stores
- Limited Diet: 70-90%
- Obesity

Insomnia

Sleep Habits Behavior
- Sensory
- Communication
- Transitions
- Emotional Regulation

Biological Differences
- Melatonin
- Glutamate
Methods

• Sleep as Outcome (n=1987)
  – Children’s Sleep Habits Questionnaire

• Analysis: Multiple Logistic Regression
  – Model 1: adjust for sociodemographic variables: age, sex, race, family income, caregiver education
  – Model 2: adjust for sociodemographic & study group
  – Model 3: adjust for all covariates: sociodemographic, group, cognitive (MSEL), anxiety (CBCL), social (SRS), neurological/genetic, GI, BMI
Methods

• Behavior as Outcome in children with Sleep Problems
  – Child Behavior Checklist (CBCL):
    • internalizing and externalizing domains
    • empirically derived syndrome scale scores: anxious/depressed, attention problems, emotionally reactive, and aggressive behavior

• Analysis:
  – MANOVA models assessed associations between elevated sleep scores and elevated behavior scores
Results

• After adjusting for all co-occurring conditions, the following were associated with sleep problems:
  – GI 1.6 times more likely to have sleep problems
    \[\text{aOR (95\% CI) 1.61 (1.20, 2.17)}\]
  – Anxiety/depression 4.42 times more likely to have sleep problems
    \[\text{aOR (95\% CI) 4.42 (2.08, 8.65)}\]

• Sleep problems associated with increase in CBCL t-score:
  – Internalizing behavior by 6.9 points
  – Externalizing behavior by 7.1 points
Conclusions

• When evaluating sleep problems in young children, gastrointestinal and anxiety/depression symptoms should be considered.
Next Steps

• Genetics
Thank You

FAMILIES

SEED STAFF/COLLABORATORS

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Centers for Disease Control and Prevention (CDC)

NIH/NCATS Colorado CTSA Grant Number UL1 TR001082

The Carbon Valley Half Marathon supported the analysis for this manuscript.