Prenatal Alcohol Exposure and Sleep

SARAH M. INKELIS, M.S.

CENTER FOR BEHAVIORAL TERATOLOGY
SAN DIEGO STATE UNIVERSITY
Presenter Disclosure

Sarah Inkelis

• I have no current or past relationships with commercial entities.
Learning Objectives

• Identify research methods for studying sleep in humans

• Explore evidence base for sleep disturbance related to prenatal alcohol exposure

• Consider neurobehavioral correlates of sleep disruption, and relationships to the neurobehavioral profile of FASD
Fetal Alcohol Spectrum Disorders

- Prenatal alcohol exposure
  - Of all substances of abuse, alcohol produces the most serious neurobehavioral effects in the fetus
  - Effects of prenatal alcohol exposure can vary widely
  - Sleep disturbance may further exacerbate daytime functioning

Jones & Smith, 1975
Sleep is Crucial to Early Brain Development
• Children with neurodevelopmental disorders may be more vulnerable to these consequences

• Disordered sleep may exacerbate long-term cognitive and behavioral consequences of FASD

Ingrassia & Turk, 2005; Volgin & Kubin, 2012
Sleep Stages

REM

• Rapid eye movements (REM)
• Irregular respiration
• Irregular heart rate
• Low or absent muscle tone
• Involuntary motor behaviors

NREM

• No REM
• Regular respiration
• Regular heart rate
• Chin muscle tone
• Lack of body movements
• 3 substages: N1 (light sleep), N2, N3 (deep sleep)

Grigg-Damberger et al., 2016; Berry et al., 2015
Measuring Sleep

- Polysomnography
- Actigraphy
- Questionnaires, Sleep Diaries
Polysomnography

- Gold standard of sleep measurement
- Provides measures of brain activation, eye movement, muscle tone, and heart rate
Actigraphy

- Less expensive, non-invasive alternative to polysomnography
- Uses movement data as a measure of activity/inactivity, and proxy for sleep/wake
- Good at detecting sleep, but poor specificity for wake

Philips Respironics Actiware
Sleep Questionnaires & Diaries

• Questionnaires and sleep diaries allow patients to self-report on sleep, quality of life, daytime functioning

• Parent-report measures are often used in studies with children

• Subjective data augments objective sleep data collected via polysomnography or actigraphy
Sleep Disturbance in PAE
Parent-Reported Sleep Problems in FASD

Wengel et al., 2011
Sleep Disturbance in Infants

- Difficulty reaching NREM sleep
- More easily awakened
- Fewer intact sleep cycles
- Spent less time asleep

Sander et al., 1977; Havlicek et al., 1977; Rosett et al., 1979; Scher et al., 2000
Napping Pattern in Non-Exposed Newborn

Napping Pattern in Alcohol-Exposed Newborn

Fragmentation

Sander et al., 1977
Sleep Disturbance in Infants

- Abnormal EEG patterns
- ↑ Major body movements, restlessness
- ↓ Sleep-related spontaneous motor movements
Sleep Differences at 6 to 8 weeks

Troese et al., 2008
Sleep Disturbance in Children

Actigraphy
- Longer to fall asleep
- Shorter sleep duration
- Low sleep efficiency

Polysomnography
- Sleep fragmentation
- Mild breathing problems
- Low sleep efficiency

Melatonin
- Abnormal secretion

Wengel et al., 2011; Pesonen et al., 2009; Chen et al., 2012; Goril et al., 2016
Sleep Disturbance in Preclinical Models
Sleep Disturbance in Preclinical Models

Ipsiroglu et al., 2019
Sleep Disturbance – Summary

- Sleep fragmentation has been found across studies
- Effects of prenatal alcohol exposure on sleep are apparent at birth
- Evidence suggests sleep disturbance persists in childhood
Sleep

Neurobiology

Environmental Factors

Melatonin → Suprachiasmatic Nucleus

SES → Caregiving Style

Stress/Trauma
Sleep and Neurobehavioral Function

- hyperactivity
- impulsivity
- inattention
- emotion dysregulation
- depression

Jan et al., 2010; Kheirandish & Gozal, 2006; Marcus et al., 2012; Maski & Kothare, 2013; Owens et al, 2000; Owens, 2009; Stepanski, 2002
Neurobehavioral Profile of FASD

- Self-Regulation
- Executive Function
- Social Skills
- Daily Living Skills
- IQ
- Motor Skills
- Visuo-Spatial
- Language
- Learning
- Memory
- Attention

FASD

Daily Living Skills

Language
Neurobehavioral Profile of FASD

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Sleep Problems
Clinical Implications for FASD

• Common behaviors in FASD (e.g., inattentiveness, hyperactivity) overlap with symptoms of sleep disorders
• Assessment is often focused on daytime behaviors
• Information on identifying and mitigating sleep disorders is lacking
  • Over-reliance on pharmaceutical interventions

Ipsiroglu et al., 2013
Other populations with neurodevelopmental disorders have demonstrated improvement in symptoms after improving sleep quality.

- Consistent bedtime routine and sleep schedule
- Minimize electronics before bed
- Use bed only for sleeping

Sleep is a modifiable behavior that may serve as a potential avenue for intervention in FASD.
Future Directions

• Investigate potential mechanisms of sleep disruption

• Elucidate the characteristics of sleep problems and their relationship to cognition/behavior

• Establish standard-of-care guidelines for sleep assessment and intervention
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