Growing Up in Ireland: Factors Impacting Sleep Patterns of Preterm Infants

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Introduction

- **Theoretical Background**

  - Who and why?

  - Preterm infant sleep

  - Sleep as defined by parent

- **Methods**

  - Theoretical model

  - Purpose / Significance

  - Research Questions

- **Results**

- **Outcomes / Future Research**

Who? & Why?

Who?	Why?
Preterm infants Infants born before 37-weeks gestation (EFCNI, 2011b; Raju et al., 2006) Includes - Low birth weight - Developmental conditions	**Vulnerable Group** 6% infants born preterm in Republic of Ireland in 2009 (EFCNI, 2011a) Largest child patient group in EU **Research Limited** Care frequently uncoordinated, poorly researched (EFCNI, 2011b) Research on long-term outcomes required **Targeted Public Policy Required** (EFCNI, 2011b)

Why Preterm Birth Impacts Sleep

- Disrupts consolidation of biological clock

- Disorganized sleep, poor sleep-wake cyclicity, short sleep bouts

  (Feldman, 2006; Holditch-Davis & Thoman, 1987; Weisman et al., 2011)

- As forebrain matures
- Organizes sleep-wake rhythms
- Sleep episodes longer and more continuous (Mirmiran et al., 2003)

Why Research Preterm Infant Sleep?

Why?	Research
Preterm infant sleep	Sleep a measure of infant's ability to self-regulate (e.g., Bernier et al., 2010; Thoman, Igersoll, & Acebo, 1991; Troxel et al., 2013) Central marker of neurodevelopmental maturation (Halpern, McLean, & Baumeister, 1995; Weisman et al., 2011) Greater risk of difficulties with attention, regulating arousal level, and motor responses (e.g., Barros et al., 2011; Boyd et al., 2013; Pineda et al., 2013; Scott et al., 2012) Evidence of link to sleep (e.g., Dahl, 1996; Geva, et al., 2013; Reynolds, et al., 2011; Ruff et al., 1996; Thierez, 2012)

Sleep as Defined by Parent

- Sleep problems as defined by parent important
  (Davis et al., 2004)

- 20-30% of young children have sleep disturbance
  (Dahl, 1998; Sadeh et al., 2010)

- Fifth leading concern of parents
  (El Shakankiry, 2011)

"Couldn't we have gotten one with a snooze button?"

Research Cohort

| Where?	Why?
Republic of Ireland	ROI now has longitudinal data on children No previous research found on preterm infant sleep in an Irish cohort No National health policy on service delivery for preterm infants in ROI 6% all infants born preterm Possible cultural differences: Sleep hygiene and parenting

IRELAND
- Unless born >33 gw or >1500g – No specialist services once discharged

- 4.9% infants born 32-37 gestational weeks

- Greater knowledge factors impacting sleep when older = more targeted service provision
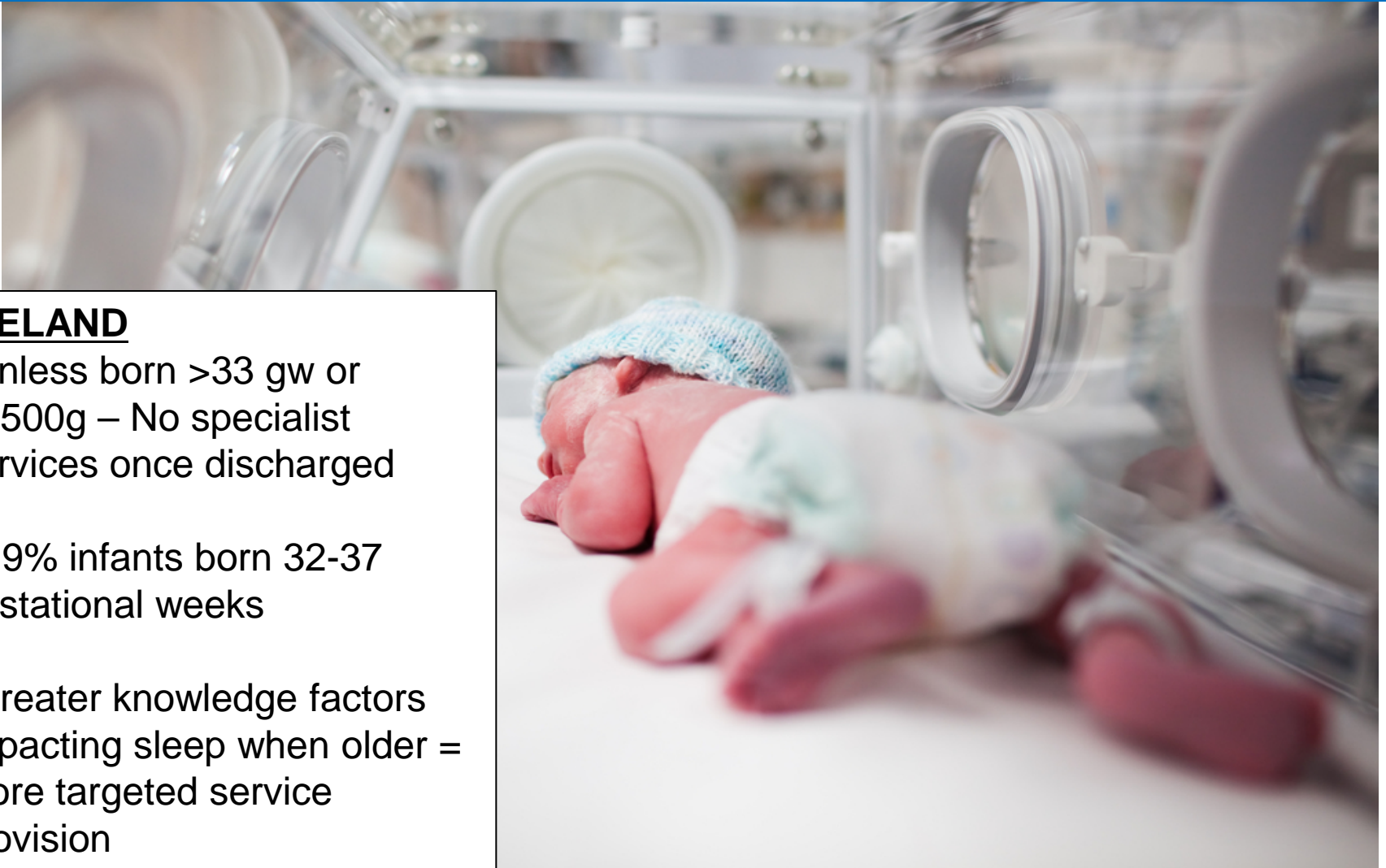
Methods

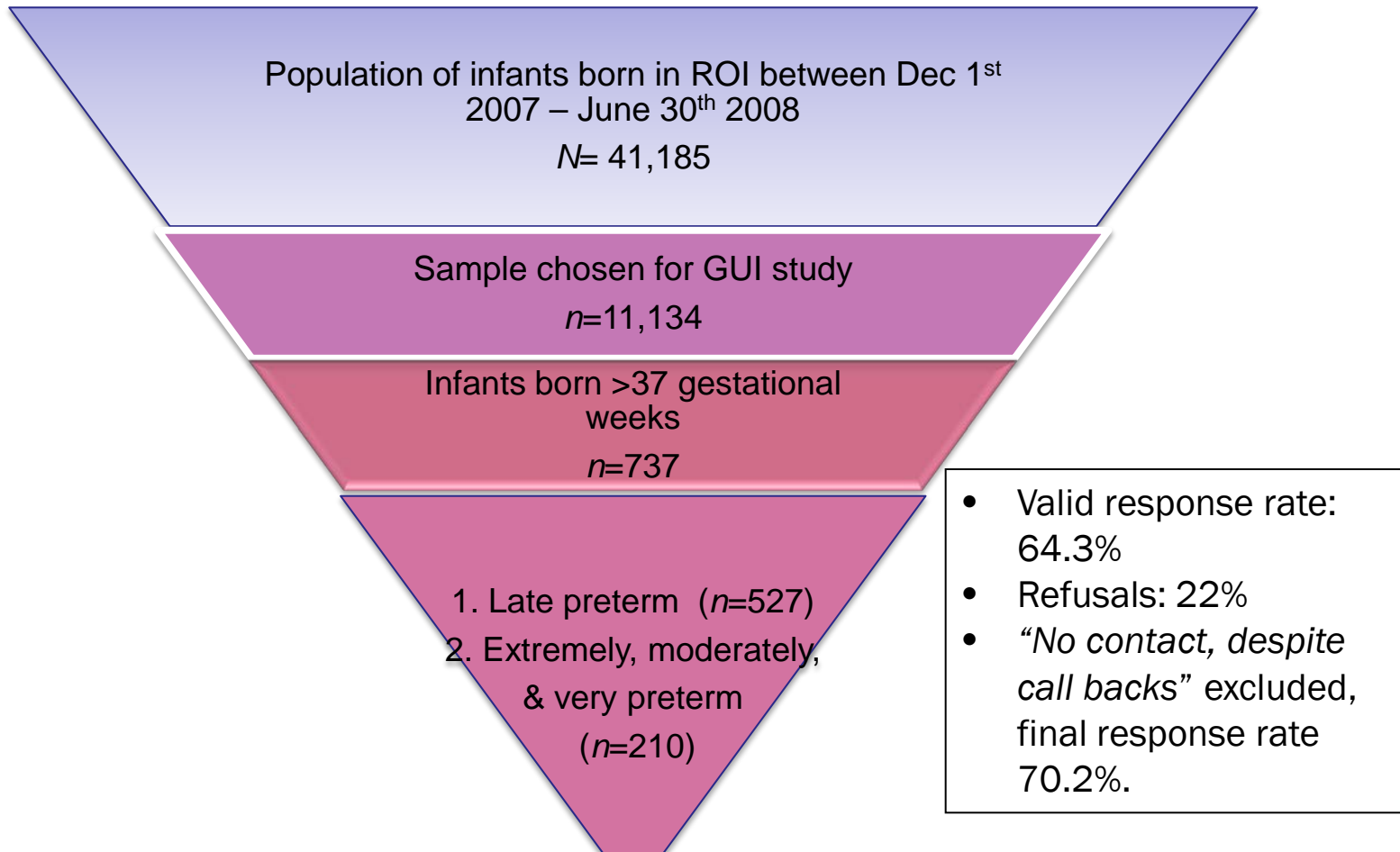| How?	Why?
Retrospective, population-based cohort design	**Large data set**
Secondary data	Enables access to data on 737 infants and their parents
Growing Up in Ireland, National Longitudinal Study of Children	
Structural equation modeling (SEM)	Supports use of SEM to investigate Transactional Model of Sleep-Wake Regulation
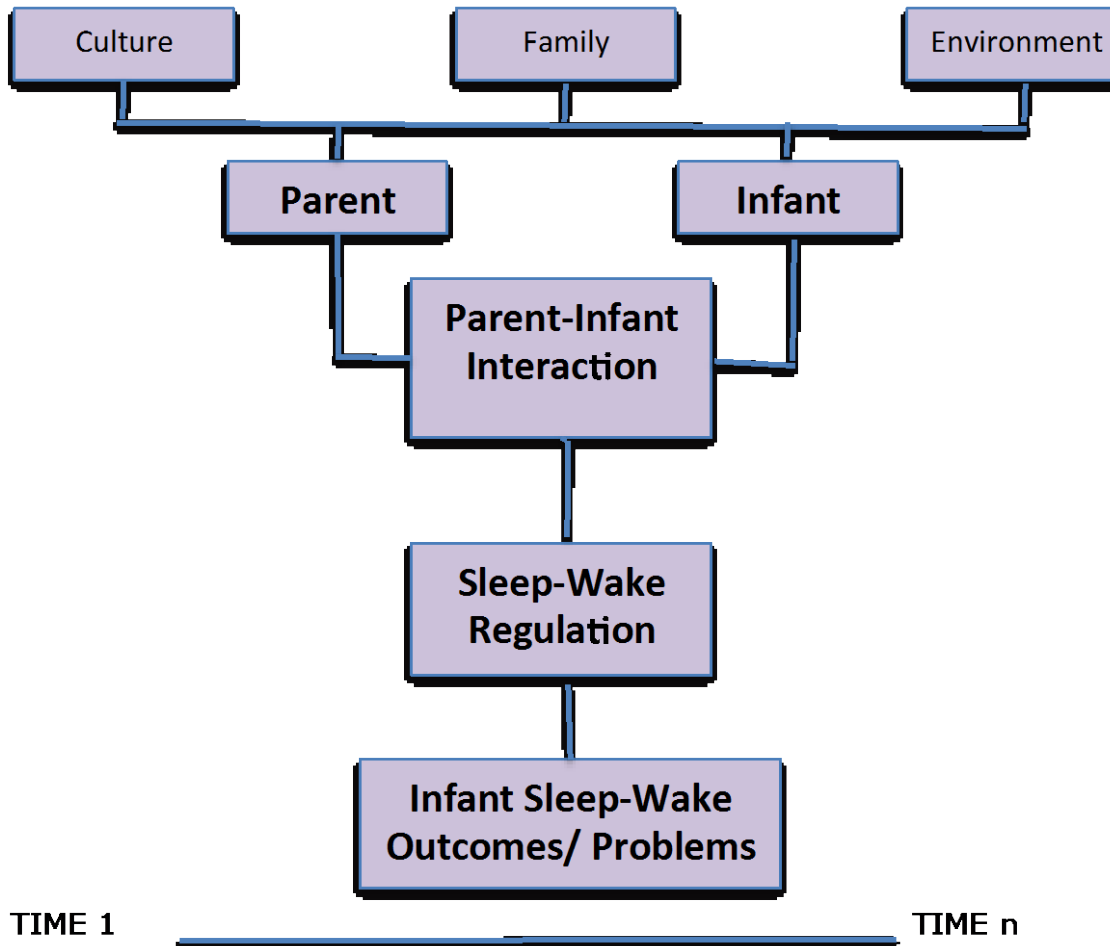
Purpose

- Document sleep patterns of Irish cohort of preterm infants at 9-months

- Identify infant and parent characteristics that promote optimal sleep development in preterm infants

- Establish whether the parent-infant relationship mediates this association

- Largest child patient group in EU (EFCNI, 2011b)

- Documentation of sleep patterns of preterm infants born in ROI when 9-months old
  (Factors influencing sleep patterns)

- Investigate parent-infant relationship as potential mediator

- Expand long term understanding of sleep patterns in preterm population

Sampling Frame

Population of infants born in ROI between Dec 1st 2007 – June 30th 2008

N= 41,185

Sample chosen for GUI study

n=11,134

Infants born >37 gestational weeks

n=737

1. Late preterm (*n*=527)
2. Extremely, moderately, & very preterm

(*n*=210)

- Valid response rate: 64.3%
- Refusals: 22%
- *"No contact, despite call backs"* excluded, final response rate 70.2%.

Mediator Model

Mediator Variable

A

Independent Variable

B

Dependent Variable

C
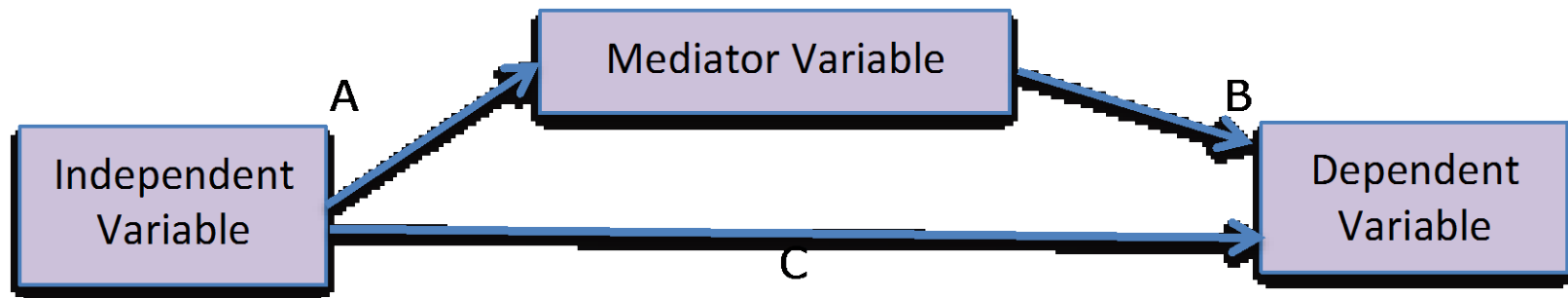
Two mediating variables
1. Maternal-infant relationship
2. Paternal-infant relationship

With TWO mediating variables, indirect effects are of concern and must be accounted for. This will be clarified during statistical analyses.

- **What are the daytime and nighttime sleep patterns in Irish infants born preterm when 9-months of age?**

Construct: Sleep patterns

Statistics: Descriptive statistics (mode, frequency, and percentage)

- **Is the parental-infant relationship a potential mediator of the relationship between infant characteristics (temperament, development, feeding) or parent characteristics (stress, depression, socioeconomic status) and preterm infant sleep patterns at 9-months of age?**

Constructs: Parent-infant relationship, Infant temperament, infant development, infant feeding, parental stress, parental depression, socioeconomic status, and sleep patterns

Statistics: Steps to SEM (Factor analysis, Multiple regression, then full structural equation model if model is over-identified)

1. Identify theoretical model

Research questions and hypotheses based on theoretical framework

2. Factor analysis

Confirm observed variables represent the latent construct

3. Multiple regression

Establish mediation relationship between observed variables

4. Structural Equation Modeling

Run full SEM, taking account of latent and observed variables.

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Demographics

Early Preterm

- 118 male (56%)
- 92 female (44%)

Late Preterm

- 272 male (51.5%)
- 255 female (48.5%)
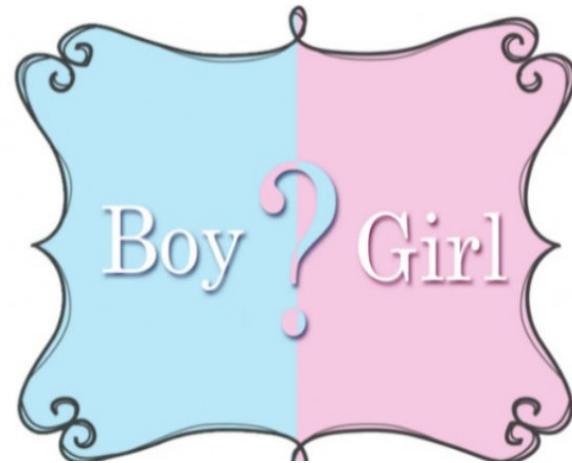
Primary Caregiver Demographics

- Mean age 30 years

- 99% female: mother

- Almost 80% Irish

- 11-13% other white backgrounds

- 5% African / Other Black

- Under 2% Chinese

Secondary Caregiver Demographics

- *n*=623 (85%) had secondary caregiver present

- Mean age: 35 years

- 99% male: father

- Other profiles similar to primary caregiver

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- Most infants sleep 1-4 hours per day

- Similar night sleep pattern between groups

- Majority of infants sleep over 8-hours per night

- Late preterm infants tended to wake more at night

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RQ2: Is the <u>parent-infant relationship</u> a potential mediator of the relationship between

<u>infant characteristics</u> (temperament, development, feeding)

or

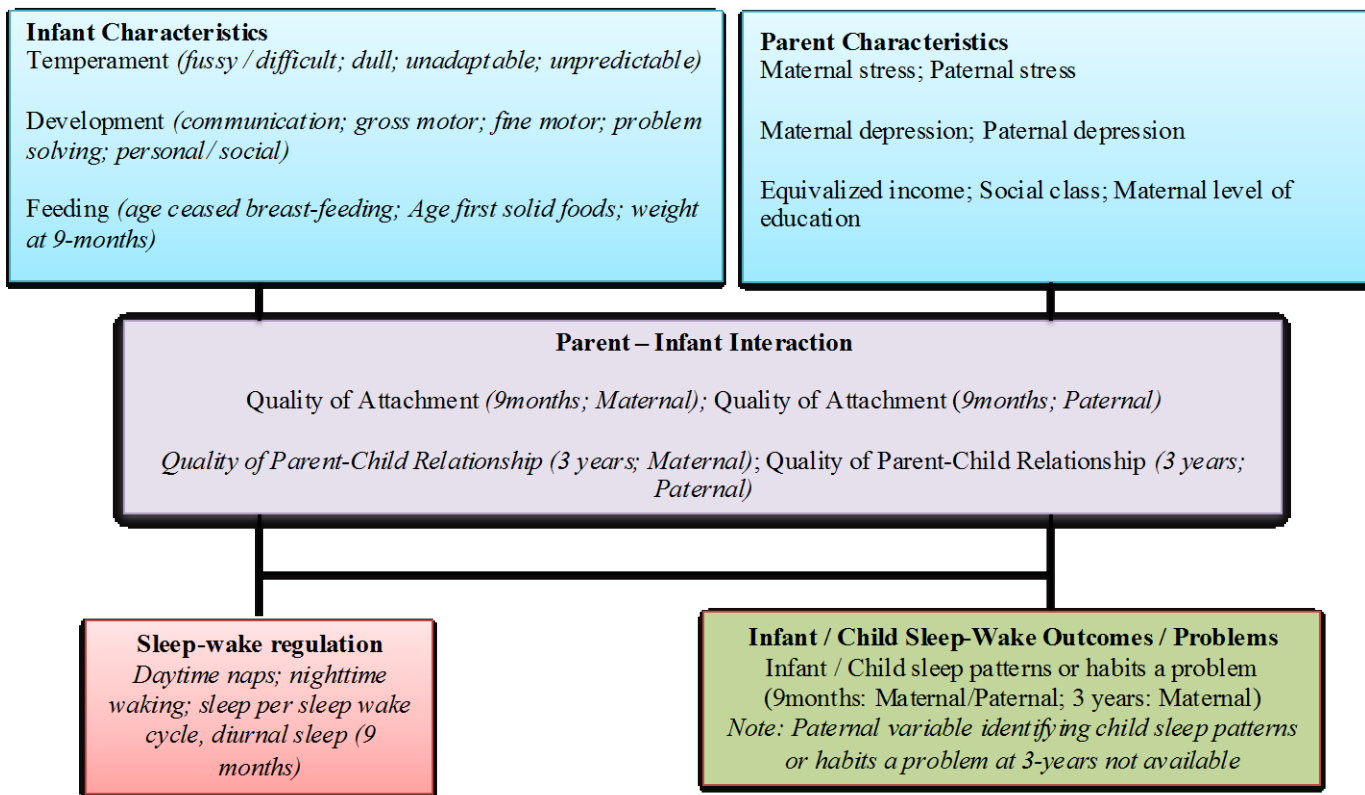**<u>parent characteristics</u> (parent mental health, socio-demographics)**

and

<u>preterm infant sleep patterns</u>
at
9 months of age?

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Infant Characteristics
Temperament *(fussy / difficult; dull; unadaptable; unpredictable)*

Development *(communication; gross motor; fine motor; problem solving; personal / social)*

Feeding *(age ceased breast-feeding; Age first solid foods; weight at 9-months)*

Parent Characteristics
Maternal stress; Paternal stress

Maternal depression; Paternal depression

Equivalized income; Social class; Maternal level of education

Parent – Infant Interaction

Quality of Attachment *(9months; Maternal)*; Quality of Attachment *(9months; Paternal)*

Quality of Parent-Child Relationship (3 years; Maternal); Quality of Parent-Child Relationship *(3 years; Paternal)*

Sleep-wake regulation
Daytime naps; nighttime waking; sleep per sleep wake cycle, diurnal sleep (9 months)

Infant / Child Sleep-Wake Outcomes / Problems
Infant / Child sleep patterns or habits a problem (9months: Maternal/Paternal; 3 years: Maternal)
Note: Paternal variable identifying child sleep patterns or habits a problem at 3-years not available

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Early v Late Preterm Groups

Factor (9 months)	Comment
Temperament	No difference between groups
Development	Early preterm group scored statistically significantly lower
Feeding	Early preterm group began solids at a significantly older age and were lighter in weight
Parent Mental Health	No difference between groups
Socio-demographics	No difference between groups
Sleep	No difference in night/day sleep Late preterm infants woke significantly more
Parent-infant relationship	Paternal-infant relationship stronger in early preterm group

TRANSACTIONAL MODEL OF SLEEP-WAKE REGULATION

Infant Temperament -

Sleep Patterns

Infant Characteristics

Temperament *(fussy / difficult; dull; unadaptable; unpredictable)*

Development *(communication; gross motor; fine motor; problem solving; personal/ social)*

Feeding *(age ceased breast-feeding; Age first solid foods; weight at 9-months)*

Parent Characteristics
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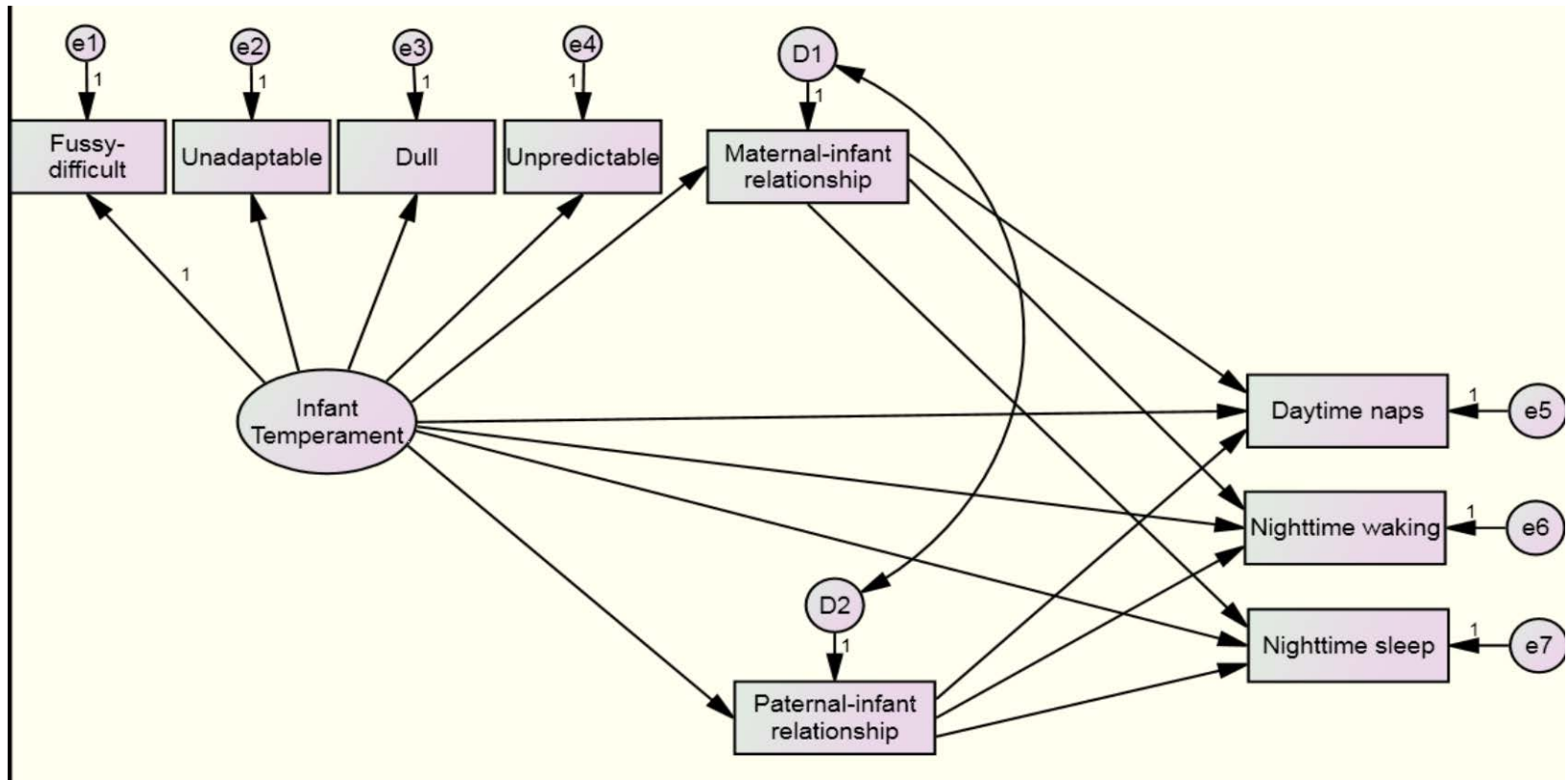*Note: Paternal variable identifying child sleep patterns or habits a problem at 3-years not available*

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- **Step 1: Regress DV on IV**
- **Step 2: Regress Mediator on IV**
- **Step 3: Regress DV on Mediator & IV**
- **Step 4: Complete mediation / partial mediation**

Complete mediation: **IV no longer affects DV when mediator introduced**

Partial mediation: **Steps 1-3 are met but Step 4 is not**

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Hypotheses: Direct Effects

Hypotheses	Early Preterm	Late Preterm
H2.1.1. Lower scores ICQ – Greater daytime naps	Rejected	Accepted
H2.1.2. Lower scores ICQ – Less nighttime waking	Accepted	Accepted
H2.1.3. Lower scores ICQ – Greater nighttime sleep	Accepted	Accepted

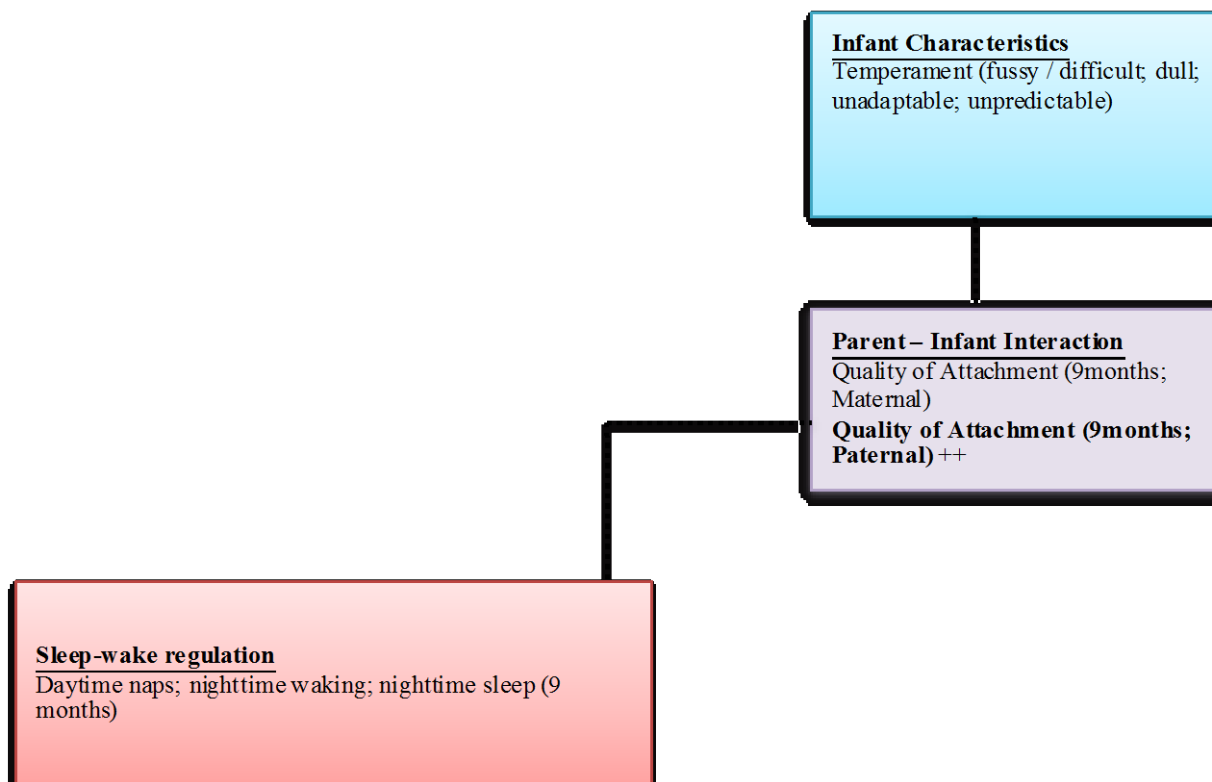ICQ – Infant Characteristics Questionnaire (Infant Temperament)

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Hypotheses: Mediators

Hypotheses	Early Preterm	Late Preterm
H2.4.1. Lower scores ICQ-maternal/paternal infant relationship – reduced nighttime waking	Accepted Maternal partially mediates Paternal partially mediates	Accepted Maternal partially mediates Rejected Paternal does not mediate
H2.4.2. Lower scores ICQ-maternal/paternal infant relationship – increased daytime naps	No direct effects of significance/ indirect effects not analyzed	Accepted Maternal completely mediates Rejected Paternal does not mediate
H2.4.3. Lower scores ICQ-maternal / paternal infant relationship – increased nighttime sleep	Accepted Maternal partially mediates Paternal partially mediates .	Rejected Maternal does not mediate Paternal does not mediate

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Infant Characteristics
Temperament (fussy / difficult; dull; unadaptable; unpredictable)

Parent – Infant Interaction
Quality of Attachment (9months; Maternal)
Quality of Attachment (9months; Paternal) ++

Sleep-wake regulation
Daytime naps; nighttime waking; nighttime sleep (9 months)

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Infant Characteristics
Development ++
(Communication; gross motor; fine motor; problem solving; personal/ social)

Parent Characteristics
Paternal depression

Infant Characteristics
Feeding (age ceased breast-feeding; **age first solid foods** ++; **weight at 9-months** ++

Parent Characteristics
Maternal stress; Paternal stress
Maternal depression
Socio-demographics (equivalized income; social class; maternal level of education)

Infant Characteristics
Temperament (fussy / difficult; dull; unadaptable; unpredictable)

Parent – Infant Interaction
Quality of Attachment (9months; Maternal)
Quality of Attachment (9months; Paternal) ++

Parent – Child Interaction
Quality of Parent-Child Relationship (3 years; Maternal);
Quality of Parent-Child Relationship (3 years; Paternal)

Sleep-wake regulation
Daytime naps; nighttime waking; nighttime sleep (9 months)

Infant Sleep-Wake Outcomes / Problems
Infant sleep patterns or habits a problem (9months: Maternal/Paternal)

Child Sleep-Wake Outcomes / Problems
Child sleep patterns or habits a problem (3 years: Maternal)
Note: Paternal variable identifying child sleep patterns or habits a problem at 3-years not available

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- Easier temperament – less waking/more sleep

- Age ceased breast feeding – night waking

- Weight 9-months / age began solids – night waking (early preterm only)

- Age ceased breast feeding / Age solid foods introduced – night sleep (late preterm only)

- Parental stress – nighttime waking & sleep (late preterm only)

- Less depression – greater nighttime sleep (late preterm only)

- Higher socio-demographic status – greater nighttime sleep

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Daytime Naps

- No factor influenced naps in early preterm group

- Easier temperament & later transition to solids – longer daytime naps (late preterm only)

- Maternal-infant relationship similar across all levels of prematurity
- Paternal-infant relationship stronger in early preterm group

- Provided mediating relationship between temperament and sleep only.
- Did not mediate development, feeding, parent mental health, or socio-demographics

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Limitations

- Controlling for threats to internal validity

- Assumed parents reported child's presentation correctly

- Reviewed summary reports of secondary data – clear understanding of original measures

- Used definitions from transactional model of sleep-wake regulation

- Established validity / reliability of original instruments used

- Subset of complete dataset used

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Limitations

- Threats to statistical conclusion validity
  - Variables represented with respect to their original definition in GUI data set

- Controlling for SEM
  - Used theoretical model to guide development of hypotheses
  - Use of large sample

- Technical difficulties

  - AMOS would not accept data from GUI dataset when weightings used

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Policy Implications

- Importance of focusing on parent mental health as well as sleep needs
- Possible influence on policy development for children with developmental needs
- Importance of paternal-infant relationship
- Differing trends between early and late preterm group

1. Considering the findings of this study ...what distal   environmental factors also have an impact on these sleep variables?

2. How are the proximal and distal factors related to sleep patterns and difficulties over time?

3. Role of markers of self-regulation in a population based data set

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Questions?