SMOKING IN PREGNANCY & CHILD BEHAVIOR PROBLEMS: WHO IS AT RISK?

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• WHAT DO WE KNOW?
Scientific evidence base for long-term behavioral “effects” of prenatal smoking

• WHO IS MOST VULNERABLE?
Risk processes that amplify prenatal exposure effects

• WHAT SHOULD WE DO?
Implications for policy and practice
BEYOND LOW BIRTHWEIGHT: PRENATAL SMOKING & ASSOCIATED BEHAVIORAL OUTCOMES ACROSS THE LIFESPAN

Developmental spectrum of conduct problems

Infancy: Irritable Temperament

Preschool-School Age: Oppositional Behavior & Aggression

Adolescence: Delinquency & Conduct Disorder

Adulthood: Violence & Criminal Offending
50% quit spontaneously when pregnant
U.S. average = 13% of pregnant women smoke prenatally (~500,000 births per year)
Down from 10 years ago, but far from the Healthy People 2010 1% goal

(PRAMS, CDC, 2007)
Prenatal smoking is not an isolated health risk behavior

Maternal Interpersonal Problems

Maternal Problems in Daily Functioning

Pickett, Wakschlag et al., 2009
WEIGHT OF THE EVIDENCE

- Consistent evidence from more than two dozen independent, cross-national studies\(^a\)
  - Prenatal smoking associated with 1.5-4x the risk of conduct problems across the lifespan
    - \(\frac{1}{2}\) pk/day or more
  - Association remains with statistical control for alternative explanations

- But is it causal?
  - Beyond statistical control:
    - Behavior genetic designs do not support direct effect\(^b\)
  - Jury still out on exposure as:
    - Risk marker vs. causal risk factor

\(^a\)Wakschlag et al., 2002; \(^b\)D’Onofrio et al., 2009
## Modeling the Proportion of Perinatal & Behavioral Outcomes Attributable to Prenatal Smoking

<table>
<thead>
<tr>
<th></th>
<th>Estimated Prevalence</th>
<th>Percent of cases attributable to prenatal smoking</th>
<th>Social, Health &amp; Economic Costs</th>
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<tbody>
<tr>
<td><strong>Perinatal</strong></td>
<td></td>
<td></td>
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<tr>
<td>Low birth weight&lt;sup&gt;a&lt;/sup&gt;</td>
<td>295,000</td>
<td>11-21% (32,000-61,000)</td>
<td>NICU, medical care expenditures, illness, quality of life, early intervention, special education, caregiver burden</td>
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<tr>
<td>Birth complications&lt;sup&gt;b&lt;/sup&gt;</td>
<td>975,000</td>
<td>11-15% (107,250-146,250)</td>
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<tr>
<td>Sudden infant death syndrome (SIDS)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>5,417</td>
<td>22-41% (1,178-2,203)</td>
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<tr>
<td><strong>Behavioral</strong></td>
<td></td>
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<tr>
<td>Conduct Disorder&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4,219,215</td>
<td>16-27% (675,075-1,139,188)</td>
<td>Direct: mental health services, public safety and welfare, adjudication, incarceration</td>
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<td>Long-term: high school drop-out, smoking and substance abuse, teenage pregnancy, lower labor force participation, domestic violence, crime rate</td>
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<sup>a</sup>DiFranza & Lew, 1995; <sup>b</sup>CDC, 1997; <sup>d</sup>Wakschlag et al, 2000
HOW STUDIES OF MECHANISMS & DEVELOPMENTAL PATTERNS CAN INFORM POLICY

- Precision of exposure measurement\textsuperscript{a}
  - Prospective
  - Longitudinal
  - Bioassays

- Theory-driven hypothesis testing\textsuperscript{b}
  - Honing in on modifiable risk processes
  - Developmental unfolding (vulnerability rather than destiny)

\textsuperscript{a}Dukic, Wakschlag, et al 2007, Pickett, Wakschlag, et al., 2008, \textsuperscript{b}Wakschlag et al., 2006
BEYOND LOW BIRTHWEIGHT: PRENATAL SMOKING & ASSOCIATED BEHAVIORAL OUTCOMES ACROSS THE LIFESPAN

Infancy: Irritable Temperament
(OR=1.3\textsuperscript{a})

Preschool-School age:
Oppositional Behavior Aggression
(Preschool OR=7.3\textsuperscript{b}; School age OR=2.6\textsuperscript{b})

Adolescence: Delinquency & Conduct Disorder
(OR=2.1-3.3\textsuperscript{cd})

Adulthood: Violence & Criminal Offending
(OR=1.5\textsuperscript{e})

\textsuperscript{a}Pickett, Wakschlag et al., 2008; \textsuperscript{b}Wakschlag et al., 2006; \textsuperscript{c}Rasaren et al., 1999; \textsuperscript{d}Wakschlag et al., 1997; \textsuperscript{e}Brennan et al., 1999
EXPOSURE-RELATED BEHAVIOR PROBLEMS EVIDENT BY AGE TWO

Interaction of Time & Exposure $F=5.1$, $p<.008$

Mean ITSEA Externalizing T Scores

- **NONEXPOSED**
- **EXPOSED**

- 12 Months
- 18 Months
- 24 Months

Age in Months

Family Health & Development Project: Wakschlag et al., 2006
WHAT REDUCES RISK?
RESPONSIVE PARENTING AS PROTECTIVE BUFFER

- Responsive parenting
  - Parental regulating function
  - Developmentally optimal parenting
  - Parental capacity to flexibly shift based on child behavior
    - Particularly critical if exposure-related behavioral vulnerabilities impede child self-regulation of behavior and emotions

Wakschlag & Hans, 1999
**RISK BUFFER: EARLY MATERNAL RESPONSIVENESS**

Interaction of Exposure & Responsiveness, p<.01

School Age Conduct Symptoms Count

<table>
<thead>
<tr>
<th>School Age</th>
<th>Conduct</th>
<th>Symptoms</th>
<th>Count</th>
</tr>
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<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>High</td>
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Observed Maternal Responsiveness During Infancy

Wakschlag & Hans, 2002
**RISK BUFFER: PATERNAL RESPONSIVENESS DURING ADOLESCENCE**

Interaction of Exposure & Responsiveness, p<.003

Adolescent Conduct Symptoms Score

Disruptive Behavior Score

East Boston Family Study, Wakschlag et al., 2011
Genetic susceptibility to conduct problems

- Monoamine Oxidase A (MAOA) genotype
- Risk genotype for aggression in animal studies
- Enhances susceptibility to environmental risk
  - Strong evidence from studies of adverse early postnatal exposures\(^a\)

\(^a\)Caspi et al., 2002; Kim Cohen et al., 2006
RISK AMPLIFIER: MAOA GENOTYPE

East Boston Family Study, Wakschlag et al., 2009
WHAT DOES IT ALL MEAN?

- Suggestive evidence that prenatal smoking may cause adverse behavioral effects across the lifespan
  - Social and public health costs profound
  - Emergence of these patterns measurable as early as first two years of life
- Whether risk marker or causal factor,
  - Multiple streams of evidence point to the public health benefits of early life prevention
    - Risk factors cluster together
  - Smoking during pregnancy and exposure-related behavioral vulnerabilities are modifiable
    - Tiered approach
      - Prenatal cessation +
      - Postnatal parenting intervention when cessation attempts fail
POLICY: WE KNOW WHAT TO DO BUT WE’RE NOT DOING IT

- Investing early = immediate & lasting cost savings
  - $1 spent on prenatal smoking cessation = $3 savings for neonatal costs & $6 savings for long-term costs
  - Billions > related to victims of violence and criminal justice system

- Best practice prenatal prevention inadequate
  - 5 “A”s (Ask, Advice, Assess, Assist & Arrange) poorly implemented in first prenatal visit
    - 5-15 minutes of counseling + self-help increases quit rates ~20%
  - Ineffective for those smokers >risk of persistence
    - Cessation vs. reduction below threshold

- Effective approaches exist but not widely adopted
  - Public Education Campaign + Pregnancy Quitline (“Great Start”)
  - Personalized Biomarker Feedback
  - Incentive-Based Interventions (“Quit & Win”)
  - Nicotine Replacement (benefits>risks)

POLICY: INCENTIVIZING STATEWIDE SYSTEMS OF CARE

- Identifying every prenatal smoker
- Expanding Medicaid coverage for prenatal cessation treatment
  - Disparities-low income women vast majority of prenatal smokers
- Building implementation capacity of health care systems to effectively provide evidence-based prenatal cessation treatment in routine care
- Substantial cost-savings from prenatal cessation treatments
  - Institute of Medicine -prenatal cessation identified as a top priority for transforming US quality of care