Brown Bag Lunch:

The Development Origin of Health and Disease: A Sex and Gender Perspective

Annie Duchesne, PhD
Department of Psychology
University of Northern British Columbia
Objectives

- Pubertal timing and women’s health
- Prenatal stress, metabolic functions and girls’ pubertal timing
- Results from a study conducted through the *Ice Storm Project*
- Early puberty in girls as gendered stressor
- Ongoing and future research
- International Society for Gender Medicine
Is 7 the New 10? Why Do Some Girls Start Puberty So Early?

By Glenn D. Braunstein, M.D.
Secular trend for the reduction in Age at Menarche

- United States
  1960 to 1990: 13.5 to 12.5; 1990 to 2000: 12.5 to 12.3; 2007 no change
  Cabera et al., 2014

- Canada
  2000-2001: Mean 12.72 years Median 12.67 years
  14.6% < 11.53 years; 68% between 11.53 and 13.91 years, 17.4% > 14.1 years

Harris et al., 2008; Al-Sahab et al., 2010
Marshall and Tanner, 1969
Pubertal timing and women’s health

Younger age at menarche (AAM)

- **Vascular diseases**
  - Canoy et al., 2015
- **Type II diabetes**
  - He et al., 2010
  - Janghorbani et al. 2014
- **Breast & endometrial cancer**
  - Berkey et al., 1999
  - Hsieh et al., 1990
  - Karageorgi et al., 2010
  - Gong et al., 2015
  - Rosner et al., 1994

- **Depressive symptoms**
  - Trepanier et al., 2013
  - Culpin et al., 2015
  - Gaysina et al., 2015
  - Tondo et al., 2017;
  - Joinson et al., 2017

- **Eating disorders**
  - Posner, 2006

- **Risky sexual behaviors**
  - Baams et al., 2015

- **Delinquent behaviors**
  - Burt et al., 2006

Menarche under 11 year old carries the higher risks
Development Origin of Health and Disease

INVESTIGATING DIRECT CORRELATES OF PRENATAL STRESS ON AGE AT MENARCHE
Project Ice storm

Natural disaster induced prenatal stress

✓ January 1998, freezing rainfall
✓ Over 3 million people left without power

Prenatal stress assessments

✓ Objective: Loss, Scope, Change range [0-24]
✓ Subjective: Intrusion, Hyper arousal and Avoidance range [0-55]

Longitudinal outcomes

✓ Psychological and physiological data collected at birth, 5.5, 8, 11, 13.5, 15.5, 18
✓ Age at menarche reported at 13.5 and/or 15.5 years of age.
**Adiposity, prenatal stress and pubertal timing**

- Increased adiposity is associated with advanced pubertal timing. (reviewed in Juul et al., 2017).
- Prenatal stress predicts increase in metabolic functions (Dancause et al., 2012)

Could the relation between prenatal maternal stress and girls’ pubertal timing be mediated by early changes in adiposity?
Adiposity, prenatal stress and pubertal timing

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Study sample (n = 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at menarche (years)</td>
<td>12.10 (0.84) [10.30–14.20]</td>
</tr>
<tr>
<td>Mother’s age at birth of child</td>
<td>30.34 (3.89) [20.23–37.25]</td>
</tr>
<tr>
<td>Highest household SES (Hollingshead)</td>
<td>27.20 (9.84) [11–47]</td>
</tr>
<tr>
<td></td>
<td>Upper class (n = 5, 16.7%)</td>
</tr>
<tr>
<td></td>
<td>Upper middle class (n = 14, 46.7%)</td>
</tr>
<tr>
<td></td>
<td>Middle class (n = 11, 36.7%)</td>
</tr>
<tr>
<td>Number (% of mothers who smoked during pregnancy</td>
<td>6 (20.00)</td>
</tr>
<tr>
<td>Length of gestation (weeks)</td>
<td>39.53 (1.96) [32.86–41.71]</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>3427.41 (604.21) [1850–4432]</td>
</tr>
<tr>
<td>Ponderal index</td>
<td>27.76 (3.57) [20.77–36.15]</td>
</tr>
<tr>
<td>Obstetric complications</td>
<td>4.29 (2.81) [0–12]</td>
</tr>
<tr>
<td>Major life events (6 months)</td>
<td>5.00 (2.74) [1–10]</td>
</tr>
<tr>
<td>Major life events (5.5 years)</td>
<td>4.04 (2.46) [0–12]</td>
</tr>
<tr>
<td>BMI at 5.5 years of age</td>
<td>15.60 (1.62) [12.92–20.02]</td>
</tr>
<tr>
<td>Objective hardship</td>
<td>9.77 (3.72) [3–18]</td>
</tr>
<tr>
<td>Subjective distress</td>
<td>11.06 (12.66) [0–55]</td>
</tr>
</tbody>
</table>

SES, socio-economic status; BMI, body mass index.

Duchesne et al., 2017, DOHaD
Significance of the model did not change after separately controlling for SES, gestational length, birth weight, obstetrical complications and major life events at birth and 5 years old.
Result Summary

Prenatal maternal stress can lead to advanced puberty in girls through its effects on BMI at 5½ years old.

Effects only found for objective hardship.

Need to reproduce this finding in a larger more socio demographically diverse population.

Important to consider early life stress history when looking at the relation between pubertal timing and women’ health.
Ongoing project: Prenatal maternal stress, reproductive and sexual health

- **Prenatal maternal stress:**
  - Sexual functions (arousal, desire and inhibition)
  - Integrity of the hypothalamic pituitary gonadal axis:
    - Pelvic imaging in boys and girls (volume of prostate and testes in boys; volume of ovaries and antral follicle counts in girls)
    - Volume of the pituitary and hypothalamic nuclei.
    - Endocrine measurements

Dr Sherri lee Jones, McGill University
Early puberty and women’s health, a cause or consequence?
Early puberty as a gendered stressor

Advanced puberty in girls

- Increase risk of sexual assault (Vicary et al., 1995)
- Increase sexual harassment (Skoog and Ozdemir, 2016)
- Increase peer victimization* (Hamlat et al., 2015)
- Increase sexual rumor * (Reynold and Juvonen, 2011)
- Decrease in body esteem* (Hamlat et al., 2015)

* Mediated the association between advanced puberty and depressive symptoms.
Prenatal adversity, depressive symptoms and sex differences:

Costello et al., 2007; reviewed in Altemus, Sarvaiya and Epperson, 2014
Early puberty, hormones and gendered stress

- Early maturing girls tend to have higher levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH) and estradiol (reviewed in Mendle, 2007)
- Cortisol stress response increases with pubertal development (van der Bos et al., 2014)
- PRECLINICAL: Stress exposure during pubertal development, estradiol and depressive-like behaviors (Ismail et al, 2012)

Pubertal development is a critical period for the development of the stress response and regulation
### Table 1. Program Components

<table>
<thead>
<tr>
<th>Developmental issues</th>
<th>Developmental process</th>
<th>Program implementation: Empowerment objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender role identification</td>
<td>At puberty, gender-intensification theory suggests gender-related expectations influence behavior.</td>
<td>Enhance positive messages about gender roles. Promote a more positive sex-role self-image.</td>
</tr>
<tr>
<td>Body image</td>
<td>Adolescent girls are at risk to develop a negative body image that leads to low self-esteem, depression, body image disturbance, and eating disorders.</td>
<td>Promote understanding of the changes that take place during puberty. Promote positive body image and body acceptance.</td>
</tr>
<tr>
<td>Self-acceptance</td>
<td>In early adolescence, girls have a drop in self-esteem, and this is accompanied by increased self-criticism, negative mood states, and for some girls, depression.</td>
<td>Promote a positive self-image in response to the biological, psychological, and social changes girls confront. Reduce self-criticism and promote positive mood states.</td>
</tr>
<tr>
<td>Sexuality</td>
<td>Girls’ sexuality is a major issue because of the potential consequences associated with high-risk behaviors. As girls develop sexually they need information and skills to prevent unwanted sex, unwanted pregnancies, and STDs.</td>
<td>Promote awareness and understanding of sexuality issues. Understanding risk factors for pregnancy. Enhance responsible decision making and safe sex. Broaden girls understanding of sex so it isn’t seen only as intercourse. Address the special risks for younger girls.</td>
</tr>
<tr>
<td>STI/HIV education</td>
<td>As a part of girls’ sexuality, girls who engage in sexual activity need to possess the ability to protect themselves from STIs.</td>
<td>Promote the use of condoms to prevent pregnancy and STIs. Teach assertiveness skills in negotiating sexual behaviors including condom use.</td>
</tr>
<tr>
<td>Responsible decision making (skills training)</td>
<td>Most adolescents in today’s society will confront decisions that could have lifelong, if not, lethal consequences. The cognitive development of young people has important implications for adolescent risk taking.</td>
<td>Promote responsible decision making by teaching assertiveness, resistance to peer pressure, and problem solving skills. In conjunction with decision making encourage personal assertiveness and skills for reducing sexual risk taking.</td>
</tr>
<tr>
<td>Planning for the future</td>
<td>Adolescent girls often experience a &quot;crisis in confidence&quot; that undermines their educational and career decisions for later life.</td>
<td>Enhance girls’ achievement motivation. Build their confidence for educational and vocational aspirations. Teach a “mastery orientation” as opposed to a “learned helplessness” orientation.</td>
</tr>
</tbody>
</table>

Note. STD = sexually transmitted disease; STI = sexually transmitted infection, HIV = human immunodeficiency virus.
Ongoing and future projects

- Investigating the mediating role of pubertal timing as a gendered stressor in the relation between prenatal adversities and depressive symptoms in adolescent girls. The National Longitudinal Survey of Children and Youth
- Neuroendocrine correlates of pubertal experiences.
- Gender perspectives on chronic stress. [Arija Birze, UofT]
- Empowerment and sense of community with incoming students UNBC through dance workshops. [Ashleigh Ritchie, Royal Academy of Dance].
Attention to sex and gender perspectives should be integrated in the study of Early life experience in men and gender diverse individuals.
Gender-specific medicine is a way of looking at the physiologic and pathophysiologic differences between men and women and great efforts need to be invested in research and education in order to rewrite many chapters in modern medicine.
– Suzanne King, PhD
– Sherri Jones, PhD
– Larine Sluggett, MSc
– Arija Birze, PhD candidate
– Ashleigh Ritchie, PhD

Merci, Thank you!