FUTURE OF PEDIATRICS TALKS!

A VIRTUAL SUMMER SERIES

Pediatric Health Network

Children's National

A few notes about today's Webinar

- All lines are muted throughout the webinar.
- Please use the Q&A box to ask questions or make comments.
- Today's Webinar recording and slides will be posted to the PHN website following the presentation. You can find past FOP presentations on our website at https://pediatrichealthnetwork.org/future-of-pediatrics/

Speakers

Nadia Merchant, MD

No conflicts to disclose:

- No financial or business interest, arrangement or affiliation that could be perceived as a real or apparent conflict of interest in the subject (content) of their presentation.
- No unapproved or investigational use of any drugs, commercial products or devices

Upcoming FOP Talks!

DATE	TOPIC	SPEAKER
July 15	Abnormal Thyroid Labs in the Primary Care Setting	Priya Vaidyanathan, MD
	A Pediatrician's Approach to a Young Child With Joint Effusion	Bita Arabshahi, MD
July 29	Allergic Reactions: When to Refer?	Amaziah Coleman, MD Claire Boogaard, MD
	Dermatologic Manifestations of COVID-19	Anna Kirkorian, MD
August 12	Obstructive Sleep Apnea: Primary Care Management and When to Refer	Claire Lawlor, MD
	Neuropsychological Evaluations: What are they, when are they needed and how can I get them for my patients?	Kristina Hardy, PhD Laura Kenealy, PhD
August 26	Meeting Teens Where They Are: the Contraception Discussion	Brooke Bokor, MD, MPH Natasha Ramsey, MD
	School's Out: Supporting School Attendance and Distance Learning Engagement	Asad Bandealy, MD Heidi Schumacher, MD

PHN Webinars

July 7th – 12PM PCP Town Hall: Back to School Guidance featuring Nathaniel Beers, MD

https://childrensnational.org/healthcare-providers/refer-a-patient/covid/covid-19-webinars

July 8th – 12PM: PHN Office Manager and Practice Administrator Steering committee presents *Practice Management: Road to Recovery Series*

Link to register: https://cvent.me/mq8XxD or email PHN@childrensnational.org if you are interested in attending.

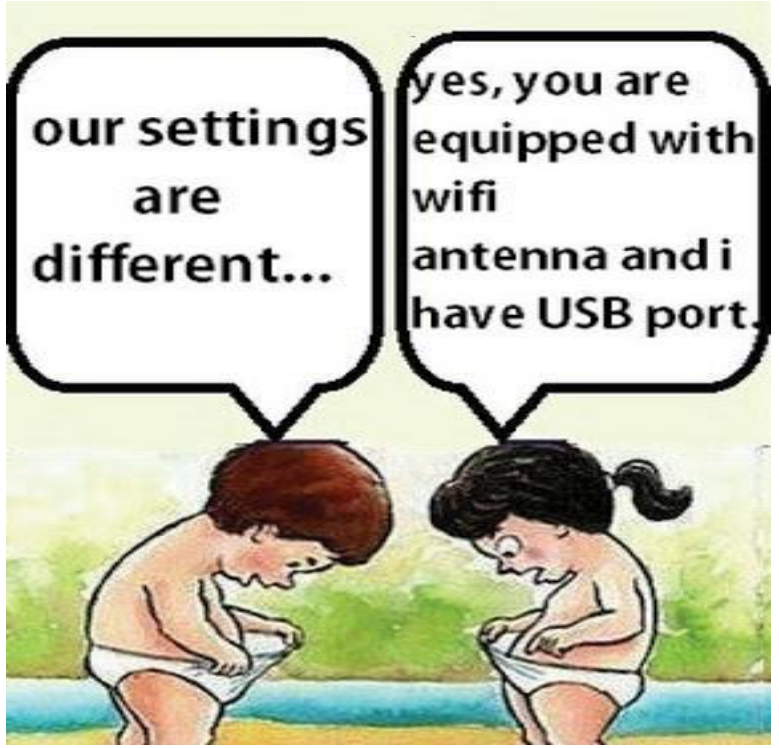
July 8	Reports and Recalls
July 22	Payment Collection
August 5	Best Practices: New Initiatives and Implementing Change
August 19	Managing a COVID-19 positive Employee and Wellness In Your Workplace

Normal and Abnormal Variation in Pubertal Development

Nadia Merchant, MD

Assistant Professor of Pediatrics

Division of Endocrinology and Diabetes



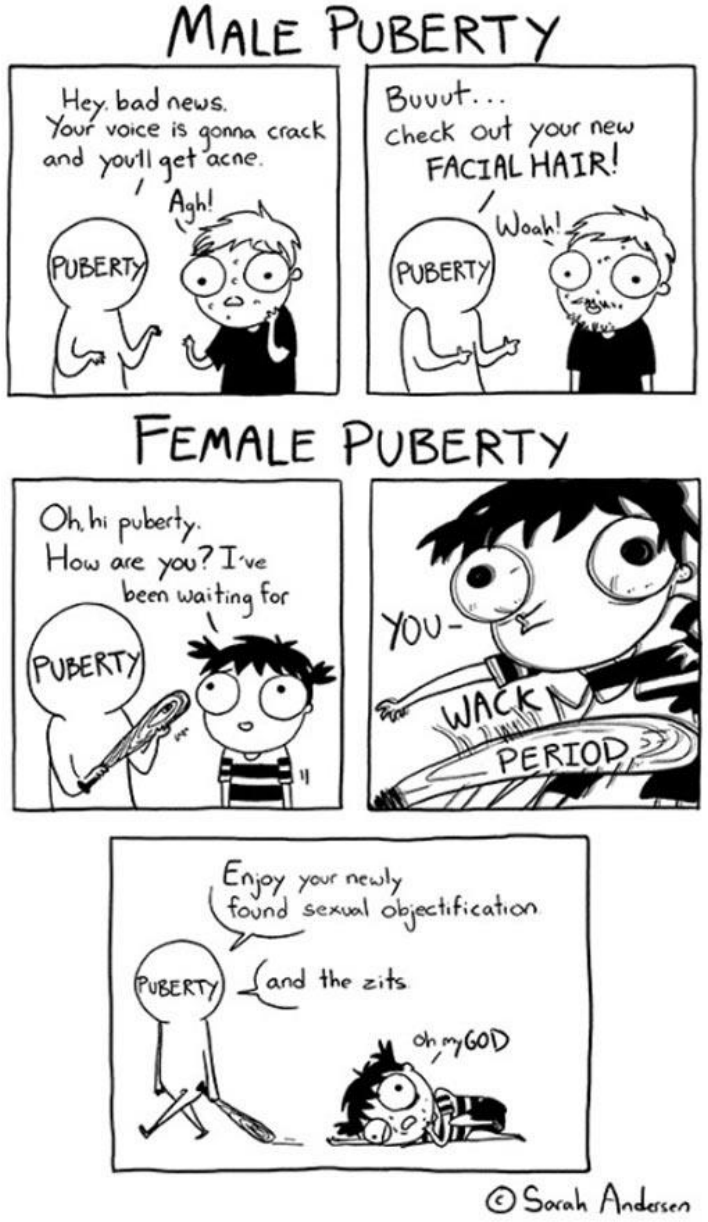
FUTURE OF PEDIATRICS

Objectives

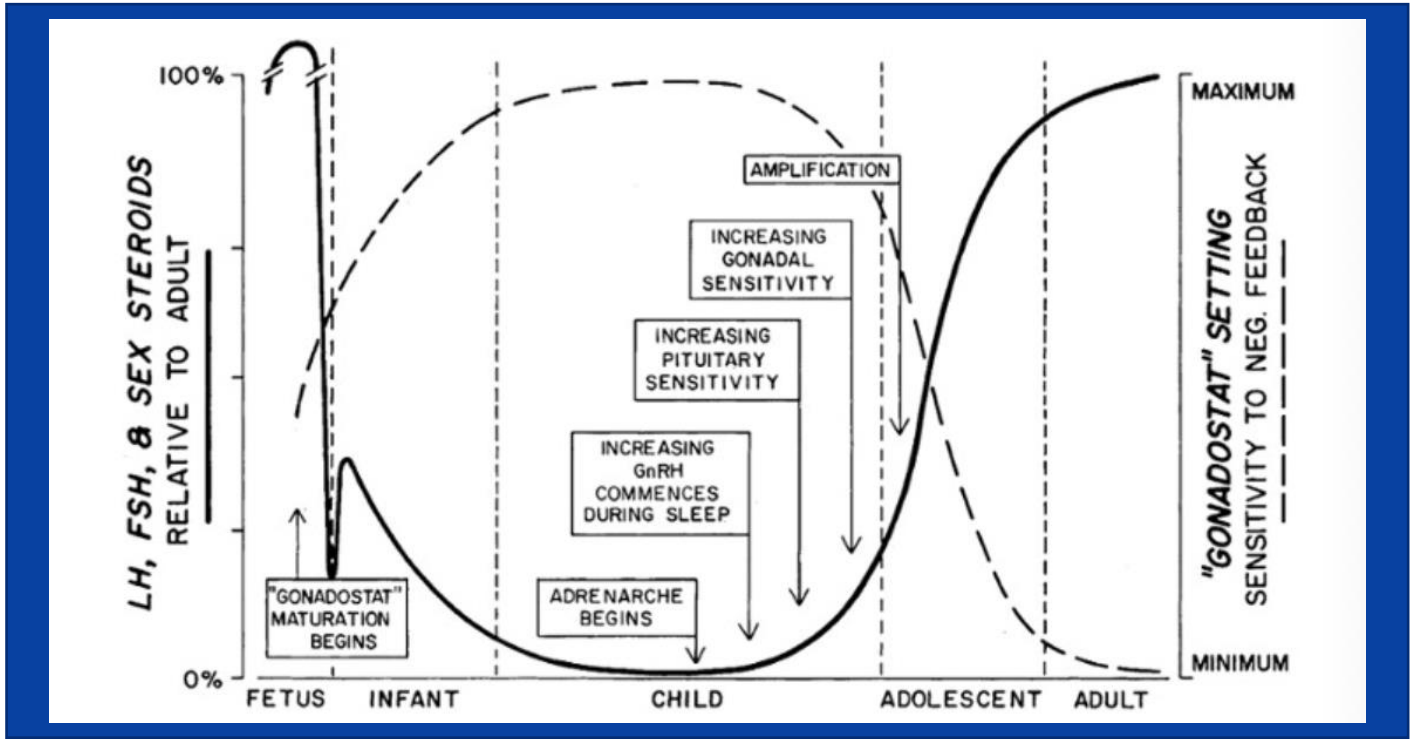
- Discuss the clinical signs of puberty, usual sequence of appearance, and typical rate of progression
- Identify benign and pathologic variations in pubertal development
- Understand evaluation and treatment options for early or delayed puberty
- Identify indications for an endocrine referral for a child with a pubertal variation

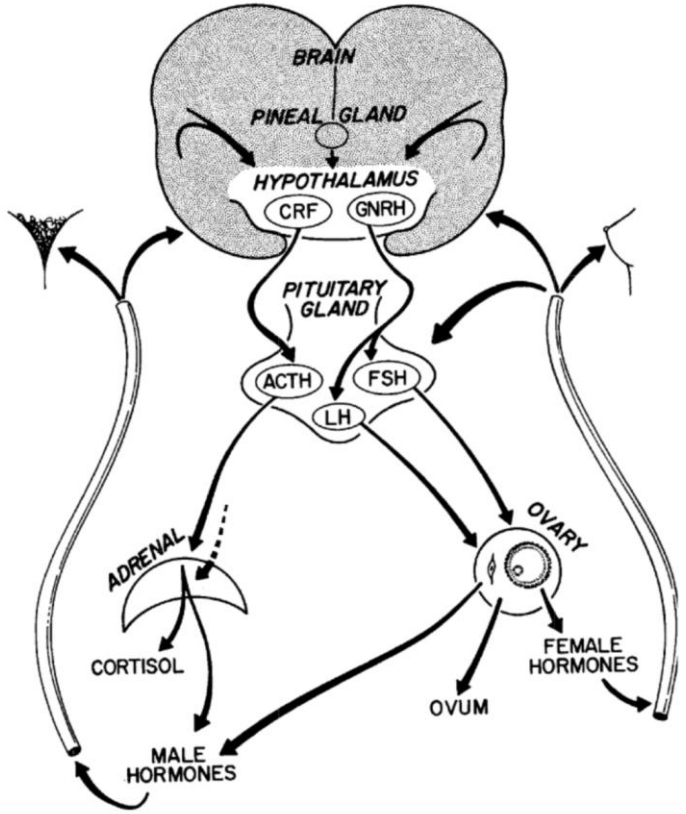
When is Puberty Normal?

- AAP recommends a complete physical examination at every health supervision visit that includes evaluating and documenting pubertal development.
- Accurate and consistent tracking of the timing, tempo, and sequence of pubertal development can aid in early identification and treatment of pubertal disorders.



Physiology of Puberty

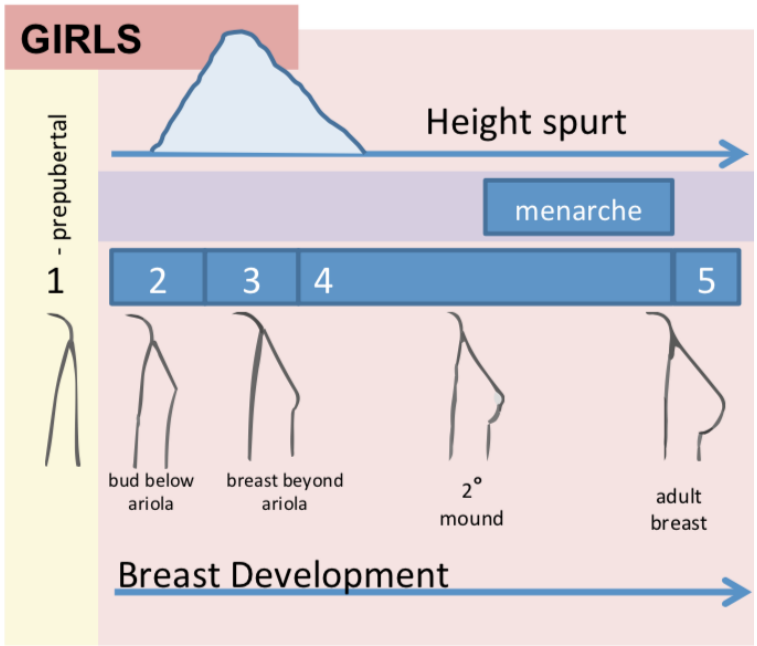


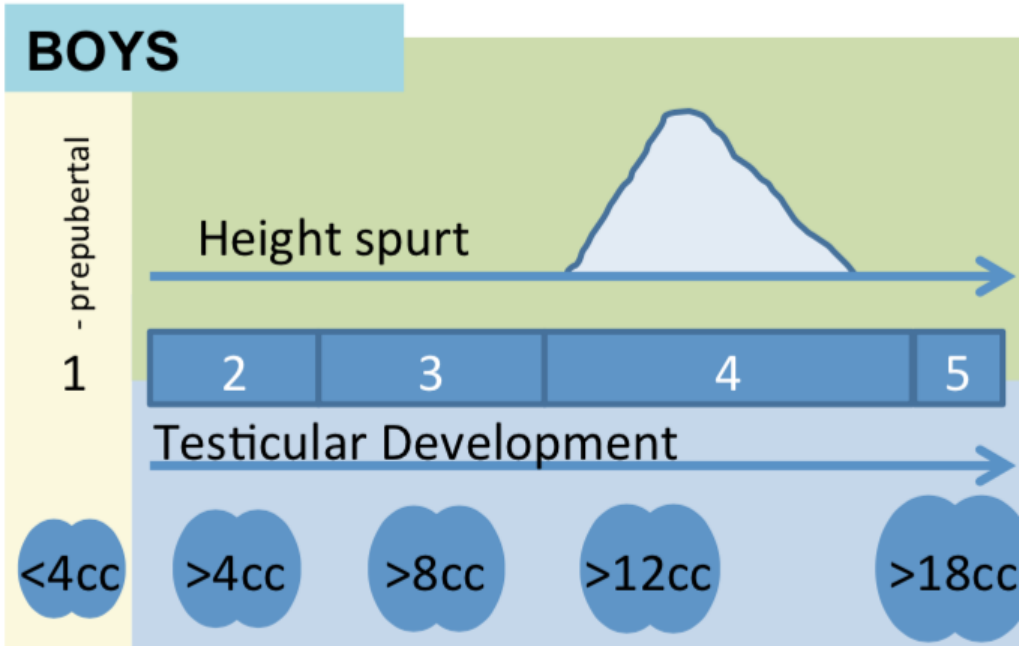


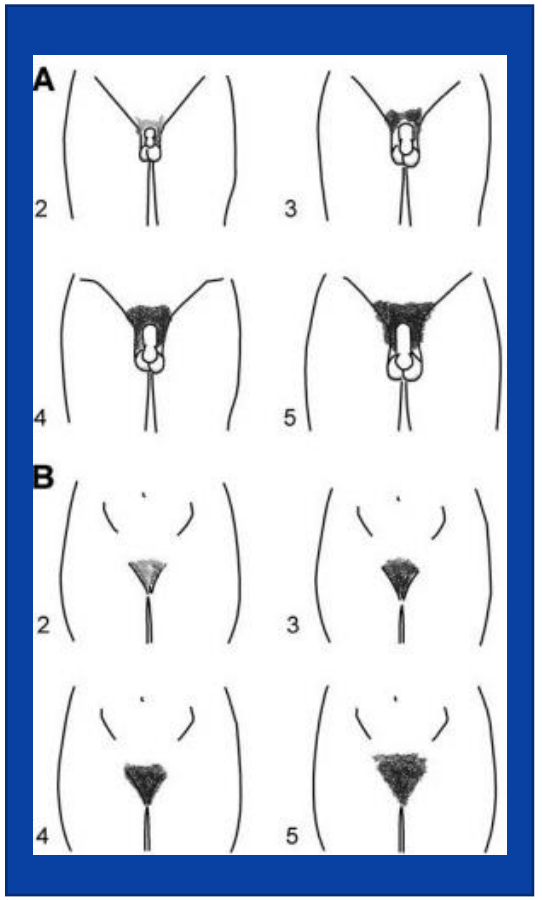
In Sperling, M. (2014). *Pediatric endocrinology*.

Normal Puberty and Tanner Staging

- Normal puberty begins between the ages of 8 and 13 years in girls and between 9 and 14 years in boys.
- Mean age of peak height velocity 12.2 years in girls and 13.8 years in boys.







Muir A, *Pediatr Rev*. 2006;27(10):373-381

Potential Adverse Outcomes of Pubertal Variations

Abnormal timing of pubertal development may result in a variety of undesirable outcomes, such as the following:

- Short adult stature
- Adverse psychosocial outcomes, including engagement in exploratory behaviors at an earlier age than adolescents maturing within the normal range or later (early puberty)
- Decreased sports involvement (delayed puberty)
- Delayed acquisition of normal bone density (delayed puberty)
- Symptoms of emotional tension and psychosomatic complaints
- Feeling different from peers about masculinity or femininity
- Teasing or bullying

Nobody likes The Puberty Fairy.

Precocious Puberty

Benign Variations of Pubertal Development: Premature Thelarche

- Frequent in female infants and toddlers.
- Breast development usually begins before 2 years, over time there is little or no progression and sometimes regression, and a normal rate of linear growth in observed.
- The cause is unknown but may be due to transient appearance of functioning ovarian cysts.
- It is usually benign.
- The risk of central precocious puberty is greater if breast growth begins after 3 to 4 years of age.

Breast Development

White Participants

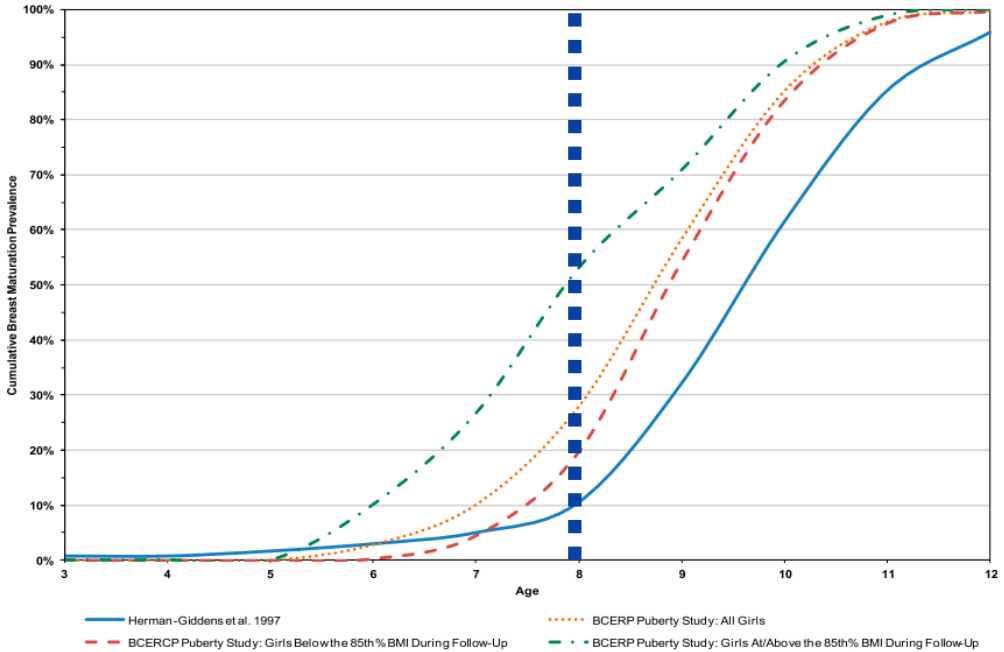


FIGURE 1
Comparing the cumulative prevalence of Breast Stage 2+ for non-Hispanic white participants between the BCERP Puberty Study and PROS.[9]

Non-Hispanic Black

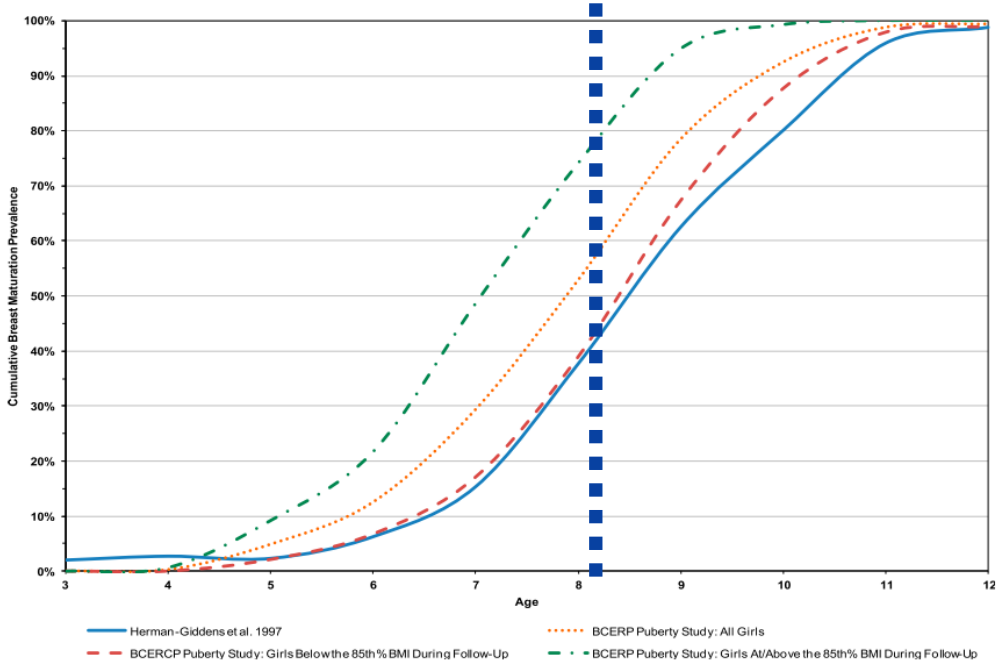


FIGURE 2
Comparing cumulative prevalence of Breast Stage 2+ for non-Hispanic black participants between the BCERP Puberty Study and PROS.[9]

Median age at onset of breast stage 2 was 8.8, 9.3, 9.7, and 9.7 years for African American, Hispanic, white nonHispanic, and Asian participants, respectively. Girls with greater BMI reached breast stage 2 at younger ages.

Biro, F. M. et al (2013). Onset of breast development in a longitudinal cohort. *Pediatrics*, *132*(6), 1019–1027.

Benign Variations of Pubertal Development: Premature Adrenarche (Girls or Boys)

- Typically occurs between 5 and 8 years of age.
- Caused by early increase in secretion of weak androgens from the adrenal gland.
- More common in African American and Hispanic girls and in obese children of either sex.
- Mildly elevated adrenal androgens, mainly Dehydroepiandrosterone sulfate (DHEA-S), with normal levels of testosterone and 17-hydroxyprogesterone.
- Rapid progression of pubic and axillary hair, severe acne, and rapid growth should raise concern for possible late-onset congenital adrenal hyperplasia (CAH) or an adrenal or testicular tumor.
- Similar symptoms, but with a stunted or decreased growth rate, are concerning for Cushing syndrome.
- Functional ovarian hyperandrogenism or polycystic ovarian syndrome may develop in up to 20% of girls with premature adrenarche.

Precocious Puberty

Precocious Puberty in Girls?

- Breast ≥ Tanner II and age < 8 yo
- Estrogenization of vaginal mucosa
  (pre = red, pubertal = pink)
- Leukorrhea or menstruation
- Growth acceleration

Precocious Puberty in Boys?

- Testicular Volume ≥ 4 cc prior to 9 years
- Scrotal thinning
- Growth acceleration

Family History

- Early or late pubertal development in parents or siblings
- Unusually short or tall stature
- Female family members with hirsutism, severe acne, or irregular menses
- Infertility

Precocious Puberty; Ladies First…

- Breast ≥ Tanner II and age < 8 yo
- Estrogenization of vaginal mucosa (pre = red, pubertal = pink)
- Leukorrhea or menstruation
- Growth acceleration

YES?

- Bone age
- 8 am labs: LH, FSH, estradiol, free T4, TSH
- If significant andrenarche on exam: consider DHEAS, total testosterone, 17-hydroxyprogesterone, androstendione

High LH/FSH
Gonadotropin Dependent

- Idiopathic
- Brain Tumor (Hypothalamic Hemartoma, Glioma)
- CNS Malformation, Trauma, Radiation

Consider Brain MRI

Low LH/FSH
Gonadotropin Independent

- Primary Hypothyroidism
- McCune Albright Syndrome
- Ovarian Cyst/Tumor
- Exogenous Estrogen
- Adrenal (CAH)

Precocious Puberty; Now lets move on to Gentleman…

- Testicular Volume ≥ 4 cc prior to 9 years
- Scrotal thinning
- Growth acceleration

YES?

- Bone age
- 8 am labs: LH, FSH, testosterone, free T4, TSH
- If significant andrenarche on exam: consider DHEAS, 17-hydroxyprogesterone, androstendione

High LH/FSH

<u>Gonadotropin Dependent</u>

- Idiopathic
- Brain Tumor (Hypothalamic Hemartoma, Glioma)
- CNS Malformation, Trauma, Radiation

Consider Brain MRI

Low LH/FSH

<u>Gonadotropin Independent</u>

- Primary Hypothyroidism
- Exogenous Testosterone
- Adrenal (CAH, adrenal tumor)
- Testicular (McCune Albright Syndrome, tumor, testotoxicosis)

Delayed Puberty

Delayed Puberty

Girls: No breast buds by 13
Boys: No testicular development > 4 cc by 14

1. Growth rate, tanner stage
2. Family History of Delayed Puberty
3. Chronic Disease, anosmia, radiation or chemotherapy, anorexia

- Bone age
- Basal serum LH, FSH, IGF-1, TSH, free testosterone or estradiol, IGF-1

Low LH, FSH

Elevated FSH

Growth rate prepuberatal

Growth rate less than prepubertal

GnRH deficiency or constitutional delay of growth and puberty

Functional hypogonadotropic hypogonadism (secondary to chronic disease, anorexia)
Permanent hypogonadotropic hypogonadism or hypopituitarism

Hypergonadtropic Hypogonadism

Consider Referral

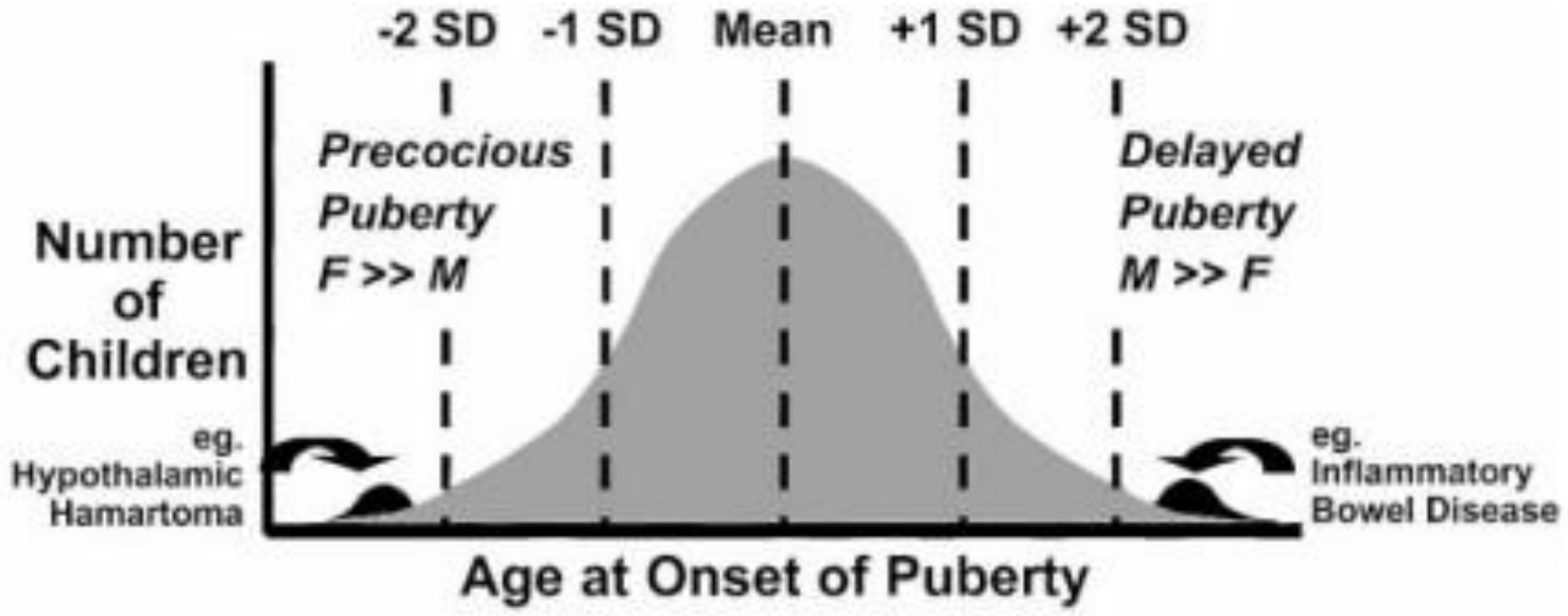
- **Premature Adrenarche**
  - Pubic or axillary hair alone in a girl < 7 years or a boy <9 years (since the great majority of these children have premature adrenarche and need no tests or treatment, following the child in the PCP setting is also an option)
  - Rapid pubertal progression; in hair growth or other signs of virilization

- **Premature Thelarche**
  - Breast development beginning after the age 3
  - Significant thelarche (Tanner stage 3 or more)
  - Rapid linear growth and breast development
  - McCune-Albright syndrome suspected
  - Vaginal bleeding or other coincident signs of pubertal development

- **Precocious Puberty**
  - Breast development in a girl < 8 years
  - Testicular enlargement >4 cc especially with penis enlargement in a boy <9 years
  - Rapid linear growth
  - Rapid progression of Tanner staging

- **Delayed Puberty**
  - Lack of breast development in girls by age 13 years or no menses by 16 years
  - Lack of testicular enlargement in boys by age 14 years

Variation in Timing of Puberty



Biro, F. M., et al. (2013). Onset of breast development in a longitudinal cohort. *Pediatrics*, *132*(6), 1019–1027.

What is needed with referral…

- Try to track signs of puberty at PCP visits
- Growth charts
- If bone age obtained, please ask family to take CD for appointment
- If obtaining labs, try to obtain labs 8 am, especially LH (order 3rd generation)

- The younger the child, more rapid the progression of findings, greater the likelihood of detecting pathology
- Lots of variation in puberty, especially with different races and ethnicities → we are always willing to see a patient if there are concerns

Thank You


MOM, CAN YOU WASH THIS SHIRT?
I JUST HUNG IT IN YOUR CLOSET AN HOUR AGO!
I KNOW BUT...
GAAAK!
THESE SWEAT GLANDS SHOULD BE REGISTERED AS LETHAL WEAPONS.

Central Precocious Puberty: GNRH analog

	Leuprolide	Histrelin
Functions	A GnRH analog when given chronically suppresses LH and FSH production and slows pubertal progression and bone age advancement.	GnRH analog that is inserted by a surgeon, avoiding the need for injections.
Application	Given intramuscularly monthly or every 3 months. A 6-month formulation was approved by the FDA in 2017.	Implanted in the inner arm subcutaneous tissue, approved for replacement every 12 months, its effect may last for 24 months.
Side effects	Sterile abscesses, rare allergic reactions, acne, or rash.	Rare local insertion site reactions, keloid formation, and pain.

Once treatment is started, it is important to monitor the following:

- Progression of pubertal development
- Growth rate
- Skeletal maturity (bone age) progression
- LH and estradiol or testosterone to assess adequate suppression

Delayed Puberty: Hormonal Therapy

Boys			
	Use	Administration	Side Effects/Cautions
Testosterone (various forms)	Delayed puberty: short-term to jump-start pubertal development Hypogonadism: higher doses for long-term replacement	Intramuscular: much easier to increase dose over time than with patch or gel Transdermal (patch or gel)	High doses: premature epiphyseal closure IM preparations: local reactions Patch: local irritation
Girls			
	Use	Administration	Side Effects/Cautions
Estrogens (various forms)	Not routinely recommended, but may be used in delayed puberty Induce breast development, induce menstruation, maintain bone mass	Oral Transdermal by patch	Liver toxicity Potential risk of thromboembolism and hypertension
Progestins	Added to induce endometrial cycling. Usually necessary only if treatment continues longer than 1 to 2 years, after breakthrough bleeding	Oral most commonly used	Minor: headaches, breast tenderness, abdominal discomfort

Once treatment is started, it is important to monitor the following:

- Progression of pubertal development
- Growth rate
- Skeletal maturity (bone age) progression—to avoid excess advancement of bone age