

Puberty-tracking system aids researchers, too

Some studies suggest that menstruation at an early age, a prolonged period of puberty, or other developmental anomalies during the pre-teen and teenage female years may foretell an increased risk of breast cancer later in life. This has turned a spotlight on a clearer picture of what exactly *is* normal when it comes to pubertal development in girls.

One of the primary tools that epidemiologists and other clinicians use to follow a girl's progress through puberty is the Tanner staging system, also known as the sexual maturity rating, that breaks down puberty into discrete steps, said Dr. Louise Greenspan, M.D., Kaiser Permanente Medical Center, San Francisco. Dr. Greenspan explained the steps in the staging system and the associated age ranges and averages, and described the system's history during the 2005 conference on Emerging Topics in Breast Cancer and the Environment Research.

Developed in 1969, the system grew out of a two-decade-long study of girls as they transitioned through puberty, she said. "The Tanner staging system is named after Dr. James Tanner, who was a British pediatrician. He performed a longitudinal study in which the subjects were observed repeatedly over a period of time in the same context." In all, the study included 192 girls, all of them white, British and living in a children's home, she said. Some children were orphans and some came from broken homes. Over the study's 20-year period, she described, the girls underwent examinations and photographs every three months. Dr. Tanner and others in his research group reviewed the collected data and compartmentalized what is a continuous process of development into five stages.

The Tanner staging system evaluates both breast development and pubic hair, and Dr. Greenspan focused her talk on the breast-development portion.

Stage one

This stage is the period before pubertal development begins, she said. The breast shows no outwardly noticeable changes.

Stage two

Also known as thelarche, a breast at Tanner stage two has an enlarged areola, a the papillary (nipple) mound that may be visible, and a breast bud that is palpable (noticeable to the touch) lying under the areola, she described. "In the Tanner study, the average age of thelarche was 11.15 years, with a range of 8.5 to 13 years." Other contemporary studies done in the United Kingdom, United States and Hong Kong at or around the time of the Tanner study showed a range of 9.9 - 10.8 years. A 1992-93 study, known as the Pediatric Research in Office Settings (PROS) study, of 17,000 U.S. girls had results a bit younger than the Tanner study, she said. Dr. Greenspan said, "The Caucasian girls averaged 9.96 with a range of about 7-12; and the African American girls were even younger."

Stage three

In Tanner stage 3 breast development, the bud enlarges beyond the areola, the areola experienced early changes including pigmentation, and small glands, called Montgomery glands, form on the areola. "There is further breast enlargement, but there is no separation of the contours of the areola from the breast. This is all one mound," she explained. The age attainment of stage three in Tanner's study was 12.15

years. She added, "The contemporary U.K. and U.S. studies reported 11.2-11.4 years, which is consistent with the PROS study, but is significantly later than the African-American girls, who attained breast stage 3 at a mean of 10.19 years."

Stage four

The areola and nipple project above the contour of the breast to form a secondary mound in stage four, Dr. Greenspan said. The areola becomes more pigmented and enlarged, and nipple also becomes pigmented. "This is the most variable of all the stages," she commented. "In fact, in the Tanner study, some girls skipped stage 4, and went directly from Tanner Stage 3 to Tanner stage 5." In the Tanner study, the mean age of Tanner Stage 4 was 13.1 years.

Stage five

"Tanner Stage 5 breast development is the mature, adult breast," she said. "There is projection of only the papilla with recession of the secondary mound back to the contour of the breast, and there is a further increase in breast size." Interestingly, of the 57 girls who reached stage 5 in the Tanner study, four of them regressed to stage 4, she said. "People think that breast development is a linear process, but longitudinal studies have shown that there is some hormonal fluctuation and girls can go back." In the Tanner study, the mean attainment of stage 5 was 15.3 years with a range of 11.8-18.9 years. In other contemporary studies, the average age was about 13.8.

Other information from the Tanner study

Menarche, or the first menstrual period, is not part of the Tanner staging system. "You need a certain amount of estrogen to menstruate, but it can happen at Tanner stage 2, 3, 4 or even 5. It's very interesting that the response of the vaginal mucosa and the vaginal lining to estrogen and progesterone is different from what's happening in the breast," she said. In the Tanner study, 25 percent of the girls had menarche by stage 3, and 60 percent by stage 4. The average age was 13.5 years. In comparison, the contemporary U.K. and U.S. studies showed 12.8 and 12.9 years, while the PROS study revealed average ages of 12.8 for Caucasian girls and 12.1 for African-American girls.

The Tanner study also provided a view of puberty's span. In it, girls made the transition from thelarche to menarche, or the onset of breast development to the first menstrual cycle, in an average of 2.3 years. The range was 0.5-5.75 years. She commented, "I suspect that the girls at both ends were abnormal, because 0.5 is a little quick and 5.75 is delayed puberty. In fact, if there is more than three years between thelarche and menarche, it is considered delayed puberty." The study also showed that the time from stage 2 to the complete breast maturation of stage 5 averaged about 4.2 years.

Dr. Greenspan noted that this data is helping researchers today to gain a clearer picture of what constitutes normal development, and will assist in current and future studies of developmental trends.

Summary of Dr. Greenspan's presentation at the November 2005 BCERC Scientific Symposium: Measurement of Normal Human Breast Development During Puberty.

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