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Commentary: The decreasing age of puberty—as much a psychosocial as biological problem?

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The mean age of puberty in girls in Western populations has been falling for the last 150 years. Slowing or cessation of this rate of decline in some of these countries since the 1960s suggests that the mean age

at puberty is approaching the biological limit. With continuing economic development and the resulting movement from rural to urban societies, earlier maturation is also being seen in non-Western societies.[1] It is unclear whether a similar secular decline has occurred in boys, partly because it is more difficult to assess puberty in boys. However, evolutionary biologists believe that earlier age at puberty may be biologically appropriate in both sexes as the current average age at menarche is similar to that which existed in early hunter-gatherers, and that the change to later onset of puberty resulted from poorer nutrition and increased infection rates in agrarian societies.[2]

Despite these population trends in average age at puberty, within individuals in similar environmental circumstances there remains a 4–5-year difference in the timing of menarche. What factors influence that timing? Genetics, family history, racial and ethnic group, early nutrition and childhood infections have all been implicated. First observed in Sweden in the 1980s, migration of girls adopted from less economically developed countries to more developed ones has been shown to be associated with early onset of puberty. Explanations for this relationship are controversial, but socio-economic changes, better diet in the destination country resulting in catch-up growth, racial differences and alleviation of environmental stress by adoption have been implicated.[1] The paper by Hui *et al*.[3] reporting findings from Hong Kong's 'Children of 1997' cohort study extends research on the impact of migration by highlighting an inter-generational effect on age at puberty of the offspring related to migration of the mother. This paper contributes significantly to the literature on factors that trigger puberty in non-Western societies and adds to the relatively sparse literature on the determinants of pubertal timing in boys, highlighting the gender differences in those determinants. Comparing the age at puberty of children born in 1997 in Hong Kong with Chinese mothers native to Hong Kong, with children whose Chinese mothers were brought up in mainland China, they found that the female, but not the male, children of the migrant mothers had earlier puberty (as measured by onset of breast development).

How robust are these findings? Although pubertal stage was assessed at routine clinical examinations using pubic hair development for both sexes, and breast development for girls and genital development for boys, the breasts and testicles were not palpated. Non-palpation can lead to misclassification of pubertal stage, particularly in obese children.[4] The children of migrant mothers were taller and fatter by 7 years of age, and this may have resulted in more of these girls being recorded erroneously as having breast development. Moreover, age at menarche, an important confounding variable, was missing for 60% of the mothers. Although the population of mainland China at that time was unlikely to have earlier puberty than the population of Hong Kong, it is possible that the migrant mothers were an earlier maturing subset.

Why does an earlier age at puberty matter? Hui *et al*.[3] claim that given the association of early puberty with chronic diseases, these inter-generational influences may be relevant to the emerging epidemics of chronic diseases in migrant populations or in countries undergoing rapid economic development, where the age of puberty is declining rapidly. As the effects of early puberty on chronic diseases differ between the sexes, and Hui *et al*.[3] show the maternal migration effect only in girls, we will focus on effects in women. Early puberty in girls has been associated with increased risk of breast cancer,[5] ovarian cancer,[6] obesity,[7] diabetes[8] and raised triglycerides in later life.[9] The effects on diabetes and raised triglycerides may be explained by both increased post-menarcheal and adult body mass index in those with early puberty. Let us attempt to quantify the effects of differences in puberty associated with maternal migration on later disease. The size of the independent effect of maternal migration in Hui *et al*.'s study was to advance the age of pubertal onset by approximately, in the fully adjusted model, 1.4 months. It has been estimated that the rate of breast cancer is increased by 5%[5] and that the rate of midlife obesity is increased by 12%[7] per year earlier age at menarche. These figures translate to an increased rate of breast cancer of ~0.6% in girls of migrant mothers and increased rate of obesity in later life of 1.4%. Thus maternal migration is likely to only contribute a small amount to the emerging epidemics of chronic diseases in migrant populations and in countries undergoing rapid economic development.

A second set of harms related to early puberty are psychosocial. Early puberty is associated with increased risk for many psychosocial disorders; depression and other mental disorders, psychosomatic syndromes, substance abuse and antisocial behaviours.[10] These findings may be understood in terms of neurological development. Some domains of neurodevelopment, largely related to affect (romantic motivation, sexual interest, emotional intensity, changes in sleep/arousal, appetite, risk of affective disorders in females, increase in risk taking, novelty seeking, sensation seeking), are puberty specific, whereas most aspects of cognitive development (reasoning, logic and capacities for self-regulation of emotions and drives) mature in a more age-related fashion, continuing to develop slowly long after puberty is over.[11] The child experiencing early puberty will be experiencing 'turbo-charged' feelings without the cognitive abilities to modulate these strong feelings and motivations. In high-risk social situations this can lead to the adoption of reckless behaviours such as early sexual behaviour, leaving school early, substance abuse, which in some cases can have lifelong detrimental effects either through biological or psychosocial pathways.

Age at puberty can thus have an impact on individuals' life course trajectories through influences on

early behaviours and psychosocial characteristics, as well as on obesity and ultimately chronic disease. The 'Children of 1997' are now 14 years old and it will be fascinating to see how this effect of maternal migration on age at puberty plays out in relation to all aspects of their lives. Given the relatively poor accuracy of recalled age at menarche,[12] follow-up of such cohorts with prospective information on early life factors is vital in understanding the role of development on later life outcomes.

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