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## Pubertal timing and callous-unemotional traits in girls: Associations across two samples from the UK and Cyprus

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### ABSTRACT

**Introduction:** Girls remain an understudied group when examining delinquency. Callous-unemotional traits are chief among personality traits that relate to delinquency. Some suggest, however, that girls who evince callous-unemotional traits delay their delinquent behavior until adolescence. This transitional period encompasses physical factors that relate to engagement in risky decision making, but we don't know how these factors relate to callous-unemotional traits. Early pubertal timing shows positive associations with delinquency; we tested if this was also the case for callous-unemotional traits.

**Methods:** We tested associations among pubertal timing (i.e., maturity and menarche age), delinquency, and callous-unemotional traits within girls (ages 11–18 years) sampled from two European countries (UK and Cyprus). We also tested the interaction between callous-unemotional traits and pubertal timing in statistically predicting delinquency to test if associations between early puberty and delinquency were moderated by callous-unemotional traits.

**Results:** Greater callous-unemotional traits were surprisingly negatively related to early pubertal timing. Those girls in the delayed menarche group had the highest level of callous-unemotional traits, higher than the typical and early menarche groups. Only callous-unemotional traits statistically predicted variance in delinquency and no moderation was evident.

**Conclusions:** The implications are that callous-unemotional traits and the transition to puberty may be particularly important for girls' adjustment in adolescence, particularly if menarche is delayed allowing girls to avoid punishment by capitalizing on their immaturity.

The developmental transition period of adolescence is important to start to understand why some girls might eschew society's rules without feeling guilty about it. Delinquency in girls carries extreme risk for poor adult outcomes at a high cost to society, both in terms of public health but also to long term employability and socioeconomic status (Odgers et al., 2008), so this transitional period is the focus of much research. Girls who engage in delinquency early in adolescence may have intimate relationships in adulthood that involve abuse and violence, and they are more likely to experience economic deprivation, including unemployment, under education,

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low income, and low socioeconomic status (Odgers et al., 2008). Therefore, there are some girls who engage in delinquency in adolescence, but this behavior comes at a life-long cost to themselves, to those around them, and to society. The mechanism by which girls start to be delinquent is poorly understood (Frick & Viding, 2009), and some research suggests they may have particular risk factors related to entering adolescence. Yet, girls remain an understudied group with regard to delinquency and offending (Loeber, Jennings, Ahonen, Piquero, & Farrington, 2017, pp. 29–35).

Some level of aggression and antisocial behavior is normative in childhood and adolescence, yet girls show particular risk factors which become clear when one understands normative developmental transitions (Loeber, Capaldi, & Costello, 2013). Delinquency and antisocial behavior that is not necessarily illegal in adolescence is somewhat normative, particularly when these behaviors are transient and contextual (Moffitt, Caspi, Dickson, Silva, & Stanton, 1996). Yet, a small sample of girls engage in high rates of delinquency (Loeber et al., 2017, pp. 29–35), so identifying factors that are related to delinquency make for fruitful investigations. If we know what factors are related to antisocial personality traits – themselves relatively stable and predictive of future delinquency – then we can start to build interventions to prevent these traits or to at least dampen their negative effect on outcomes. Antisocial personality traits can include traits of psychopathy that have been downward extended to youths and include traits that are not transient developmentally immature characteristics of teenagers (Vachon, Lynam, Schell, Dryburgh, & Costa, 2018). One facet of psychopathic traits are callous-unemotional (CU) traits, which are defined as a lack of empathy and concern for others' well-being, as well as showing emotions superficially. Callous-unemotional (CU) traits (Frick, Ray, Thornton, & Kahn, 2014) are an important marker of conduct problems and delinquency that has shown relative stability across development. Since CU traits confer risk for conduct problems and delinquency (see Frick et al., 2014 for a review), it is important to understand the ways in which CU traits are related to developmental transitions, with adolescence being a challenging time for some adolescents.

One obvious hypothesis, since both pubertal timing and CU traits are positively related to delinquency, is that CU traits and early puberty would be positively related to each other. Indeed, delinquency has shown a positive association with early puberty in girls (Haynie, 2003; Stice, Presnell, & Bearman, 2001), possibly because of factors such as the choice of peer group (Caspi, Lynam, Moffitt, & Silva, 1993; Goldstein, Malanchuk, Davis-Kean, & Eccles, 2007; Magnusson, Stattin, & Allen, 1985). Another hypothesis is that they might not have any association with each other. A third alternative, and perhaps the most relevant to disentangling risk factors for adolescent delinquency, is that they may be negatively correlated.

There is some reason to think that this third alternative, a negative correlation, is plausible. Research suggests delayed puberty and CU traits could both be related to childhood maltreatment, household dysfunction, and hormones (Goulter, Kimonis, Hawes, Stepp, & Hipwell, 2017; Kimonis, Centifanti, Allen, & Frick, 2014; Li, Denholm, & Power, 2014). Indeed, high levels of foetal testosterone is linked to late-onset puberty and low levels of empathy, a key component of CU traits (Helleday, Edman, Ritzén, & Siwers, 1993). Yet, some of the links between puberty and hormone levels have been unreplicated among girls (see Mendle, Turkheimer, & Emery, 2007). With respect to maltreatment, delayed development of pubertal indicators in relation to child neglect was observed in a study of a British birth cohort [ $n = 17638$ ] (Li et al., 2014), but some research suggests early or late age of menarche may differ based on the accumulation of maltreatment or the kind of maltreatment experienced (Boynton-Jarrett et al., 2013). However, there have been no studies of this question in the literature to date with regard to CU traits and possible pubertal timing.

Specifically, adolescence may be a developmental period where girls with CU traits start to engage in delinquency. Girls, unlike boys, have been shown to show poor adjustment related to CU traits without parents noting conduct problem behavior as children (Silverthorn, Frick, & Reynolds, 2001). That is, levels of CU traits were assessed in adjudicated adolescent youths (ranging from age 13–18 years) based on early-onset and late-onset conduct problems. Girls in the delayed-onset group were similar to boys in the childhood-onset group in clinical correlates and high levels of CU traits, although onset was determined by parent retrospective reports which are inherently problematic and biased. Yet, the hypothesis put forward is that girls with CU traits show a 'delayed onset' to their conduct problems (Silverthorn et al., 2001). There have been critiques of the 'delayed onset' hypothesis, and longitudinal studies have found childhood-onset trajectory groups of girls: those who continue to show problems across the life-course (not just in adolescence), at least when examining offenders (El Sayed, Piquero, & TenEyck, 2017). A six-site large cohort study showed that boys' adolescent delinquency could be predicted from early aggression and conduct problems (Broidy et al., 2003). Yet, girls' delinquency could not be reliably predicted from stable patterns of early aggression or conduct problems. Thus, factors have still yet to be identified that relate to girls' delinquency. It may be that factors predicting girls' delinquency are more proximal in time to the behavior.

One reason why this transitional period from childhood to adolescence, marked by menarche, may be important for girls' delinquent behavior is that childhood vulnerabilities may be accentuated at puberty. Girls' adjustment to puberty is influenced by contextual factors and in some ways, puberty may be a stressful life event that triggers the use of the same coping mechanisms that have worked for girls in their early to middle childhood years. These ways of coping may become accentuated at puberty and may actually be maladaptive to use in adolescence (see Allison & Hyde, 2013 for a review; Caspi & Moffitt, 1991). So, it may be that tried and true coping methods from childhood, even if maladaptive, may provide a shorthand for dealing with the transition of adolescence. Shyness in childhood, for example, may transition to introversion or internalizing symptoms in adolescence (see Allison & Hyde, 2013 for a discussion). Fearless temperament or disinhibition may transition to risky decisions via this route, too.

Alternatively, it has been proposed that the increased pubertal hormone levels can directly effect neurological changes in the brain. In turn these developmental changes can affect stress and emotional sensitivity at a time in adolescence when self-regulatory parts of the brain are not fully online (Mendle et al., 2007). Thus, increases in sensation-seeking and risk-taking may result. There is some evidence that reorganization of some brain structures coincide with puberty (Sisk & Zehr, 2005), and difficulties in adjusting to this sometimes tumultuous and emotional event may lead to deviant behavior (see Graber, 2003; Susman & Rogol, 2004). Social

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