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 JOURNAL OF  
 ADOLESCENT  
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Original article

## Longitudinal Latent Cognitive Profiles and Psychosocial Well-being in Early Adolescence

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*Article history:* Received November 24, 2016; Accepted May 3, 2017

*Keywords:* UK; Cognition; Early adolescence; Risky behaviors; Mental health; Cohort studies

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 A B S T R A C T

**Purpose:** Engaging in exploratory risky behaviors and experiencing poor mental health during early adolescence are important markers for poor health during adulthood. Prior research suggests protective effects from cognition, but less is known about the associations between early childhood cognition and early adolescent psychosocial well-being, as identified by self-esteem, mental health, and exploratory risky behaviors. This article investigates the extent that early adolescent psychosocial well-being at the age of 11 years is associated with patterns of cognitive skills measured across the first decade of a child's life.

**Methods:** We used data collected from the four follow-up sweeps of the UK Millennium Cohort Study and utilized latent profile analysis to identify three discernible cognitive profiles ( $n = 16,899$ ).

**Results:** We find cohort members in low-achieving profiles to be more likely to engage in exploratory risky behaviors—drinking, smoking, and antisocial conduct—and to have poor self-esteem and more problem behaviors, compared with their peers in high-achieving profiles. Socioeconomic and family psychosocial markers considerably attenuated these disadvantages.

**Conclusions:** Understanding which adolescents have adverse psychosocial well-being has implications for the prevention of chronic diseases and for clinical care and policy.

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 IMPLICATIONS AND CONTRIBUTIONS

Adolescents with poor cognitive skills are more likely to engage in risky behaviors, to have low self-esteem, and more problem behaviors. Socioeconomic factors, parental mental health, and parental supervision were important in explaining differences. Future research should identify protective factors and possible interventions to improve adolescent psychosocial well-being.

Adolescence is a crucial period of psychological, social, and biological change. Early adolescence is an important period given the potential emergence of antisocial behavior, poor mental health, and experimentation with alcohol and smoking [1–3]. The uptake of risky behaviors during this developmental period is concerning as they are linked to subsequent life course outcomes such as educational failure, hypertension, and premature mortality [2,4]. Poor mental health during adolescence has been linked to academic achievement, subsequent anxiety and

depression, and eating pathology [5]. The social costs from the loss of productivity and an array of health care expenses due to these pernicious consequences [6] has led to an extensive body of research aimed at better understanding the social etiology of adolescent mental health and exploratory risky behaviors (hereafter referred to as psychosocial well-being) [7]. Ultimately, having information about groups of adolescents who are most vulnerable to poor mental health and exploratory risky behaviors can help in planning both prevention and intervention programs to promote the success of all children.

Existing scholarship has considered the influence of cognitive development in shaping adolescent psychosocial well-being [1,8,9]. However, much of the evidence has focused on cognitive skills in middle to late adolescence [10], finding strong cognitive performance, measured by higher grades, advanced

**Conflicts of interest:** The authors have no conflicts of interest to disclose.

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courses and school engagement, to be associated with lower levels of alcohol use [11,12] and is protective against cigarette use [13]. Less is known about the linkages between cognitive skills during early childhood and adolescent psychosocial well-being [14]. Understanding inequalities in children's cognitive skills is consequential given the economic benefits of intervening during early childhood to reduce long-term inequalities [15].

Recent evidence examining longitudinal patterns of cognition in early childhood emphasizes the importance of considering the heterogeneity in patterns of cognitive skills and the need to move beyond cross-sectional means [16]. Very few studies examine longitudinal patterns of cognitive skills and associated outcomes. Those studies that have examined patterns of cognitive skills have either relied on cross-sectional cognitive data [14], focused on subgroups of children [17], or grouped cognition along with other domains of school readiness (e.g., health or gross motor skills) [18,19]. No prior studies have explored outcomes in early adolescence.

This study attempts to address these gaps in the literature by investigating the link between patterns of cognitive skills in early childhood and psychosocial well-being among early adolescents. We focus on early adolescence (11 years of age), a period during which increased prevalence of mood disorders has been observed [20] and which may be a sensitive phase due to the onset of puberty and accompanying academic transitions and increasing influence of peer groups [21]. Second, cognition may have a greater influence on psychosocial well-being during developmental transitions [8]. We use a nationally representative sample of children born at the millennium to first identify patterns of children's cognitive skills. Next, we examine the extent to which longitudinal cognitive profiles are associated with markers of adolescent psychosocial well-being (cigarette use, alcohol drinking, antisocial behavior, happiness, self-esteem, and problem behaviors) among 11-year-olds.

## Methods

### Data

The Millennium Cohort Study is a nationally representative sample of 19,244 families of children born in the United Kingdom between 2000 and 2002, who were living in the United Kingdom at 9 months old and who were eligible to receive Child Benefit [22]. The sample is clustered at the electoral ward level and disadvantaged residential areas and those with a high proportion of ethnic minority residents were oversampled. Primary respondents were mainly mothers, and data collection occurred when cohort members were 9 months, and 3, 5, 7, and 11 years old. During home interviews, trained interviewers carried out cognitive assessments; at the fifth (age 11 years) sweep, interviews were conducted during home visits with both cohort members and their parents/caregivers, and questions were asked about adolescent psychosocial well-being, socioeconomic circumstances, and family psychosocial factors. Cohort members filled out a self-completion booklet. Ethical approval was granted by the Northern and Yorkshire multicentre research ethics committees.

Child cognitive skills are moderated by multiple births, and therefore, we analyzed data on singleton-born cohort members. To characterize longitudinal latent cognitive profiles, we first analyzed a sample of cohort members who had at least one cognitive assessment across the four sweeps. The analytic

sample for the latent profile analysis was 16,899. The sample of cohort members with at least one marker of psychosocial well-being at age 11 years was 13,072. This sample was further reduced to a maximum of 11,263 participants with complete data on covariates. Sample sizes varied by outcome measure and ranged from 10,822 to 11,263.

### Measures

**Markers of psychosocial well-being.** This study investigated six measures of adolescent psychosocial well-being. Cohort members reported on whether they had ever tried a cigarette (1 = yes, 0 = no) and ever had an alcoholic drink (1 = yes, 0 = no). Antisocial behavior was self-assessed through four questions asking about being noisy or rude in public, theft, public defacement, and public damage. A binary variable was derived indicating any antisocial behavior versus none. Happiness was measured with six items reflecting cohort member's happiness about different aspects of their life: school work; school; appearance; family; friends; and life as a whole ( $\alpha = .83$ ). Responses on each question ranged from a score of 0 (not at all happy) to a score of 3 (completely happy) and were summed, and a binary variable was constructed to indicate the top 10% of the distribution or high level of happiness (1 = top 10% of scores, 0 = bottom 90% of scores) [23]. Cohort members rated their self-esteem using a shortened and adapted version of Rosenberg's Self-Esteem Scale which comprised five items on a four-point Likert scale (1 = strongly agree to 4 = strongly disagree;  $\alpha = .74$ ) [24]: self-satisfaction, having good qualities, able to do things similar to others, person of value, and feel good about oneself. Similar to self-reported happiness, self-esteem was categorized as a binary variable indicating high self-esteem or the top 10% of the distribution. Parents answered questions about their child's socio-emotional behavior using the Strengths and Difficulties Questionnaire a valid and reliable measure of children's emotional, social, and behavioral difficulties [25]. Scores are summed across four behavioral domains (peer problems, conduct disorders, hyperactivity, and emotional problems) to construct a total difficulties score, which was analyzed as a binary variable with scores defined as "abnormal" or "borderline," collectively referred to as behavioral difficulties (coded as 1), and "normal" (coded as 0) [25]. An externalizing behavior score was the sum of conduct problems and hyperactivity-inattention scales and an internalizing behavior score was the sum of emotional symptoms and peer problems scores. Both externalizing and internalizing scores were used as continuous variables in sensitivity analyses.

**Cognitive skills.** Cognitive skills were assessed using a subset of the British Ability Scales II (BAS II), which is a battery of cognitive abilities and educational achievement tests [26]. The individual subscales are widely validated, age appropriate, can be analyzed separately and have been shown to predict later child cognitive performance [22]. Data were available on the BAS II Naming Vocabulary Subscale (age 3 and 5 years) which measures vocabulary and expressive reasoning, the Word Reading subscale (age 7 years) involving verbal reasoning, and the Verbal Similarities subscale (age 11 years) assessing cohort member's verbal reasoning and verbal knowledge [22]. Other BAS subscales (e.g., testing spatial abilities) were administered but unavailable at all four sweeps of data collection. Scores on BAS II subscales are

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