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Full length article

Early onset of cannabis use: Does personality modify the relation with changes in perceived parental involvement?

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ABSTRACT

Background: The present study examined (1) the association between changes in perceived parental control and support from age 13 to 15 and early onset of cannabis use (before age 16), and (2) whether personality modifies the association between a decline in perceived parental control and support and early onset of cannabis use.

Method: Objectives were studied using data (three waves covering two years) from 444 Dutch adolescents participating in the Research on Adolescent Development and Relationships (RADAR) study. Adolescents had a mean age of 13 years at baseline, and reported at each wave about perceived parental control and support. Big Five personality traits and past year cannabis use were also measured by self-report. Joint latent growth curve–discrete-time survival analyses were used to answer the research questions.

Results: Early onset of cannabis use was reported by 19.4% of the sample. Overall, a decline in perceived parental control or support from age 13 to age 15 was unrelated to the risk of early onset of cannabis use. In adolescents with low levels of emotional stability and extraversion, a stronger decline in perceived parental control was associated with an increased risk of early cannabis use.

Conclusions: Experiencing a decline in parental control from age 13 to 15 is associated with early onset of cannabis use in adolescents characterized by low emotional stability and low extraversion.

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1. Introduction

Experimentation with cannabis is most likely to begin in adolescence and, according to European estimates, about a third of adolescents have tried cannabis by the age of 16 (Andersson et al., 2007). Among adolescent cannabis users, initiation seems to peak at age 15 (Monshouwer et al., 2005). At the same time, cannabis involvement has been related to several adverse outcomes, including other illicit drug use, poor school performance and early dropout, crime and mental health problems including depression, psychosis and substance use disorders, that seem most pronounced in adolescents who start using cannabis before age 16 (Arseneault et al., 2002; Fergusson et al., 2002; Lynskey and Hall, 2000; Rey et al., 2004). Research on initiation of cannabis use before

age 16 can improve our understanding of a developmental pathway that may end with such serious adverse outcomes.

In search for identifying the factors that may underlie an early onset of cannabis use, researchers have focused on parenting, particularly parental control and parental warmth (Baumrind, 1989). Parental control refers to the extent to which parents require their child to obtain permission and insist on being informed about their children's whereabouts, activities, and associates. Unlike parental knowledge that may be gained primarily by spontaneous adolescent disclosure, parental control refers to active parental efforts to set limits on the child's behavior (Stattin and Kerr, 2000). Although linkages between parental control and adolescent problem behaviors are not consistently found (Racz and McMahon, 2011), previous cross-sectional and longitudinal studies have indicated that adolescent substance use (Fletcher et al., 2004; van der Vorst et al., 2006) and general problem behavior including substance use (Stattin and Kerr, 2000; Willoughby and Hamza, 2011) are somewhat more likely among adolescents who perceive low parental control. Similarly, low levels of parental warmth or support, referring to the extent to which adolescents perceive their parents to be

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loving, affectionately demonstrative, supportive, and involved, have been found to be cross-sectionally as well as prospectively related to general substance use, and specifically cannabis use, in mid-adolescence (Creemers et al., 2011; Stice and Barrera, 1995).

Despite the importance of these previous studies, the knowledge they have provided regarding the association between perceived parenting behavior and adolescent substance use is incomplete in at least two ways. First, most available studies on parenting in relation to substance use utilize variation in levels of parenting behavior at a given time point to predict variation in substance use in time. However, the adolescent years are marked by changes in the parent–child relationship in which teenagers become more autonomous and independent from their parents (Grotevant and Cooper, 1986), as well as by changes in associated parenting behavior. For instance, it has been demonstrated that, over the course of adolescence, children experience a decline in parental control and perceive their parents as becoming less emotionally supportive (Keijsers and Poulin, 2013; Loeber et al., 2000). Experiencing more pronounced changes in parenting behavior has been linked with psychopathology development among adolescents (Hale et al., 2011). However, it is unknown whether the magnitude of the change in perceived parenting behavior during the early adolescent years is associated with early onset of cannabis use.

A second gap in available research on the association between perceived parenting and adolescent cannabis use regards the lack of consideration of moderation by child factors. More specifically, the association between a decrease in perceived parental control or support and cannabis use may be most pronounced in specific subgroups of adolescents. For instance, Engels et al. (2005) demonstrated in a longitudinal study that the impact of low family functioning (at a given time point) on the development of problem drinking was most pronounced among individuals characterized by childhood aggression, which is by itself a risk factor for problem drinking. Following this line of reasoning, the link between a decline in perceived parental control and support and onset of cannabis use might be most pronounced in adolescents characterized by traits associated with adverse patterns of cannabis use. In terms of the Five Factor Model of personality, (low) agreeableness, (low) conscientiousness and (high) openness have been linked with cannabis use, while such associations have not been found with emotional stability and extraversion (Fridberg et al., 2011; Terracciano et al., 2008). Whether the association between changes in perceived parenting behavior during adolescence and early onset of cannabis use depends upon these personality traits of the adolescent is unknown.

Using data from a longitudinal population sample of Dutch adolescents, the aims of the current study were to examine (1) the association between changes in perceived parental control and support from age 13 to 15 and early onset of cannabis use (before age 16; this study does not focus on early versus later onset of cannabis use but on early versus no onset of cannabis use), and (2) whether the association between changes in perceived parental control and support and early onset of cannabis use is moderated by adolescent personality characteristics.

2. Methods

2.1. Sample and participants

The current study presents data from a population-based prospective cohort study in the Netherlands, entitled Research on Adolescent Development and Relationships (RADAR). Because this study, in which adolescents are followed from age 12 to 18 years, has a specific focus on delinquency development, the objective of the RADAR sampling was to oversample adolescents at risk of developing such behavior (200 at risk adolescents, 300 normal risk adolescents). To obtain this sample, a random selection of 429 elementary schools in the province of Utrecht, and the cities of Amsterdam, Rotterdam, The Hague, and Almere were invited to participate with all grade 6 classes. Of these schools, 296 were willing to participate, and for logistic reasons, data were collected at 230. In these schools, children were screened for the presence of externalizing problems using the Teacher's Report Form, yielding information for 5150 children. Because of the intensive data collection that requires a firm grasp of the Dutch language, only children of Dutch origin were eligible for participation (N = 3237 children). To obtain the target number of 500 families, a random selection was made consisting of 1544 children, oversampling children with externalizing scores at or above the borderline clinical range (referred to as 'at-risk adolescents'). More specifically, 87% (N = 457) of the at-risk adolescents was selected to proceed versus 40% (N = 1087) of the children with externalizing scores below the borderline clinical range (referred to as 'control adolescents'). Parents were approached by telephone to inform them about the project and to ask whether they were interested in participating in the RADAR study. Because phone records were missing or incorrect (N = 99), because the pre-requirements of the full family approach (both parents present, and presence of a sibling ≥10 years of age) were not met (N = 364), or because parents refused further participation (N = 470), 611 of the 1544 families (40%) were included in the sample. Of these predominantly intact two-parent families, 114 did not provide written informed consent for all participating family members. Of the remaining 497 cases, 291 were control adolescents and 206 were at-risk adolescents. Non-participation in the RADAR study was not related to the target adolescent's sex (1, N = 1544) = 2.75, p = 0.10). Mean externalizing behavior scores for nonparticipating families were similar to participating families, both for control adolescents (F (1, 1085) = 0.024, p = 0.88) as for at-risk adolescents (F(1, 455) = 2.02, p = 0.16). RADAR was approved by the medical ethical committee of Utrecht University.

For the present study, data from the first (T1), second (T2), and third (T3) assessment waves of the RADAR study were used. At T1, adolescents were in the first grade of junior high (corresponding to eighth grade in US) and were 13 years old on average (SD = 0.5). At T2 and T3 adolescents were, respectively, 14 and 15 years old (SDs = 0.5). Attrition in the RADAR study was low, with 466 of the remaining 497 families participating at T2 (6.2% attrition) and 474 of the 497 families participating at T3 (4.6% attrition) (Keijsers et al., 2012). Participants with missing information on cannabis use (N = 53) were excluded. The final 444 included participants (57% male) did not differ from the excluded participants in terms of perceived parental control or support, or any of the personality dimensions (all p's > 0.05).

2.2. Measures

Cannabis use was assessed at each wave using self-report questionnaires, querying the frequency of past year cannabis use (response options ranging from 0 = never to 13 = 40 times or more). Confidentiality of the study was emphasized so that adolescents were reassured that their parents would not have access to the information they provided. *Early onset of cannabis use* was defined as cannabis use at T1, T2 or T3.

Perceived low parental control was assessed at each wave using the self-report version of a questionnaire developed by Stattin and Kerr (2000). The subscale Parental Control measures the child's perception of parental rules and restrictions on their behavior, thereby limiting the amount of freedom children have to do things without telling their parents. Subjects were asked to rate items (e.g., 'Does your father/mother always require that you tell them where you are at night, who you are with, and what you do?') on a 5-point scale ("never" to "always") for their father and mother separately. From T1 to T3, Cronbach's alphas for the 6-item scale parental control ranged from 0.84 to 0.88 (mother) and from 0.83 to 0.85 (father). The scale has adequate factor validity in a Dutch sample (Hawk et al., 2008). In order to obtain a measure comparable to lack of parental support, we calculated low parental control by reverse-coding the scores and by averaging the mean-item scores (average of 6 items) for fathers and mothers (correlations ranged from 0.64 to 0.67).

Perceived lack of parental support was assessed at each wave using the self-report version of the Level of Expressed Emotion Scale (Cole and Kazarian, 1988). For the subscale Lack of Emotional Support, subjects were asked to rate 19 items (e.g., 'My parents do not support me when I am upset') on a 4-point scale ('not agree at all' to 'totally agree'). Mean item scores (average of 19 items) were calculated. From T1 to T3, Cronbach's alphas for this subscale ranged from 0.81 to 0.92. The Level of Expressed Emotion Scale has an acceptable factor validity amongst Dutch youths (Hale et al., 2011).

Personality was assessed at each wave by the short self-report version of the Big Five personality questionnaire (Gerris et al., 1998; Goldberg, 1992). This questionnaire includes 30 general traits, six for each of the five factors. Participants were asked to indicate to what extent these traits applied to them on a 7-point scale, ranging from absolutely disagree to absolutely agree. The dimension agreeableness was measured with items such as kind and helpful (Cronbach's alphas 0.78–0.87). Conscientiousness was measured with items such as organized and efficient (Cronbach's alphas 0.52–0.90). The dimension emotional stability was assessed with reverse-codes of items such as nervous and sensitive (Cronbach's alphas 0.80–0.85). The dimension extraversion was assessed with reverse-codes of items such as quiet and shy (Cronbach's alphas 0.60–0.88). Finally, the dimension openness to experience was measured with items such as creative and having wide interests (Cronbach's alphas 0.71–0.84). For each of the personality dimensions, T1, T2 and T3 scores were averaged.
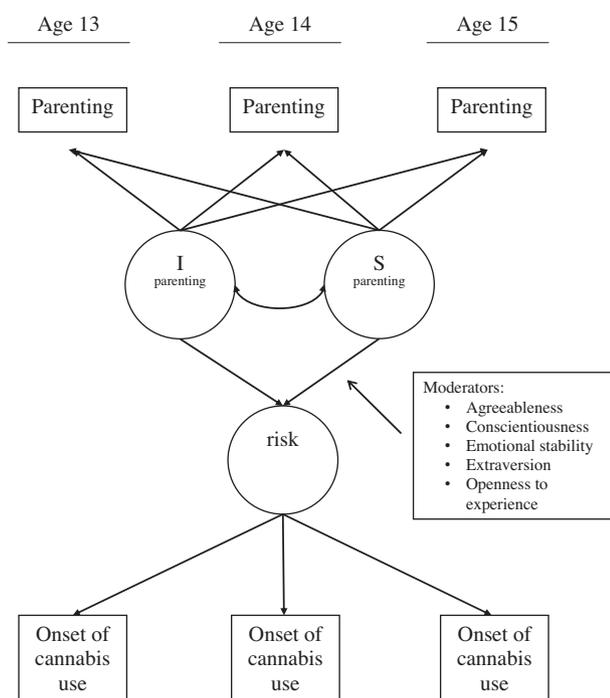
Age 13   Age 14   Age 15

Fig. 1. Hypothesized model. *I* = intercept, *S* = linear slope.

Several covariates were taken into account. *Parental cannabis use* (no/yes) was defined as any past year cannabis use at T1, T2 or T3 by father or mother, measured by parent-reports. *Early alcohol use* and *early tobacco use* (no/yes) were defined as any use at T1, assessed with the items "Have you ever tried alcohol?" and "Have you ever tried tobacco smoking?". Past year *presence of any disruptive disorder* (no/yes), including DSM-IV attention deficit and/or hyperactivity disorder, oppositional defiant disorder, and conduct disorder, was assessed at T1 using the parent version of the Diagnostic Interview Schedule for Children (Ferdinand and van der Ende, 2002; Schaffer et al., 2000).

2.3. Statistical approach

For descriptive purposes, means of variables and correlations between them were calculated. To investigate our research aims, joint latent growth curve–discrete-time survival analyses (LGM–DTSA) were fitted in Mplus 6.11 (Muthén and Muthén, 1998–2010). Maximum likelihood estimation with robust standard errors using a numerical integration algorithm, was used to account for the non-normal distributions of study variables. Models were fitted separately for parental control and support and were controlled for male sex, parental cannabis use, early tobacco use, early alcohol use, and presence of any disruptive disorder. Personality scores were standardized to a mean of 0 and a standard deviation of 1.

Because we were particularly interested in the development of parenting from age 13 to 15, we first determined the development of parental control and support using latent growth modeling (LGM). In LGM, random effects are used to capture individual differences in development. The random effects are conceptualized as continuous latent factors, the growth factors. The growth curves are determined by two latent growth factors: intercepts, which represent the initial status of the growth curve; and linear slopes, which represent the linear developmental change. Model fit of LGMs was determined using the comparative fit index (CFI, critical value ≥ 0.95) and the root mean square error of approximation (RMSEA, critical value ≤ 0.08) (Bentler, 1990; Brown and Cudeck, 1993).

We then investigated the association between changes in the two parenting measures with risk for early onset of cannabis use, using LGM–DTSA (Muthén and Masyn, 2005). Discrete-time survival analysis (DTSA) enables to study the probability, or hazard, of experiencing a non-repeatable event, such as onset of cannabis use. This type of analysis considers the timing as well as the occurrence of the first time an adolescent uses cannabis, and thus allows for examining the longitudinal progression of the likelihood that cannabis initiation occurs within a one-year interval. DTSA models right-censored data and properly accounts for the fact that many adolescents will not initiate use during the observation period. Furthermore, DTSA can be combined with latent growth curve models to investigate whether changes in the latent growth factors are associated with probability of an event occurring.

An illustration of our LGM–DTSA model is presented in Fig. 1. In this figure, the factor 'risk' specifies a proportional odds assumption for the hazard of cannabis initiation. By regressing the latent 'risk' factor on the LGM intercepts and slopes of perceived parenting, the joint development of probability of onset of cannabis use

as a function of change in perceived parenting was tested. We ran these models (a) without accounting for time-invariant covariates (Model 1), and (b) accounting for sex, parental cannabis use, early tobacco use, early alcohol use, and presence of any disruptive disorder (Model 2). To achieve the most parsimonious models, non-significant covariates were excluded from the models.

To test if associations between changes in parenting and early cannabis use were moderated by personality, we performed separate LGM–DTSAs for parental control and support in combination with each of the personality dimensions. We tested main effects in step 1, including the significant covariates. Interactions between parenting and personality were added in step 2.

3. Results

3.1. Descriptive information

Early onset of cannabis use was reported by 19.4% (N = 86) of the adolescents. Means of parenting and personality measures from T1 to T3 are presented in Table 1 and correlations between the variables are shown in Table 2. Table 3 presents the estimated developmental changes in perceived parental control and support from age 13 to age 15. Fit indices indicated that models fitted the data adequately (CFI = 1.00; RMSEA = 0.00 for parental control and CFI = 0.99; RMSEA = 0.08 for parental support). Slope factors of low parental control were significant, indicating that adolescents perceived a linear decrease in parental control over time (mean slope = 0.15; SE = 0.03, p < 0.001; note that the value of the mean slope indicates an increase in low parental control). No significant changes over time were found in lack of parental support (mean slope = 0.02; SE = 0.01, p = 0.15). However, the significant variance around the slope factor indicated that there was significant variation amongst individuals in the rate of change of perceived parental support (variance = 0.03; SE = 0.01, p < 0.001).

3.2. Early onset of cannabis use as a function of parenting behavior

The unconditional DTSA to estimate the probability of early onset of cannabis use resulted in observed hazards, that is the probability of cannabis use in a specific time interval provided that it has not occurred previously, of 0.023, 0.049, and 0.133, at age 13, 14, and 15, respectively. Nested model comparisons to investigate the proportionality assumption (Satorra, 2000) showed that all covariates had similar effects across all ages, except early tobacco use. Because early tobacco use was positively related to cannabis use at age 15, but not at age 13 and 14, it was retained in the models only for age 15 cannabis use.

Results of the LGM–DTSA are in Table 4. Irrespective of the inclusion of the significant covariates in the model, neither initial levels nor changes in perceived parental control were associated with early onset of cannabis use. Changes in perceived parental support were also not associated with early cannabis initiation. However, higher initial levels of perceived lack of parental support were significantly associated with a higher likelihood of early cannabis initiation.

3.3. Moderation by personality

Testing for main effects in step 1 (not presented in a table) yielded one main effect of personality, indicating that higher levels of extraversion were positively associated with early cannabis use (OR = 1.37, 95%CI = 1.09–1.73, p < 0.01 in model with parental control and OR = 1.67, 95%CI = 1.29–2.17, p < 0.01 in model with parental support). Results of step 2, in which moderation by personality was tested, are in Table 5. For parental control, findings of the parenting by personality interactions indicated that the levels of emotional stability and extraversion moderated the association of change in perceived parental control with cannabis use. To

Table 1
Means of parenting and personality measures at T1, T2 and T3.

	T1	T2	T3	T1–T3
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Low parental control	1.45 (0.92)	1.60 (0.95)	1.77 (0.95)	
Lack of parental support	0.60 (0.39)	0.60 (0.44)	0.64 (0.49)	
Agreeableness	4.48 (0.76)	4.43 (0.70)	4.48 (0.70)	4.46 (0.61)
Conscientiousness	2.99 (1.11)	3.04 (1.15)	2.94 (1.15)	2.98 (1.00)
Emotional stability	3.39 (1.12)	3.51 (1.21)	3.51 (1.23)	3.47 (1.01)
Extraversion	4.09 (1.05)	4.12 (1.09)	4.08 (1.08)	4.10 (0.91)
Openness to experience	3.90 (0.95)	3.91 (0.97)	3.91 (0.95)	3.90 (0.82)

Note: T1 = first assessment wave (mean age 13 years old), T2 = second assessment wave (mean age = 14 years old), T3 = third assessment wave (mean age = 15 years old).

Table 2
Correlations between early onset of cannabis use, low parental control at T1 to T3, lack of parental support at T1 to T3, personality, and all covariates.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Early onset of cannabis use T1–3																
2. Low parental control T1	−0.03															
3. Low parental control T2	0.04	0.47***														
4. Low parental control T3	0.06	0.36***	0.57***													
5. Lack of parental support T1	0.14**	0.16*	0.15**	0.11*												
6. Lack of parental support T2	0.14**	0.12	0.13**	0.06	0.66***											
7. Lack of parental support T3	0.16**	0.12	0.09	0.04	0.50***	0.67***										
8. Agreeableness	−0.04	−0.12	−0.14**	−0.19***	−0.39***	−0.38***	−0.39***									
9. Conscientiousness	−0.13**	0.05	−0.14**	−0.14**	−0.10*	−0.17***	−0.14**	0.32***								
10. Emotional stability	−0.01	−0.04	0.04	0.06	−0.10*	−0.12*	−0.13**	−0.09	−0.13**							
11. Extraversion	0.15**	−0.04	−0.01	0.07	−0.19***	−0.24***	−0.18***	0.20***	−0.16**	0.46***						
12. Openness to experience	0.02	0.03	−0.09	−0.12*	−0.10*	−0.16**	−0.14**	0.56***	0.26***	−0.21***	0.06					
13. Gender	−0.08	0.07	−0.10*	−0.09	−0.01	−0.05	−0.02	0.16**	0.06	−0.23***	0.01	0.12*				
14. Disruptive behavior disorder	0.08	−0.09	−0.01	0.01	0.12*	0.15**	0.08	−0.04	−0.12*	−0.09	−0.04	0.02	−0.04			
15. Parental cannabis use	0.23***	0.08	0.07	0.12*	0.01	0.03	0.04	−0.02	−0.06	0.03	0.09	0.01	−0.01	0.05		
16. Early tobacco use	0.33***	0.07	0.11*	0.07	0.20***	0.20***	0.14**	−0.10*	−0.18***	−0.01	0.07	−0.02	−0.06	0.14**	0.11*	
17. Early alcohol use	0.22***	0.08	0.05	0.06	0.09	0.11*	0.17***	−0.11*	−0.14**	0.08	0.05	0.01	−0.18***	−0.01	0.06	0.34***

Point biserial correlations for associations between a continuous and a dichotomous variable.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

decompose the direction of effect of these moderations, the significant two-way interaction terms were probed by estimating the effects of change in perceived parental control on cannabis use, with levels of emotional stability or extraversion being high

($M + 1$ SD) or low ($M - 1$ SD) (Holmbeck 2002). As illustrated in Fig. 2a, results indicated that a stronger decline in perceived parental control was associated with a higher likelihood of cannabis use in adolescents with low levels of emotional stability (OR = 5.18,

Table 3
Estimated levels and rates of development in low parental control and lack in parental support using Latent Growth Modeling.

	Intercept		Slope		Model fit			
	Mean (SE)	Variance (SE)	Mean (SE)	Variance (SE)	χ^2	df	CFI	RMSEA
Low parental control	1.47 (0.05)***	0.51 (0.10)***	0.15 (0.03)***	0.15 (0.04)**	0.76	1	1.00	0.00
Lack of parental support	0.60 (0.02)***	0.13 (0.02)***	0.02 (0.01)	0.03 (0.01)***	3.80	1	0.99	0.08

** $p < 0.01$.
*** $p < 0.001$.

Table 4
The association between changes in parenting behavior and early onset of cannabis use.

| | Low parental control | | | | Lack of parental support | | | |
| | Model 1 | | Model 2 | | Model 1 | | Model 2 | |
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Slope parenting	2.20	0.86–5.61	2.00	0.76–5.06	3.28	0.62–17.44	3.17	0.57–17.65
Intercept parenting	1.06	0.69–1.62	0.90	0.56–1.43	3.96[**]	1.81–8.66	4.16[**]	1.86–9.30
Parental cannabis use			3.90[***]	2.05–7.37			4.35[***]	2.30–8.26
Early alcohol use			3.59[***]	1.92–6.11			3.28[***]	1.81–5.97

[**] $p < 0.01$,
[***] $p < 0.001$. After including parenting behavior, early tobacco use was no longer significantly related to early onset of cannabis use and was therefore removed from the model.

Table 5
Early initiation of cannabis use as a function of development in lack of parental control and support over time, personality, and parenting by personality interactions.

| | Low parental control | | Lack of parental support | |
	OR	95%CI	OR	95%CI
	Agreeableness			
Slope	1.76	0.76–4.10	3.39	0.61–18.73
Agreeableness	0.73	0.49–1.10	1.12	0.83–1.50
Agreeableness × slope	2.23	0.58–8.55	0.64	0.02–18.23
	Conscientiousness			
Slope	1.64	0.73–3.71	2.50	0.40–15.56
Conscientiousness	0.79	0.54–1.17	0.80	0.61–1.06
Conscientiousness × slope	0.91	0.31–2.64	0.78	0.07–9.13
	Emotional stability			
Slope	1.79	0.90–3.59	3.46	0.60–20.07
Emotional stability	1.17	0.89–1.54	0.98	0.77–1.23
Emotional stability × slope	0.36[**]	0.20–0.65	1.95	0.45–8.56
	Extraversion			
Slope	2.18	0.94–5.04	4.31	0.74–25.13
Extraversion	1.66[**]	1.25–2.21	1.68[***]	1.30–2.17
Extraversion × slope	0.40[**]	0.18–0.88	0.95	0.28–3.17
	Openness to experience			
Slope	1.98	0.88–4.45	3.36	0.59–19.18
Openness to experience	0.99	0.66–1.42	1.17	0.89–1.55
Openness × slope	1.37	0.49–3.83	0.31	0.06–1.61

Notes: Corrected for the intercept of parental control/support and for parental cannabis use and early alcohol use.
[**] $p < 0.01$.
[***] $p < 0.001$.

95%CI = 3.07–8.71, $p < 0.001$), but not in adolescents with high levels of emotional stability (OR = 0.65, 95%CI = 0.26–1.67, $p = 0.38$). Furthermore, and illustrated in Fig. 2b, a stronger decline in parental control was associated with a higher likelihood of cannabis use in adolescents with low levels of extraversion (OR = 5.01, 95%CI = 1.67–14.98, $p < 0.01$), but not in adolescents with high levels of extraversion (OR = 0.91, 95%CI = 0.36–2.32, $p = .85$). For parental support, no moderation by personality was found.

4. Discussion

The aims of the present study were to examine the association between changes in parental control and support from age 13 to 15 and early onset of cannabis use, and to determine whether this association was moderated by adolescent personality characteristics. In line with findings from previous research, adolescents experienced their parents as becoming less controlling from age 13 to 15 (Keijsers and Poulin, 2013), suggesting that adolescents became more autonomous and independent during this period. Adolescents did not perceive their parents as becoming less supportive. This inconsistency with findings from previous research (Hale et al., 2011; Loeber et al., 2000) might be due to the fact that the focus of our study was on mid-adolescence, while others observed a growing lack of perceived support from mid to late adolescence. Possibly, the experience of a decline in parental support is more clearly manifested at later stages of adolescence.

Our results indicated that, overall, perceiving lower levels of parental control or support over time was not associated with early onset of cannabis use. However, specific personality traits appeared to moderate the relation between changing levels of perceived parental control, though not support, and cannabis use. For adolescents with lower levels of emotional stability and extraversion, there was a positive association between a stronger decline in perceived parental control and early onset of cannabis use. Because emotional stability was not correlated with early cannabis use in this study and has not been generally associated with cannabis use (Fridberg et al., 2011; Terracciano et al., 2008), our finding pertaining to emotional stability is not in line with the thought that a decline in perceived parental control might be more detrimental for adolescents who are more likely to use cannabis based upon their personality. Possibly, adolescents with lower levels of emotional stability, who are emotionally reactive and vulnerable to stress, may experience a decline in perceived parental control as frightening, further increasing their vulnerability. Extraversion, however, was positively related to cannabis use in this study. Yet, since lower levels of extraversion seem to protect adolescents against early cannabis use, our finding contrasts the thought that particularly adolescents who are more likely to use cannabis are affected by a decline in perceived parenting behavior. We speculate that peer influences may explain our contrasting finding. Adolescents who experience decreasing levels of control may find more opportunities to spend an unsupervised leisure time with peers. This may heighten their risk of negative behavior,
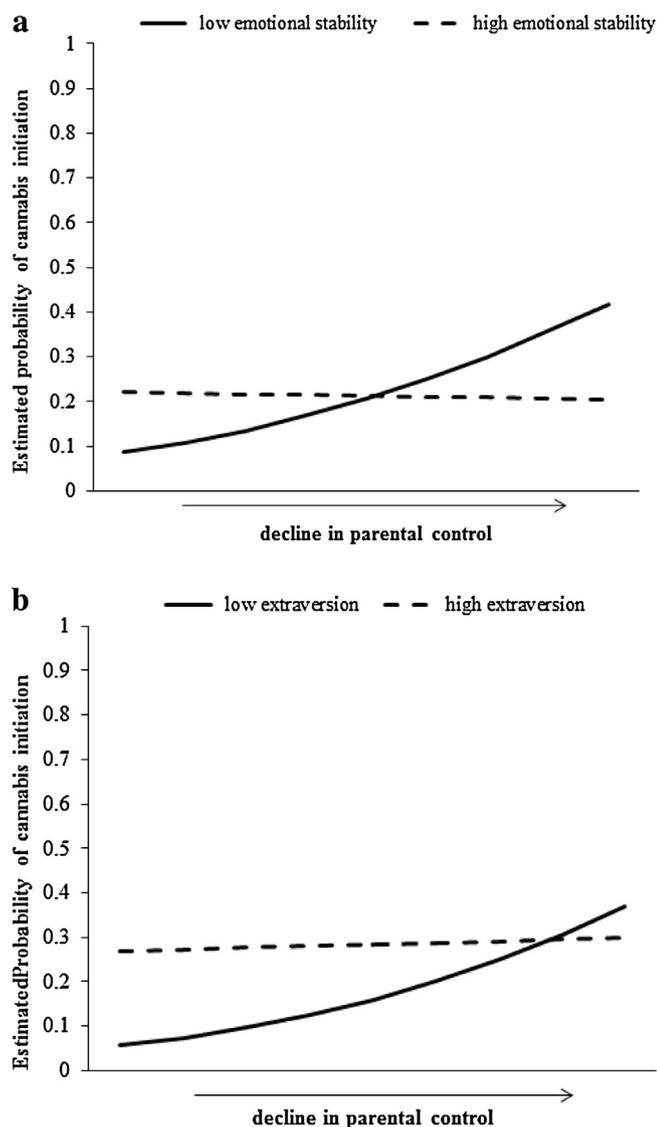
Fig. 2. (a) Graphical presentation of the emotional stability (ES) by parental control interaction in relation to early onset of cannabis use. (b) Graphical presentation of the extraversion (EX) by parental control interaction in relation to early onset of cannabis use.

including early experimentation with cannabis use. For adolescents with lower levels of extraversion this may reduce the protective effect of their personality on the risk of early cannabis use. An alternative explanation for the positive association between a decline in parenting and early onset of cannabis use in adolescents with lower levels of emotional stability and extraversion is that parents may lower their control when adolescents are engaged in problem behaviors, such as substance use (Kerr et al., 2008; Stice and Barrera, 1995; Willoughby and Hamza, 2011). However, it remains unclear why this would only occur in adolescents with lower levels of emotional stability and extraversion. Future prospective research in early adolescent samples is needed to understand the direction of the association between changes in parental control and support and early onset of cannabis use, as well as differential sensitivity based on adolescent personality characteristics.

The present study is not without limitations. First, population samples are characterized by low levels of cannabis use, especially when young age groups are studied. For this reason, we did not have sufficient information to also study frequency of cannabis use. Second, the sampling procedure and composition of the sample might have had an influence on the main variables in this study other

than cannabis use. Despite the oversampling of children with risk of developing delinquency in our sample, the prevalence rate of life-time cannabis use in this study is comparable to national estimates of lifetime cannabis use among 15-year olds (van Dorsselaer et al., 2010). However, the fact that predominantly intact two-parent families were recruited for this study (86%), and that families with low socio-economic status were underrepresented in the sample, might limit the generalizability of our findings to broken families and to families from low socio-economic backgrounds. Third, although confidentiality of the study had been emphasized, self-reports of substance use may be subject to over- or underreporting of cannabis use (Murray and Perry, 1987), which may have influenced the results. Fourth, the longitudinal design we employed aimed at testing linkages between changes in parenting and the risk of early cannabis use, and moderation by personality, and did not test the temporal sequence of changes in parenting and risk of early cannabis use. As a result, we cannot draw any conclusions about the direction of the associations. In addition, although the big five personality dimensions have been found to be relatively stable in most adolescents (Pullmann et al., 2006), individual differences in developmental changes in some personality traits (i.e., behavioral control) have been linked to the risk of substance use (Wong et al., 2006). Such mechanisms should be further examined in future research.

Another suggestion for future research is to measure parenting from childhood to late adolescence, to test if the timing of changes in parental control and support is related to age at onset of cannabis use. Possibly, a decline in parental control or support is perceived earlier (in late childhood/early-adolescence) by adolescents who start using cannabis at a (very) early age than by adolescents who start using cannabis at a later age or who do not initiate cannabis use. Although not the focus of this study, it would also be interesting to study the relative influence of sibling cannabis use, which has been related to cannabis initiation in previous research (Ellickson et al., 2004).

In conclusion, this study demonstrated that experiencing a decline in parental control and support from age 13 to 15 is not generally associated with early onset of cannabis use. However, for parental control this does not apply to all individuals, as a decline in parental control and early onset of cannabis use are positively related in adolescents characterized by low emotional stability and low extraversion. Our findings suggest that stimulating parents to maintain developmentally appropriate levels of control in combination with supporting behavior across the first years of adolescence may contribute to the prevention of early cannabis use in at least a subgroup of adolescents. In addition, our results indicating that early substance use and parental cannabis use are associated with an increased risk of early cannabis use emphasize that prevention work should also focus on these risk factors.

Author disclosures

Contributors

All authors have been personally and actively involved in substantive work leading to this report. Authors van Lier, Koot and

Meeus designed the study and wrote the protocol. Author Creemers managed the literature searches and summaries of previous related work. Authors Creemers, Buil and van Lier undertook the statistical analysis, and author Creemers wrote the first draft of the manuscript. Authors Buil, van Lier, Keijsers, Meeus, Koot and Huizink commented on the first drafts of this manuscript leading to substantial improvements. All authors contributed to and have approved the final manuscript.

Conflict of interest

The authors declare no conflicts of interest.

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