

Which forms of child/adolescent externalizing behaviors account for late adolescent risky sexual behavior and substance use?

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Background: Health risk behaviors like substance use (alcohol, tobacco, soft/hard drugs) and risky sexual behavior become more prevalent in adolescence. Children with behavior problems are thought to be prone to engage in health risk behaviors later in life. It is, however, unclear which problems within the externalizing spectrum account for these outcomes. **Methods:** Three hundred and nine children were followed from age 4/5 years to 18 years (14-year follow-up). Level and course of parent-rated opposition, physical aggression, status violations and property violations were used to predict adolescent-reported substance use and risky sexual behavior at age 18 years. **Results:** Both level and change in physical aggression were unique predictors of all forms of adolescent health risk behavior. Levels of status violations predicted smoking and soft drug use only, while change in property violations predicted each of the health risk behaviors. The links between opposition and health risk behaviors were accounted for by co-occurring problem behaviors. **Conclusions:** Of externalizing problems, physical aggression is the best predictor of adolescent substance use and risky sexual behavior from childhood onwards. Possible explanations and implications of these findings, and future research directions are discussed. **Keywords:** Behavior problems, substance use, sexual behavior, school children, adolescence.

Worldwide, substance use, risky sexual behavior and their adverse consequences are common among adolescents. After a decrease in the eighties, illicit substance use in the US increased again in the early nineties (Crockett, 1997). Frequent and excessive use of substances increases the risk for lung cancer, heart and vascular disease, and brain damage (e.g., Windle & Windle, 2003). Risky sexual behavior is increasing worldwide, given the increasing prevalence of adolescent pregnancies and sexually transmitted diseases (STDs) (Creasas, 1997). STDs can eventually lead to fertility problems or cervical cancer (e.g., Diclemente & Crosby, 2003). Moreover, these health risk behaviors have been related to alcohol or drug dependence, psychological disorders, teenage parenthood, educational failure, and conviction (Viner, 2005).

There is an abundance of evidence linking childhood externalizing behaviors to adolescent substance use (e.g., Fergusson, Horwood, & Ridder, 2005; Hawkins, Catalano, & Miller, 1992; Lynskey & Fergusson, 1995) and risky sexual behavior or teenage pregnancy (Bennett & Bauman, 2000; Fergusson & Woodward, 2000; Woodward & Fergusson, 1999). However, externalizing behavior is comprised of rather different behaviors. In fact, through meta-analyses, Frick et al. (1993) identified four clusters of behaviors within broader externalizing problems: opposition (e.g., argues a lot, disobedient), physical aggression (e.g., gets in many fights, physically attacks people), status violations

(e.g., runs away from home, truancy), and property violations (e.g., lying, vandalism). Because of this, several researchers have emphasized the need to distinguish between these forms of externalizing problems when studying their link with poor outcomes (Bongers, Koot, van der Ende, & Verhulst, 2004; Tremblay, 2000).

To our knowledge, no studies have explored which of the distinct externalizing problems identified by Frick and colleagues (1993) are linked to substance use and risky sexual behaviors. A number of studies did explore links from multiple externalizing forms to adverse adolescent outcomes (however, not for risky sexual behavior). For instance, White and co-workers (White, Xie, Thompson, Loeber, & Stouthamer-Loeber, 2001) found that when adolescent oppositional defiant disorder (ODD) and conduct disorder (CD) were considered, CD predicted both alcohol and marijuana use at age 18, whereas ODD predicted only alcohol use. However, these influences were not tested simultaneously. Biederman et al. (1997) did control for co-occurring behaviors and showed that childhood CD, and not ODD, predicted substance use disorders in adolescence, while effects of attention deficit hyperactivity disorder (ADHD) on substance use disorders were mediated by conduct problems. However, DSM-IV CD is comprised of four clusters of behavior problems (physical aggression/violence, destruction/vandalism, deceitfulness or theft, and serious violations of rules). Thus, although CD may be a better predictor of poor outcomes than ODD, we still do not know whether all forms of problem behaviors that

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comprise CD account for these outcomes. Results from two studies (Broidy et al., 2003; Nagin & Tremblay, 1999) suggest that the predictive association from (deviant levels of) opposition to delinquency (which might comprise substance use) is, by and large, accounted for by (deviant levels of) physical aggression. To our knowledge, with respect to CD symptoms such as property and status offences, no findings on their unique prediction to adverse adolescent outcomes have been reported.

When studying the link between specific forms of externalizing problems and health risk behaviors, it is important to account for the role of developmental change of these behaviors in this association. However, some of the longitudinal studies described above (e.g., Biederman et al., 1997; White et al., 2001) actually studied the rank order between externalizing behavior and outcomes at two points in time, thus ignoring the influence of individual change in externalizing behavior and its association to the outcomes. However, many children exhibit some forms of, for instance, physical aggression in early childhood, but most desist from such problems when they grow older (Broidy et al., 2003; Nagin & Tremblay, 1999; NICHD, 2004). Especially those who followed a stable high path of aggression (i.e., the deviant non-desisting path) were at highest risk for poor outcomes (Broidy et al., 2003; Nagin & Tremblay, 1999). We therefore studied the link between the level and change of opposition, physical aggression, status violations, and property violations in concert in their link to substance use and risky sexual behavior. We explored the degree to which each of these forms of externalizing problems is uniquely linked to substance use and risky sexual behavior.

Finally, many studies on the prediction of health risk behaviors relied on a single rater of both predictor and outcome measures, thereby ignoring the risk of biased results. This study tries to avoid a potential rater bias by relating parental reports of externalizing behaviors in childhood and adolescence to self-reports of health risk behaviors in adolescence.

Methods

Sample

The original sample of 420 children aged 2 or 3 years was taken randomly from the Dutch province of Zuid-Holland, using inoculation registers and the municipal population register of Rotterdam in 1989 (Koot & Verhulst, 1991). Data were collected when children were 2/3 (1989), 4/5 (1991), 10/11 (1997) and 18 years old (2005). For the current study, parent reported behavior problems at the age 4/5, 10/11 and 18 years assessment and adolescents' self-reports at 18 years were used. Written informed consent was obtained from parents at the age 4/5, 10/11 and 18 assessments as well as from adolescents at the age 18 assessment.

At age 4/5, 95% of the original sample was reached (201 boys, 195 girls; mean age = 4.83 years, $SD = 8.4$ months). At age 10/11, response was 85% (180 boys, 178 girls; mean age = 10.46 years, $SD = 7.2$ months). At age 18, 324 parents (77%; 165 boys, 159 girls; mean age = 18.19 years; $SD = 8.4$ months) completed questionnaires. Thirty-seven parents refused or did not get permission from their children to participate, while 41 parents were unreachable (no address information, or emigrated). Two children died between age 10/11 and 18 years. Finally, 16 parents who initially gave their consent to participate never returned questionnaires.

Self-reports were obtained for 311 participants (152 boys, 159 girls; 74% of original sample). Forty adolescents were untraceable (no address information, emigrated) and 2 children died between 10/11 and 18 years. Forty-five adolescents refused participation and 22 did not return questionnaires.

Instruments

Parent-rated behavioral problems over the past six months were assessed using the Child Behavior Checklist/4–18 (CBCL/4–18; Achenbach, 1991; Verhulst, van der Ende, & Koot, 1996) at age 4/5 and 10/11 and the updated version (CBCL/6–18; Achenbach & Rescorla, 2001) at age 18. Parents rated 112 emotional and behavioral problem items on a 3-point Likert scale (0 = *not true*, 1 = *somewhat true or sometimes true*, and 2 = *very true or often true*). Good reliability and validity of the Dutch translation of the CBCL have been confirmed (Verhulst et al., 1996).

Items reflecting the four clusters of externalizing behavior (Frick et al., 1993) were used. Opposition consists of 7 items: *Argues a lot*, *Disobedient at home*, *Disobedient at school*, *Stubborn, sullen or irritable*, *Sulks a lot*, *Teases a lot*, and *Temper tantrum or hot temper*. Physical aggression covered 3 items: *Gets in many fights*, *Physically attacks people*, and *Threatens people*. Status violations included 3 items: *Runs away from home*, *Swearing or obscene language*, *Truancy or skips school*. Property violations contained 6 items: *Cruel to animals*, *Lying or cheating*, *Sets fires*, *Steals at home*, *Steals outside the home*, and *Vandalism*. All these items were also summed to a general externalizing behavior score. The 2-week test-retest reliabilities ($N = 89$, all $ps < .01$) are $r = .79$ for opposition, $r = .78$ for physical aggression, $r = .54$ for status violations, $r = .80$ for property violations, and $r = .83$ for general externalizing behavior.

Outcomes

Self-reported substance use (tobacco, alcohol, and drugs) were assessed through the World Health Organization survey of Health Behavior in School-aged Children (Currie et al., 2004). For *tobacco use*, frequency of smoking, and number of cigarettes smoked a day ($r = .46$, $p < .01$) were combined to rate seriousness of smoking behavior (0 = *smokes never or rarely (any more)*, 1 = *smokes occasionally*, 2 = *smokes regularly but \leq five cigarettes a day*, 3 = *smokes regularly and \geq five cigarettes a day*; or *smokes daily but \leq five cigarettes a day*, 4 = *smokes 6–14 cigarettes each day*,

5 = smokes ≥ 15 cigarettes each day. This variable correlated .92, ($p < .01$) with the z-scores for frequency of smoking and amount of cigarettes smoked a day items, indicating that this combined variable appropriately represented the original items.

Alcohol use was assessed through two items (frequency of alcohol use, and frequency of drunkenness; $r = .48$, $p < .01$). These items were combined (0 = never drinks (anymore) or drinks very rarely, 1 = drinks rarely and got drunk \leq twice, 2 = drinks occasionally but got drunk \leq twice; or drinks rarely but got drunk 3–10 times, 3 = drinks regularly but got drunk \leq twice; or drinks occasionally and got drunk 3–10 times; or drinks rarely and got drunk >10 times, 4 = drinks daily but got drunk \leq twice; or drinks regularly and got drunk 3–10 times; or drinks occasionally and got drunk >10 times, 5 = drinks daily and got drunk 3–10 times; or drinks regularly and got drunk >10 times, 6 = drinks daily and got drunk >10 times). This variable correlated .97 ($p < .01$) with the sum of the two original items' z-scores.

Soft drug use (including marijuana and hashish) scores were scored on a 5-point scale: 0 = never uses soft drugs (anymore), 1 = uses soft drugs rarely, 2 = uses soft drugs regularly, 3 = uses soft drugs often, 4 = uses soft drugs daily.

Hard drug use (e.g., cocaine, amphetamine, speed, XTC, LSD) was scored as: 0 = never used hard drugs, 1 = ever used hard drugs.

Risky sexual behavior was scored through nine items: age of first sexual activity other than intercourse, age of first intercourse, number of sexual partners, number of variable sexual partners (without a relationship), no condom use while having varying sexual partners, has suffered from sexually transmitted diseases (STDs), partner has had many sexual contacts, partner possibly HIV infected, got (someone) accidentally pregnant, had sex in exchange for something else. For females an item was added on (improper or no) use of oral contraception (conditional upon they are sexually active). Each response was dichotomized (0 = non-risky behavior, 1 = risky behavior). These items were summed and divided by the number of items (9 for males, 10 for females).

Procedure

At the age 4/5 year assessment all parents were interviewed at home by trained female interviewers. At age 10/11, parents were sent questionnaires by mail. At the final assessment, all traceable participants received a letter asking for their participation, and contact information. Parents were only phoned after consent had been given by the target adolescent. Participants could fill out questionnaires through the mail (49.5% of parents, 19.2% of adolescents) or over the internet. No effects of rating method (mail vs. internet) on parent-reported externalizing scores ($t = -.14$, $p > .05$) or the percentage of adolescents reporting no versus one or more risky outcomes ($\chi^2(2, N = 309) = .07$, $p > .05$) were found.

Statistical analyses

The analyses were conducted in two stages. In the first stage a growth model on general externalizing behavior

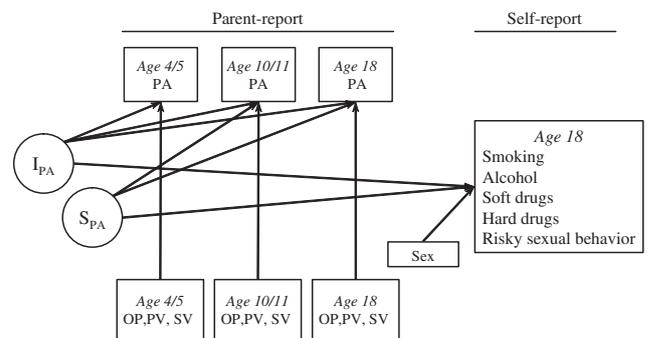


Figure 1 Growth parameters of physical aggression (PA) predicting late adolescent health risk behaviors, controlled for sex, and time varying opposition (OP), status violations (SV), and property violations (PV)

was fitted in which the development of externalizing problems was described through an intercept (initial level) and slope (change with age). The outcome variables were regressed on the growth parameters to estimate the link between externalizing problems and health risk behaviors. After ascertaining the link between general externalizing problems and health risk behaviors, in the second stage we analyzed the link between specific forms of externalizing problems. Using aggression as an example, we first specified the baseline model in which the growth parameters of aggression predicted the outcomes. In the subsequent model, the scores on opposition, status and property violations at each assessment were included in the model as time-varying covariates, thus controlling for their co-occurrence in predicting the outcomes. The final model is depicted in Figure 1. The same procedure was used for opposition, status and property violations. All models were run in Mplus 4.2 (Muthén & Muthén, 2006).

Results

Preliminary analyses

Only cases of which outcome variables and at least one childhood assessment were available were used (309 children; 151 boys, 158 girls). Compared to the original sample (420 children) the children who were included did not differ with respect to sex and age, and to externalizing problems at age 2/3 years. Excluded children were of lower SES ($\chi^2(3, N = 420) = 26.52$, $p < .01$), and their parents were more likely to be divorced or never married ($\chi^2(4, N = 420) = 14.29$, $p < .01$).

Frequencies of alcohol use, smoking, soft drug use and hard drug use are presented in Table 1. A higher percentage of males than females were in the higher risk categories on alcohol ($\chi^2(6, N = 309) = 39.87$, $p < .01$) and soft drug use ($\chi^2(4, N = 309) = 17.38$, $p < .01$). The percentage of adolescents that reported using substances (i.e., alcohol, tobacco, and marijuana) was comparable to the general Dutch population (Monshouwer, Van Dorsselaer, & Gorter, 2004). Boys and girls had similar scores of risky sexual behavior ($M = .09$, $SD = .15$ for both boys and girls).

Table 1 Percentage of males and females in each category of substance use

Score	Alcohol (Max = 6)		Smoking (Max = 5)		Soft drugs (Max = 4)		Hard drugs (Max = 1)	
	Boys (n = 150)	Girls (n = 158)	Boys (n = 149)	Girls (n = 157)	Boys (n = 150)	Girls (n = 158)	Boys (n = 150)	Girls (n = 158)
0	8.7	7.6	64.4	72.0	74.7	86.1	90.0	92.4
1	2.7	13.9	4.0	4.5	10.7	12.0	10.0	7.6
2	19.3	34.8	6.0	3.8	3.3	1.3		
3	22.0	24.7	4.7	2.5	9.3	.0		
4	21.3	12.0	12.8	7.6	2.0	.6		
5	23.3	6.3	8.1	9.6				
6	2.7	.6						

Note. Descriptions of categories are in the methods section. Max = Maximum value on outcome.

Table 2 Parameter estimates and model fit for the baseline models of general externalizing behavior and opposition, physical aggression, status, and property violations

Baseline models	Parameter estimates		Sex effect		Model fit	
	Intercept	Slope	Intercept	Slope	CFI	RMSEA (C.I.)
General externalizing	4.50** (.23)	-.08** (.02)	.94** (.29)	–	1.00	.03 (.00–.11)
Opposition	3.30** (.13)	-.09** (.01)	–	–	.98	.06 (.00–.11)
Physical aggression	.35** (.04)	-.01** (.00)	.27** (.06)	-.01* (.005)	.95	.08 (.01–.16)
Status violations	.39** (.04)	.002 (.005)	.29** (.06)	–	.96	.06 (.00–.12)
Property violations	.32** (.04)	-.001 (.003)	.11* (.05)	–	1.00	.00 (.00–.08)

Note. Values in parentheses are standard errors. Dashes indicate no sex-differences in growth parameter (females are reference category). C.I. = Confidence Interval. $N = 309$ (151 boys, 158 girls). ** $p < .01$; * $p < .05$.

These values indicate that adolescents on average endorsed one of the risks associated with sexual behavior; however, the majority of the adolescents endorsed none of the risks (66.1%) whereas a smaller portion endorsed one or multiple risks (33.9%).

To ascertain that externalizing behaviors were well represented by opposition, aggression, status violations and property violations over time, a model in which these four scales load on an overall externalizing behavior factor at each time point was fitted. A final model allowing for auto-regression of scales (e.g., aggression) across adjacent time points had a good fit to the data (CFI = .93; RMSEA = .07, C.I. = .06–.09). Parameter estimates of development of general and specific externalizing behaviors, and sex differences in the growth parameters, are displayed in Table 2. As illustrated in Figure 2 (top), on average general externalizing levels decreased over time (bold line). Individual differences in intercept (i.e., level) and slope (i.e., change) are depicted by high versus low and increasing versus decreasing individual trajectories (normal lines). With respect to the specific forms of externalizing behaviors, parameters in Table 2 show that oppositional problems and physical aggression decreased with age, whereas status violations and property violations were constant over time. Compared to females, males had higher levels of each form of externalizing problems, except on opposition. Males' levels of physical aggression decreased at a higher rate than females; no sex differences were found in the slopes of the other forms of externalizing behavior.

Externalizing problems and health risk behaviors

As a starting point, we estimated the associations between the growth parameters of general externalizing problems and health risk behaviors at age 18 years (model 1, see Table 3). Positive associations were found between the intercept of externalizing problems and each substance use outcome, and between growth in externalizing problems and each of the health risk behaviors (see Figure 2 for an illustration of the relationship between the intercept (bottom left), and slope (bottom right) of general externalizing behavior and smoking as a health risk outcome).

To test for sex differences in these associations, a multiple group model (males vs. females) was fitted in which the associations between the growth parameters and outcomes were held equal between the sexes. Model fit did not significantly improve when sex-specific associations were allowed for ($\Delta\chi^2 = 15.46$, $\Delta df = 10$, $p > .05$), indicating sex-invariance in the associations between externalizing behavior and health risk behaviors. Therefore, subsequent models were fitted for males and females combined.

Opposition, aggression, status and property violations and health risk behaviors

Opposition. We first fitted the baseline model (model 2, see Table 3) in which the growth parameters of opposition predicted the outcomes. Estimates were

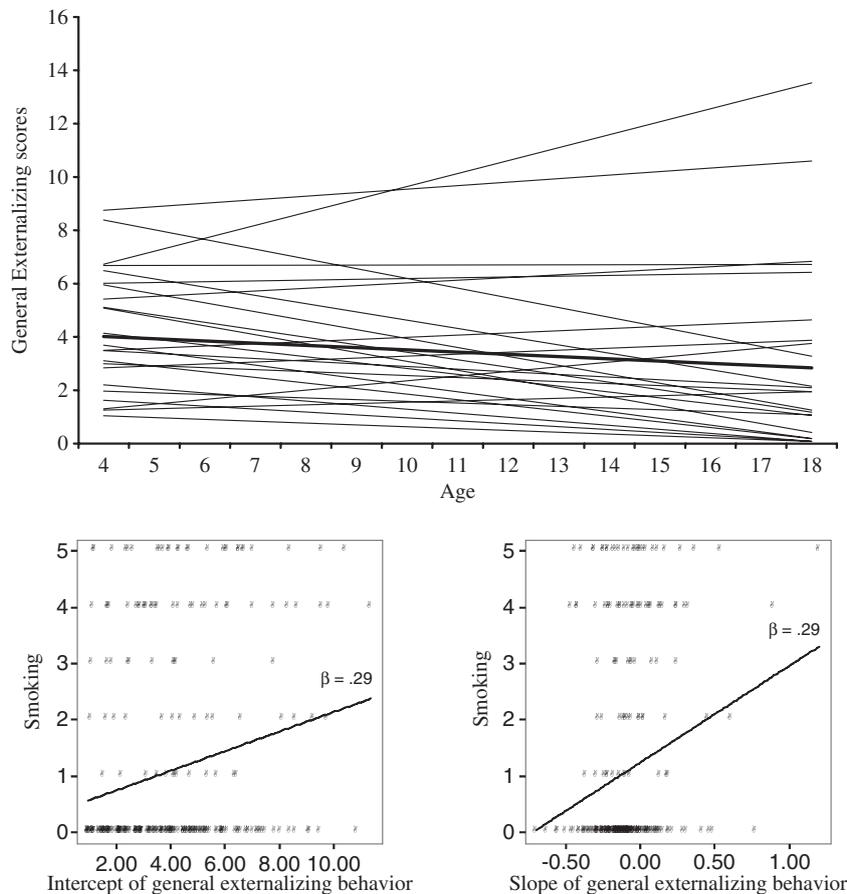


Figure 2 Average and individual general externalizing growth trajectories (top) and relationships between the intercept (bottom left), and slope (bottom right) of general externalizing behavior and late adolescent smoking

controlled for sex, but not yet for other forms of externalizing problems. Positive associations between the intercept and slope of opposition and smoking and hard drug use were found. Additionally, a positive association between its slope and alcohol use was found. We then controlled for aggression, status violations and property violations by including them as time-varying covariates in the model (model 3). None of the previous associations remained significant, indicating that earlier oppositional problems do not predict late adolescent substance use or risky sexual behavior after other forms of externalizing problems are accounted for.

Physical aggression. In the baseline model (model 4), the intercept of physical aggression was associated with alcohol use, smoking, soft drug use and hard drug use, whereas its slope was positively associated with alcohol use only. After controlling for the other three clusters of externalizing behavior (model 5), the intercept remained a significant predictor of alcohol use, soft drug use, and hard drug use, whereas the slope of physical aggression predicted each of the health risk behaviors.

Status violations. As no variance was found in the slope of status violations, only an intercept model was specified. In the baseline model (model 6), this

intercept predicted each health risk behavior except risky sexual behavior. However, when the other externalizing problems were accounted for, the associations remained significant only for smoking and soft drugs use (model 7).

Property violations. Estimates of the baseline model (model 8) show positive associations between the intercept and slope of property violations and smoking and hard drug use (model 9). After controlling for the other clusters, all associations with the intercept became nonsignificant. However, the positive associations between its slope and each of the outcome variables remained significant.

Discussion

Of all behavior problems from the externalizing spectrum, childhood and adolescent physical aggression was most consistently linked to late adolescent health risk outcomes. Note that, in accordance with previous research, physical aggression declined from childhood onwards (Bongers et al., 2004; Broidy et al., 2003; Nagin & Tremblay, 1999; NICHD, 2004). This suggests that stable high levels of physical aggression indicate developmental deviance, and our findings indicate

Table 3 Predictive associations between growth parameters of general externalizing behavior, opposition, physical aggression, status, and property violations with adolescent health risk behaviors

	Alcohol			Smoking			Soft drugs			Hard drugs			Risky sexual behavior			Model fit		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	χ^2 (df)	CFI	RMSEA (C.I.)
1. General Externalizing Beh.	I .11	.04	.20**	.20	.05	.29**	.07	.02	.22**	.03	.01	.26**	.01	.01	.09	7.90 (6)	1.00	.03 (.00-.09)
	S .95	.42	.15*	2.16	.55	.29**	.56	.25	.16*	.23	.08	.20**	.12	.05	.17*			
2. Control for sex	I .07	.05	.09	.23	.07	.24**	.04	.03	.10	.03	.01	.21**	.01	.01	.10	10.78 (7)	.99	.04 (.00-.09)
	S 1.26	.61	.14*	2.39	.78	.22**	.62	.36	.12	.25	.12	.15*	.09	.07	.08			
3. Control for sex, PA, SV and PV	I .06	.19	.05	.25	.36	.18	.05	.15	.08	.03	.05	.12	.01	.02	.08	89.33 (52)	.96	.05 (.03-.07)
	S 12.37	11.56	.24	25.61	23.88	.42	10.54	10.03	.36	3.75	3.57	.39	1.64	1.66	.28			
Physical aggression																		
4. Control for sex	I 1.05	.45	.25*	1.19	.56	.23*	1.10	.32	.45**	.37	.10	.45**	.06	.05	.11	10.89 (7)	.99	.04 (.00-.09)
	S 5.71	3.52	.13	8.79	4.57	.17	4.00	2.08	.16	1.94	.76	.23**	.99	.50	.19			
5. Control for sex, OP, SV and PV	I 1.54	.75	.29*	1.84	.04	.29	1.90	.68	.62**	.43	.15	.43**	.13	.09	.22	76.29 (52)	.96	.04 (.02-.06)
	S 14.38	5.56	.23**	34.38	8.81	.46**	13.71	4.03	.38**	5.01	1.41	.42**	2.57	.85	.36**			
Status violations																		
6. Control for sex	I .74	.33	.17*	1.71	.44	.33**	.83	.20	.33**	.14	.07	.17*	.05	.04	.10	42.60 (15)	.93	.08 (.05-.11)
	S -	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
7. Control for sex, OP, PA, and PV	I 1.00	.51	.17	2.68	.80	.37**	1.15	.35	.33**	.22	.13	.19	.09	.06	.14	127.47 (69)	.91	.05 (.04-.07)
	S -	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Property violations																		
8. Control for sex	I .68	.38	.15	1.96	.51	.35**	.38	.23	.14	.31	.08	.35**	.07	.05	.13	8.91 (7)	.99	.03 (.00-.08)
	S 6.01	4.41	.14	23.56	8.03	.45**	5.25	2.89	.21	2.56	1.06	.31*	1.33	.70	.27			
9. Control for sex, OP, PA and SV	I .04	.82	.01	1.59	1.06	.19	-.67	.87	-.17	.15	.18	.11	.12	.09	.15	74.04 (52)	.96	.04 (.01-.06)
	S 20.41	9.96	.27*	38.54	16.17	.42*	18.71	9.57	.42*	5.64	2.57	.38*	2.19	2.12	.25*			

Note. I = intercept; S = slope; OP = Opposition; PA = Physical aggression; SV = Status violations; PV = Property violations; C.I. = Confidence interval. N = 309. **p < .01; *p < .05.

that as such they are unique predictors of adolescent health-impeding behaviors. This is in accordance with previous studies on health risk behaviors (Biederman et al., 1997; Underwood, Kupersmidt, & Coie, 1996) and coincides with findings on the prediction of delinquent outcomes (Broidy et al., 2003; Nagin & Tremblay, 1999). Research has shown that physical aggression, as well as substance use and risky sexual behavior, is associated with poor behavior control (Donohew et al., 2000; Luengo, Carrillo de la Pena, Otero, & Romero, 1994; Tarter et al., 2003), suggesting that poor behavior control may underlie the association between aggression and these health risk behaviors. It may also underlie the predictive association of property violations as such problems have also been linked to difficulties in behavior control (Luengo et al., 1994). However, alternative explanations, such as tension/stress reduction (e.g., Bennett & Bauman, 2000) or sensation seeking (Eysenk, 1997), may additionally account for the link.

High levels of status violations (e.g., truancy, running away from home) predicted smoking and soft drug use in late adolescence. Deviant peer influences may underlie this link as both status violations and substance use are typically influenced by peers (Allen, Donohue, Griffin, Ryan, & Turner, 2003; Keenan, Loeber, Zhang, Stouthamer-Loeber, & Vankammen, 1995). For instance, young adolescents who skip classes tend to do this in the companionship of a friend, and may stimulate each other in smoking cigarettes or marijuana (Hawkins et al., 1992; Bryant & Zimmerman, 2002). Additionally, low academic achievement may also account for the link, as it has been found to be highly associative of both truancy (included in status violations) and substance use (Bryant & Zimmerman, 2002).

Strong points of this study were its 14-year longitudinal design, covering childhood and adolescence, the use of a general population sample, and the use of multiple informants. A limitation of this study is the relatively small sample size of 309 participants. Although the prevalence of substance use was in accordance with the general Dutch population (Monshouwer et al., 2004), the absolute number of youths, especially in the high risk categories, was low. The sample size also prohibited the study of sex differences in the predictive associations between the subtypes of externalizing problems and health risk behaviors. However, no sex differences in the association between general externalizing behavior scores and health risk were found, which is consistent with Fergusson et al. (2005).

There are two limitations regarding the measures used in this study. The first concerns the use of parent-reported externalizing problems. Parents may be unaware of certain covert behaviors such as truancy or stealing. However, the parent-reported CBCL delinquency scale, which includes such items, was found to predict contact with police, academic

problems and having received mental health services (Verhulst, Koot, & van der Ende, 1994) in addition to DSM-IV disruptive behavior disorders 14 years later (Hofstra, van der Ende, & Verhulst, 2002). Moreover, when compared to teacher and self-reports, only parent-reported conduct disorder symptoms predicted police contacts (Loeber, Green, Lahey, & Stouthamer-Loeber, 1991). Additionally, the results with respect to status violations should be regarded in light of the relatively low test-retest reliability of this variable. Second, our substance use measures were obtained through adolescents' self-reports; however, they were not biochemically validated.

A final limitation is the use of only three assessments, making it impossible to study non-linear trends in externalizing problems or to account for a possible middle-adolescence crime-curve (D'Unger, Land, & McCall, 2002). However, the linear models we tested fitted the data well.

Conclusion

Of all included forms of externalizing behaviors physical aggression appeared the best predictor of late adolescent engagement in health risk behaviors. Physical aggression is present from infancy (Alink et al., 2006; Tremblay et al., 2004) and toddlerhood (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; NICHD, 2004) onwards, and is a significant predictor of adolescent delinquency (Broidy et al., 2003; Nagin & Tremblay, 2001) and health-risking behaviors (e.g., Lynskey & Fergusson, 1995; White et al., 2001). However, for the latter outcome no control for other co-occurring problem behaviors has been made so far. The current study clearly showed that physical aggression (as well as property violations) uniquely contributes to each of the health risk behaviors from preschool onwards. This suggests that preventive interventions aimed at physical aggression could be initiated in early childhood in an effort to reduce the risk of each of these outcomes.

This study also underscored the need to distinguish between aggressive and oppositional behaviors. In several studies that linked conduct problems to substance use and risky sexual behaviors in adolescence or adulthood, symptoms of conduct disorder (e.g., destruction of property, stealing) were lumped together with oppositional items (e.g., disobedience, irritability) (e.g., Fergusson et al., 2005; Fergusson & Woodward, 2000; Lynskey & Fergusson, 1995). Our results suggest that such a combination may result in an underestimation of the associations of physical aggression with adolescent risk behaviors.

Physical aggression diminishes with age, even in individuals following high trajectories (cf., Bongers et al., 2004; Broidy et al., 2003). Despite this, it is still predictive of various problematic behaviors in (late) adolescence. To understand the pathways

towards these adolescent (health) risk behaviors, we would need to focus on the developmental sequencing within the externalizing behavior spectrum and simultaneous development of health risk behaviors. Moreover, future research should address the influence of underlying mechanisms and co-occurring processes (e.g., poor behavioral control, peer influences) that may explain the link between early physical aggression and adolescent substance use and risky sexual behavior.

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