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Adolescent Substance Use, Aggressive Behaviors, and Peer Context Behavioral Norms

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The goal of this study was to examine behavioral norm effects in 2 peer contexts (classroom, school) on adolescent substance use (tobacco, alcohol, cannabis) and aggressive behaviors (bullying, physical fighting). Participants were 5,642 adolescents (M_{age} = 14.29 years, SD = 1.26; 49% boys). There were 3 hypotheses. First, behavioral norms in both contexts affect individual behavior. Second, classroom norms have stronger effects on individual behavior than school norms. Third, classroom and school norms interact and exacerbate each other's influence. Results indicated that classroom norms had stronger effects than school norms on individual tobacco and alcohol use. Furthermore, school norms had equal or stronger effects than classroom norms on the 2 indicators of aggressive behaviors. There was no evidence for an interaction between classroom and school norms for any dependent variable. This study demonstrates that the complexity of multiple (nested) peer contexts should be considered to fully understand peer influence processes.

Keywords: homophily; substance use; aggressive behavior; normative social influence; norm; peer context

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Adolescence is a period of decreasing parental dependence, supervision, and guidance (Brown & Larson, 2009; Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006) and growing opportunities and responsibilities for adolescents to make autonomous decisions that influence their health (Swanson, Edwards, & Spencer, 2010). It is a phase often marked by the onset of health-risk behaviors (e.g., substance use) and the decline of positive health behaviors (e.g., healthy food consumption; Williams, Holmbeck, & Greenley, 2002). Although an important goal for adolescents is to develop self-governance of behavior (Hill & Holmbeck, 1986), behavioral decisions are not made in isolation of salient others (Ryan, 2001).

In adolescence, peer interest intensifies and adolescents are increasingly concerned with being accepted and achieving a high social standing in relevant peer contexts (Brown & Larson, 2009; Steinberg, 1999). As a result, the behavioral norms in those peer contexts (derived from the behaviors that are occurring in them) become very important. Adolescents are highly susceptible to peer influence concerning which behaviors to adopt and avoid (Prinstein & Dodge, 2008) because adhering to the behavioral norms of the peer group is likely to enhance their status. This normative social influence (see Cialdini & Goldstein, 2004; Cialdini & Trost, 1998) results in adolescents' tendency to become more similar to their peers in attitudes and behaviors. This phenomenon follows the principles of homophily stating that similarity breeds connection and that—vice versa—increased connection further enhances similarity (Lazarsfeld & Merton, 1954; McPherson, Smith-Lovin, & Cook, 2001). This has been shown, for instance, for substance use (e.g., Andrews, Tildesley, Hops, & Li, 2002; Borsari & Carey, 2001; Chassin, Hussong, & Beltran, 2009) and for aggressive and violent behaviors (e.g., Poulin et al., 1997; Prinstein, Boergers, & Spirito, 2001); two major clusters of adolescent behavior that are known to be highly susceptible to peer influence and to seriously impact adolescent health.

Typically, previous studies have examined such behavioral similarity in one peer context. The peer context commonly investigated is the friendship network at school. Friends are an informal, voluntary peer context in which adolescents choose to spend time. Although friends are a powerful source of influence (e.g., Kiesner, Kerr, & Stattin, 2004; Popp, Laursen, Kerr, Stattin, & Burk, 2008), other structural peer contexts may also influence adolescent behavior in important ways (Brown, Bakken, Ameringer, & Mahon, 2008). Structural peer contexts are formal, involuntary peer contexts to which adolescents belong without having any choice over their membership. Examples are the classroom and the school.

It is important to investigate the effects of these structural peer contexts because adolescents spend a lot of time in them and because research has shown that friends are not always the only nor the strongest source of behavioral similarity (Brown et al., 2008; Hartup, 2005). When researchers have examined structural peer contexts, they have typically focused on their composition in terms of gender, ethnicity, and ability. However, the *behavioral* composition of classroom and school, that is, the behaviors that typically occur in them, are also likely to affect adolescent behavior. In fact, the behavioral composition of these structural peer contexts may strongly affect adolescents' own engagement in certain behaviors.

The behaviors in the structural peer contexts of classroom and school may impact multiple adolescent behaviors. The fact that certain behaviors occur in certain contexts may be of crucial importance for adolescents' behavioral similarity (Kindermann & Gest, 2009). For example, bullying is more prevalent among classmates than among schoolmates. Thus, behavioral similarity in bullying is expected to be higher among classmates than among schoolmates. Behavioral similarity is thus expected to vary as a function of the combination of peer context and adolescent behavior (Kiesner, Poulin, & Nicotra, 2003).

This study extends earlier research by investigating behavioral composition effects of two structural peer contexts (classroom, school) on five health-risk behaviors divided in two clusters: substance use (tobacco, alcohol, cannabis) and aggressive behaviors (bullying, physical fighting). Two effects were distinguished: additive and interactive.

ADDITIVE BEHAVIORAL COMPOSITION EFFECTS

Additive behavioral composition effects refer to the assumption that the behavioral composition of each peer contexts may explain unique variance in behavior (e.g., Kiesner et al., 2004; Kiesner et al., 2003; Urberg, Değirmencioğlu, & Pilgrim, 1997). Drawing on social impact theory (SIT; Latané, 1981) and on conceptual models of peer influence (e.g., Brown et al., 2008), it is hypothesized that the variance explained by each context depends on the physical proximity and psychological salience of the peers in that context. Physical proximity refers to the amount of exposure to peers and the frequency and intensity of direct face-to-face interactions with them. Psychological salience refers to the importance, power, or credibility of specific peers for adolescents' identity and well-being.

Classmates are physically more proximal and—based on the frequency of direct peer interactions—expected to be more salient psychologically than schoolmates. This is especially true when students are in the classroom with the same peers throughout the day and week, as was the case in the sample of this study. Classmates were expected to be highly salient. Therefore, the strongest associations between individual and peer context behavior were expected for classmates. Adolescents have frequent and intense face-to-face interaction with their classmates, who frequently evaluate each other's behavior. The classroom behavioral norms for substance use and aggression therefore may have a large influence and explain much variation in adolescent health-risk behaviors. Indeed, previous research has shown, for example, that students with closer social proximity to peer substance users were more likely to use substances (Ennett et al., 2006) and that students in classrooms in which aggressive behaviors were common were more likely to engage in these behaviors themselves than students in classrooms in which aggression was less common (e.g., Barth, Dunlap, Dane, Lochman, & Wells, 2004; Salmivalli & Voeten, 2004; Thomas & Bierman, 2006).

However, adolescent peer contexts expand beyond the classroom (Brechwald & Prinstein, 2011), with a growing sense of a collective peer culture and developing out-of-classroom affiliations. The behavioral norms for substance use and aggression among schoolmates may also have an influence (McPherson et al., 2001), despite less frequent direct peer interaction. In fact, direct affiliation and interaction is not always required for behavioral similarity to occur (Brechwald & Prinstein, 2011; Hartup, 2005). Merely being exposed to or knowing of the behaviors of schoolmates may motivate behavioral similarity (Brown et al., 2008). Thus, the behavioral composition at the school level was expected to explain unique variance in adolescent behavior, over and beyond the effect of the classroom behavioral composition. However, the school effect was expected to be smaller than the classroom effect because of the lower proximity and salience of schoolmates compared to classmates.

INTERACTIVE BEHAVIORAL COMPOSITION EFFECTS

Interactive behavioral composition effects refer to the idea that adolescents' behavior may further depend on the combination of behavioral norms in different contexts (e.g., Kiesner et al., 2003; Kindermann & Skinner, 2012). Adolescents participate in multiple peer contexts at the

same time and as a result are exposed to the behavioral norms from these multiple contexts. Norms may be the same and reinforce each other across contexts (e.g., both classroom and school peers may endorse drinking), but they may also be different and vary across context (e.g., classroom may endorse drinking but school does not). As a consequence, different peer contexts may either strengthen or weaken each other's influence, and their combined effect may differ from the sum of their individual effects. Opposing norms between classroom and school may make it harder for adolescents to decide what behavior is most accepted. As a consequence, behavioral similarity with classmates may decrease. In line with this notion, Verkooijen, de Vries, and Nielsen (2007) demonstrated that opposing norms between peer contexts reduced substance use, whereas peer contexts with corresponding norms increased individual substance use. Thus, school was expected to strengthen the effect of the classroom on adolescent health-risk behaviors if their behavioral norms were the same but weaken this effect if their norms were opposite.

THE CURRENT STUDY

This study examined these main and interactive effects of the behavioral norms in two structural peer contexts: classroom and school. These effects were examined on adolescents' smoking, drinking, cannabis use, bullying, and physical fighting. Effects were expected to depend on the physical proximity and psychological salience of the peers in each context and on the likelihood that the behavior occurred in each context. Therefore, both contexts were expected to have an effect on individual behavior, but stronger effects were expected of the classroom than of the school context. The composition effects also were expected to vary as a function of the consistency between behavioral norms across contexts with stronger effect of the classroom context if the school context conveyed similar (corresponding) norms and weaker effects of the classroom context if the school conveyed different (opposing) norms. Given gender and age differences in adolescent health-risk behaviors, age and gender were controlled for as covariates (Williams et al., 2002).

METHOD

Participants

The sample of this study was drawn from the 2009/2010 Health Behaviour in School-aged Children (HBSC) study. HBSC is a cross-national survey of youths' well-being and health behaviors, conducted every 4 years in 43 countries across Europe and North America in collaboration with the World Health Organization. Requirements of sampling and stratification were followed as described in the standardized international research protocol (for a full description, see Roberts et al., 2009).

This study used data collected in The Netherlands. A random, stratified-by-urbanity sample of schools was drawn to ensure population representativeness. In total, 68 secondary schools participated in this study of the 143 schools that initially were approached for participation (48% response rate). For each school, one class per grade was selected at random from a list of all Grade 7 to Grade 10 classes. Of the 272 classes, 264 classes eventually participated. The Dutch school system has a strong classroom structure; students are in the classroom with the same peers and do not change classes throughout the day and week. Consent procedures required by ethical and legal authorities for this type of survey were followed; included

in the study were only those adolescents who volunteered to participate and whose parents did not object to their participation. The response rate within classrooms was 93% on average with illness as the main reason for nonparticipation.

The final sample consisted of 5,642 adolescents from Grades 7 to 10 (M_{age} = 14.29, SD = 1.26; 49.2% boys); 1,483 (26.3%) from Grade 7 (M_{age} = 12.78, SD = 0.50; 50% boys); 1,369 (24.3%) from Grade 8 (M_{age} = 13.77, SD = 0.50; 51.4% boys); 1,440 (25.5%) from Grade 9 (M_{age} = 14.85, SD = 0.54; 48.1% boys); and 1,350 (23.9%) from Grade 10 (M_{age} = 15.85, SD = 0.52; 47.5% boys). The majority of the participants were of native Dutch origin (81.5%, n = 4,597). For 14.1% (n = 793) of the adolescents, at least one parent was born in a non-Western country (e.g., Surinam, Turkey, Morocco).

Measures

The measures were part of a larger set. Higher scores indicated unhealthier behavior.

Substance Use. Participants rated how often in the last 4 weeks they used tobacco, alcohol, and cannabis. Tobacco and cannabis use was rated on a 7-point ordinal scale (1 = *never*, 2 = *1–2 times*, 3 = *3–5 times*, 4 = *6–9 times*, 5 = *10–19 times*, 6 = *20–39 times*, 7 = *40 times or more*). Because alcohol consumption is generally more normative among adolescents than tobacco and cannabis use, alcohol use was rated on a wider 14-point ordinal scale (1–11 = *0–10 times*, 12 = *11–19 times*, 13 = *20–39 times*, 14 = *40 times or more*) to allow for more differentiation in alcohol use between adolescents. Single-item measures of alcohol use have been shown to have good to excellent test-retest reliability and concurrent validity among adolescents (Dollinger & Malmquist, 2009; Koning, Harakeh, Engels, & Vollebergh, 2010).

Aggressive Behaviors. Two questions were asked to assess aggressive behavior: one about bullying ("How often have you taken part in bullying another student[s] at school in the past couple of months?") and one about physical fighting ("During the past 12 months, how many times were you in a physical fight?"). The bullying question was answered on a 5-point ordinal scale (1 = *I have not bullied*, 2 = *it has happened once or twice*, 3 = *2 or 3 times a month*, 4 = *about once a week*, 5 = *several times a week*) and the physical fight question on a 5-point interval scale (1 = *never*, 2 = *once*, 3 = *2 times*, 4 = *3 times*, 5 = *4 times or more*). Both single-item measures have been well validated and reliability ascertained in previous studies (Brener, Collins, Kann, Warren, & Williams, 1995; Olweus, 1996).

Peer Context Profile Scores. For each participant, a behavioral profile score (PS) for each behavior in each peer context was calculated. Behavioral PSs were operationalized as the average behavior of all participating peers in a certain context (classmates or schoolmates). To prevent upward biased estimates if a participant's own score would also be included in the peer context score (endogenous feedback) and to accurately model contextual effects on individual outcomes (Erbring & Young, 1979), a simple adaptation of a split-sample technique was used (Angrist & Krueger, 1995; Chetty et al., 2011). The total sample was randomly split in two subsamples (A and B) using even- and odd-numbered participants. Next, the behavioral PSs were calculated using the odd numbered participants in subsample B (n = 2,819). That is, classroom PS is the average behavior of all odd-numbered classmates, and school PS is the average behavior of all odd-numbered schoolmates. These behavioral PSs were then used as classroom- or school-level predictors in the multilevel analyses run on only the even-numbered participants in subsample A (n = 2,817). By virtue of random assignment to subsamples, behavioral PSs calculated using subsample B are correlated to individual behavior

in subsample A but uncorrelated to the measurement error in subsample A because of endogenous feedback. As such, behavioral PSs can be used as instrumental variables to obtain consistent and reliable estimators of individual behavior in subsample A (Auld, 2011).

Procedure

Data were collected through an anonymous school-based paper-and-pencil questionnaire in a 45- to 60-minute classroom session. All students sat in a test arrangement at their assigned desk with adequate space between desks to prevent them from looking at the questionnaires of others. At the start of the assessment, participants were informed of the goal of the study and received instructions how to fill in the questionnaire. The confidentiality and anonymity of their answers was emphasized during the instruction. During the assessment, talking was prohibited to guarantee participants' privacy and the reliability of the assessment. A research assistant was present to make sure instructions were followed and to answer questions from the participants.

Analysis Strategy

Preliminary analyses consisted of descriptive and correlational analyses for all outcome measures. For the correlational analyses, a Bonferroni correction was applied to control for family-wise error rate in multiple comparisons ($p < \alpha/10$), meaning that those associations that are marked as significant at, for example, $p < .01$ level, were actually significant at the $p < .01/10 = .001$ level. Multivariate multilevel analysis in Mplus Version 7 (Hox, 2010; Muthén & Muthén, 2012) was used to estimate the variances in adolescent substance use and aggressive behaviors and to estimate the effect sizes of the peer contexts (classroom, school) on these health behaviors. All predictor variables were grand-mean centered and interaction terms between predictor variables were calculated and analyzed using procedures by Aiken and West (1991).

Multilevel Modeling

Multilevel (ML) modeling was warranted based on some of the intraclass correlations (ICCs; >.05) and/or the design effect (DE; >2) estimates (Table 1). In the interest of consistency and to facilitate comparison, ML modeling was conducted for all outcome measures, even if the ICC and DE estimate did not strictly require it. The multivariate ML analysis had a three-level hierarchical data structure: Participants (Level 1) nested within classrooms (Level 2) nested within schools (Level 3). Model 1 was an unconstrained *intercept-only* model without predictors to examine the variance decomposition across the three levels. In Model 2, age and gender were added as Level 1 (participants) covariates. In Model 3, classroom PS was added at Level 2 (classroom). In Model 4, school PS was added at Level 3. Model 4 was used to assess the reduction of residual variance at each level (i.e., the amount of variance explained) after including all peer context PSs. Finally, in Model 5, a cross-level interaction was added of classroom PS by school PS.

All outcome measures were treated as continuous, and all models were estimated using maximum likelihood with robust Huber/White standard errors to control for nonnormality in the outcome measures (Maas & Hox, 2004). To assess explained variance and to diminish the possibility of negative R^2, a phenomenon not uncommon in multilevel modeling, Snijders and Bosker's (1994, 1999) formulas were used to assess the proportional reduction

TABLE 1. Descriptive Statistics, Correlational Coefficients With Peer Context Profile Scores, and Intraclass Correlations and Design Effects for Classroom and School Level by Dependent Variables

Dependent Variable	*N*	*M*	*SD*	*Median*	*MAD*	Skewness[c]	Kurtosis[c]	Correlations Kendall's τ_b With Peer Context Profile Scores (PSs)[a,b]		Intraclass Correlations ρ (DE)	
								$PS_{classroom}$	PS_{school}	Classroom Level	School Level
Tobacco (1–7)	2,794	1.57	1.54	1	0	2.76	6.23	.25	.14	.132 (2.26)	.017 (1.68)
Alcohol (1–14)	2,752	2.57	2.97	1	0	2.27	4.41	.37	.15	.269 (3.54)	.005 (1.20)
Cannabis (1–7)	2,768	1.10	0.58	1	0	7.34	59.55	.16	.09	.069 (1.65)	.008 (1.32)
Offender of bullying (1–5)	2,711	1.41	0.77	1	0	2.47	7.01	**.10**	**.10**	.038 (1.35)	.006 (1.23)
Physical fight (1–5)	2,699	1.59	1.06	1	0	1.99	3.22	**.12**	**.13**	.020 (1.18)	.030 (2.16)

Note. DE = design effect.

[a]All correlation coefficients significant at $p < .01$, unless otherwise specified. A Bonferroni correction was applied to control for family-wise error rate in multiple comparisons ($p < \alpha/10$).

[b]For each dependent variable, correlation coefficients in boldface are not significantly different from each other in a Fisher's *r*-to-*Z* test ($p < .05$).

[c]$SE_S = .046–.047$, $SE_K = .093–.094$.

of mean-squared prediction error for predicting individual values and group averages at the classroom and school level after including predictors. If both classroom PS and school PS significantly predicted individual behavior, additional analyses were conducted in which their effects were constrained to be equal (i.e., $B_{\text{classroom}} = B_{\text{school}}$) to determine whether they significantly differed in strength. If the constrain reduced model fit (i.e., significant χ^2 log-likelihood difference test, $\Delta deviance > 3.84$, $\Delta df = 1$, at $p < .05$), the two estimates were significantly different from each other. A Wald's χ^2 test was run to analyze the significance of the difference between the two estimates.

RESULTS

Preliminary Analysis

Descriptive and correlational statistics are presented in Table 1. Average scores for all five adolescent health-risk behaviors were low, and the distributions positively skewed. The correlations in Table 1 show that individual scores were positively associated with the peer context PSs (i.e., the average behavior of all participating peers in a certain peer context). Kendall's tau-b correlations were all significant but generally small, except for tobacco and alcohol use with classroom PS. For all three substance use measures, correlation coefficients for classroom and school PSs differed significantly from each other in a Fisher's *r*-to-*Z* test ($p < .05$), with the largest correlation for classroom PS. For aggressive behaviors, correlation coefficients for classroom and school PSs were not significantly different from each other.

Additional analyses in which both random subsamples were reversed (calculating the PSs on the even-numbered participants and running the analyses on the odd-numbered participants) showed no significant mean differences in age or any of the outcome measures ($\Delta M = .002$–$.062$). In addition, correlation coefficients of classroom and school PS with the outcome measures were not significantly different between both subsamples ($\Delta r = -.015$–$.018$; all ps $= .29$–$.48$).

Fixed Effects of Age and Gender

The covariates age and gender were added in Model 2 (Tables 2–6). Age was a significant positive predictor of individual substance use, although weakened in subsequent models including the peer context profiles scores. Given differences in the numbers of classes per school and students per class, there was significant variation in age between classes, $F(263, 2{,}553) = 62.82$, $p < .001$, and between schools, $F(67, 2{,}749) = 2.69$, $p < .001$, which reduced the unique effect of age. Gender was a significant negative predictor of all outcomes except tobacco use; boys reported more alcohol use, cannabis use, and aggressive behaviors than girls.

Fixed Effects of Classroom and School Profile Scores

The results of all multilevel analyses are presented in Tables 2–6. The χ^2 log-likelihood difference tests showed significant improvements in model fit for most subsequent models. That is, model fit was significantly better in subsequent *variance component* models than in the simpler unconstrained *intercept-only* Model 1. For substance use, Model 3 will be interpreted because model fit did not significantly improve after including school PS in Model 4. For aggressive behaviors, the full *variance component* Model 4 will be interpreted because the model fit of Model 4 was better than that of Model 3. Model estimation using the reversed random sample yielded very similar results.

TABLE 2. Fixed and Random Parameter Estimates for Tobacco Use

	Model 1[a]	Model 2	Model 3[b]	Model 4	Model 5
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Fixed effects					
Intercept (τ_{000})	1.609 (0.052)***	−3.503 (0.439)***	−1.410 (0.454)**	1.123 (0.617)	1.300 (1.012)
Age (τ_{100})		0.353 (0.031)***	0.204 (0.031)***	0.035 (0.042)	0.025 (0.066)
Gender (τ_{200})		0.035 (0.058)	0.040 (0.055)	−0.028 (0.053)	−0.058 (0.057)
$PS_{classroom}$ (τ_{010})			0.496 (0.076)***	0.607 (0.098)***	0.594 (0.101)***
PS_{school} (τ_{001})				0.132 (0.094)	0.111 (0.128)
Cross-level interactions					
$PS_{classroom} \times PS_{school}$ (τ_{011})					
Residual variances	2.033 (0.165)***	2.012 (0.164)***	2.019 (0.165)***	2.036 (0.168)***	2.032 (0.169)***
Participant level (σ^2_{eijk})	0.319 (0.069)***	0.097 (0.038)**	0.045 (0.029)	0.061 (0.034)*	0.005 (0.033)
Classroom level (σ^2_{u0jk})	0.035 (0.035)	0.070 (0.032)*	0.004 (0.013)	0.000 (0.017)	0.016 (0.038)
School level (σ^2_{u0jk})	1.609 (0.052)***	−3.503 (0.439)***	−1.410 (0.454)**	1.123 (0.617)	0.094 (0.044)*
Slope $PS_{classroom}$ (σ^2_{v01k})					−0.058 (0.057)
Model summary					
ΔDeviance (Δdf)[c]	5,091.43 (4)	−81.52 (2)***	−41.23 (1)***	18.34 (1) *ns*	−12.30 (3)**

Note. PS = profile score.
[a]Model 1 decomposition of variance: ρ_1 (participant level) = 85.2%, ρ_2 (classroom level) = 13.4%, ρ_3 (school level) = 1.5%.
[b]Model 3 modeled variance: R^2_1 (participant level) = 13.4%, R^2_2 (classroom level) = 70.2%, R^2_3 (school level) = 51.0%.
[c]For Model 1, the absolute deviance and *df* is provided. For Models 2–5, the deviance of each model was compared to the previous one.
*$p < .05$. **$p < .01$. ***$p < .001$.

TABLE 3. Fixed and Random Parameter Estimates for Alcohol Use

	Model 1[a]	Model 2	Model 3[b]	Model 4	Model 5
	B (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)
Fixed effects					
Intercept (τ_{000})	2.631 (0.106)***	−10.202 (0.863)***	−3.868 (1.094)***	−4.170 (1.102)***	1.948 (1.377)
Age (τ_{100})		0.926 (0.066)***	0.483 (0.081)***	0.504 (0.081)***	0.092 (0.094)
Gender (τ_{200})		−0.326 (0.108)**	−0.319 (0.105)**	−0.318 (0.105)**	−0.426 (0.111)***
$PS_{classroom}$ (τ_{010})			0.518 (0.053)***	0.488 (0.058)***	0.730 (0.075)***
PS_{school} (τ_{001})				0.101 (0.088)	−0.012 (0.111)
Cross-level interactions					
$PS_{classroom} \times PS_{school}$ (τ_{011})					−0.056 (0.032)
Residual variances					
Participant level (σ^2_{eijk})	6.486 (0.508)***	6.432 (0.511)***	6.409 (0.503)***	6.408 (0.503)***	6.456 (0.512)***
Classroom level (σ^2_{u0jk})	2.406 (0.315)***	0.592 (0.123)***	0.253 (0.083)**	0.252 (0.082)**	0.218 (0.117)*
School level (σ^2_{u0jk})	0.044 (0.109)	0.292 (0.079)***	0.088 (0.042)*	0.084 (0.042)*	0.117 (0.115)
Slope $PS_{classroom}$ (σ^2_{v01k})					0.218 (0.117)*
Model summary					
ΔDeviance (Δ*df*)[c]	6,685.31 (4)	−116.72 (2)***	−58.35 (1)***	−0.69 (1) *ns*	15.11 (3) *ns*

Note. PS = profile score.
[a]Model 1 decomposition of variance: ρ_1 (participant level) = 72.6%, ρ_2 (classroom level) = 26.9%, ρ_3 (school level) = 0.5%.
[b]Model 3 modeled variance: R^2_1 (participant level) = 24.5%, R^2_2 (classroom level) = 78.0%, R^2_3 (school level) = 55.0%.
[c]For Model 1, the absolute deviance and *df* is provided. For Models 2–5, the deviance of each model was compared to the previous one.
*$p < .05$. **$p < .01$. ***$p < .001$.

TABLE 4. Fixed and Random Parameter Estimates for Cannabis Use

	Model 1[a]	Model 2	Model 3[b]	Model 4	Model 5
	B (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)
Fixed effects					
Intercept (τ_{000})	1.104 (0.015)***	0.209 (0.148)	0.476 (0.160)**	0.440 (0.158)**	1.062 (0.160)***
Age (τ_{100})		0.071 (0.012)***	0.052 (0.011)***	0.055 (0.011)***	0.012 (0.010)
Gender (τ_{200})		−0.084 (0.024)***	−0.082 (0.024)***	−0.083 (0.024)***	−0.095 (0.025)***
$PS_{classroom}$ (τ_{010})			0.255 (0.105)*	0.194 (0.101)	0.313 (0.138)*
PS_{school} (τ_{001})				0.319 (0.159)*	0.205 (0.156)
Cross-level interactions					
$PS_{classroom} \times PS_{school}$ (τ_{011})					.220 (0.562)
Residual variances					
Participant level (σ^2_{eijk})	0.306 (0.056)***	0.305 (0.056)***	0.306 (0.056)***	0.306 (0.056)***	0.301 (0.054)***
Classroom level (σ^2_{u0jk})	0.023 (0.008)**	0.012 (0.005)**	0.010 (0.005)*	0.010 (0.005)*	0.000 (0.009)
School level (σ^2_{u0jk})	0.002 (0.002)	0.004 (0.002)*	0.002 (0.002)	0.000 (0.002)	0.004 (0.007)
Slope $PS_{classroom}$ (σ^2_{v01k})					0.000 (0.009)
Model summary					
ΔDeviance (Δ*df*)[c]	2,371.99 (4)	−33.30 (2)***	−10.70 (1)**	−3.25 (1) *ns*	−30.39 (3)***

Note. PS = profile score.
[a]Model 1 decomposition of variance: ρ_1 (participant level) = 92.4%, ρ_2 (classroom level) = 6.9%, ρ_3 (school level) = 0.6%.
[b]Model 3 modeled variance: R^2_1 (participant level) = 3.9%, R^2_2 (classroom level) = 34.9%, R^2_3 (school level) = 16.3%.
[c]For Model 1, the absolute deviance and *df* is provided. For Models 2–5, the deviance of each model was compared to the previous one.
*$p < .05$. **$p < .01$. ***$p < .001$.

TABLE 5. Fixed and Random Parameter Estimates for Bullying

	Model 1[a]	Model 2	Model 3	Model 4[b]	Model 5
	B (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)
Fixed effects					
Intercept (τ_{000})	1.414 (0.019)***	1.650 (0.204)***	1.455 (0.201)***	1.442 (0.198)***	1.438 (0.199)***
Age (τ_{100})		0.009 (0.014)	0.020 (0.013)	0.021 (0.013)	0.021 (0.013)
Sex (τ_{200})		−0.240 (0.030)***	−0.224 (0.030)***	−0.227 (0.029)***	−0.226 (0.030)***
$PS_{classroom}$ (τ_{010})			0.270 (0.061)***	0.180 (0.062)**	0.179 (0.069)**
PS_{school} (τ_{001})				0.370 (0.118)**	0.378 (0.129)**
Cross-level interactions					
$PS_{classroom} \times PS_{school}$ (τ_{011})					0.102 (0.454)
Residual variances					
Participant level (σ^2_{eijk})	0.563 (0.033)***	0.551 (0.032)***	0.552 (0.032)***	0.552 (0.032)***	0.552 (0.032)***
Classroom level (σ^2_{u0jk})	0.023 (0.007)***	0.019 (0.007)**	0.015 (0.007)*	0.012 (0.007)*	0.010 (0.007)
School level (σ^2_{u0jk})	0.002 (0.003)	0.003 (0.003)	0.001 (0.004)	0.000 (0.006)	0.001 (0.007)
Slope $PS_{classroom}$ (σ^2_{v01k})					0.010 (0.007)
Model summary					
ΔDeviance (Δdf)[c]	3,117.23 (4)	−37.01 (2)***	−10.63 (1)**	−4.22 (1)*	−0.37 (3) *ns*

Note. PS = profile score.
[a]Model 1 decomposition of variance: ρ_1 (participant level) = 95.7%. ρ_2 (classroom level) = 3.9%. ρ_3 (school level) = 0.3%.
[b]Model 4 modeled variance: R^2_1 (participant level) = 4.1%, R^2_2 (classroom level) = 28.3%, R^2_3 (school level) = 17.1%.
[c]For Model 1, the absolute deviance and *df* is provided. For Models 2–5, the deviance of each model was compared to the previous one.
*$p < .05$, **$p < .01$, ***$p < .001$.

TABLE 6. Fixed and Random Parameter Estimates for Physical Fighting

	Model 1[a]	Model 2	Model 3	Model 4[b]	Model 5
	B (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)
Fixed effects					
Intercept (τ_{000})	1.624 (0.032)***	1.980 (0.222)***	2.076 (0.223)***	2.042 (0.208)***	2.030 (0.201)***
Age (τ_{100})		0.025 (0.015)	0.015 (0.015)	0.017 (0.014)	0.018 (0.014)
Sex (τ_{200})		−0.470 (0.040)***	−0.453 (0.040)***	−0.453 (0.039)***	−0.453 (0.039)***
$PS_{classroom}$ (τ_{010})			0.296 (0.074)***	0.144 (0.083)	0.177 (0.080)*
PS_{school} (τ_{001})				0.517 (0.122)***	0.544 (0.139)***
Cross-level interactions					
$PS_{classroom} \times PS_{school}$ (τ_{011})					−0.212 (0.204)
Residual variances					
Participant level (σ^2_{eijk})	1.068 (0.062)***	1.014 (0.057)***	1.015 (0.057)***	1.016 (0.058)***	1.013 (0.057)***
Classroom level (σ^2_{u0jk})	0.019 (0.015)	0.015 (0.014)	0.015 (0.015)	0.012 (0.014)	0.002 (0.013)
School level (σ^2_{u0jk})	0.034 (0.011)***	0.034 (0.011)***	0.014 (0.009)	0.005 (0.007)	0.005 (0.007)
Slope $PS_{classroom}$ (σ^2_{v01k})					0.002 (0.013)
Model summary					
ΔDeviance (Δ*df*)[c]	3,965.37 (4)	−79.08 (2)***	−11.60 (1)***	−9.90 (1)**	−2.84 (3) *ns*

Note. PS = profile score.
[a]Model 1 decomposition of variance: ρ_1 (participant level) = 95.3%, ρ_2 (classroom level) = 1.7%, ρ_3 (school level) = 3%.
[b]Model 4 modeled variance: R^2_1 (participant level) = 7.9%, R^2_2 (classroom level) = 39.8%, R^2_3 (school level) = 40.3%.
[c]For Model 1, the absolute deviance and *df* is provided. For Models 2–5, the deviance of each model was compared to the previous one.
*$p < .05$. **$p < .01$. ***$p < .001$

Tobacco Use. Table 2 presents the results of Models 1–5 for tobacco use. Of the variance in individual tobacco, 13.4% was at the classroom level (see Table 2, note a) and 1.5% at the school level. As shown in Table 2, changes in the deviance statistic were significant in Model 3, indicating that the classroom context contributed significantly to the reduction of residual variance at the classroom and school level (see Table 2, note b). The estimates in Model 3 showed that individual tobacco use was significantly associated with classroom PS (see Table 2). With each scale point increase in tobacco use in the classroom, individual tobacco use was estimated to increase with .50 scale points. The change in the deviance was not significant in Model 4, indicating that no additional variance was modelled by including school PS. In line with this finding, school PS was not a significant predictor of individual tobacco use (Model 4).

Alcohol Use. Table 3 presents the results of Models 1–5 for alcohol use. Of the variance in individual alcohol use, 26.9% was at the classroom level and 0.5% at the school level. The changes in deviance statistics showed that only classroom PS (Model 3), and not school PS (Model 4), contributed significantly to the reduction of residual variance (see note b). Estimates in Model 3 showed that individual alcohol use was significantly predicted by classroom PS and not by school PS (Model 4).

Cannabis Use. As shown in Table 4, 6.9% of the variance in individual cannabis was at the classroom level and 0.6% at the school level. Changes in the deviance statistic showed that including classroom PS led to a significant reduction of residual variance (see note b). The estimates in Model 3 showed that classroom PS significantly predicted individual cannabis use. Including school PS in Model 4 did not result in a significant change in the deviance statistic indicating that school PS did not significantly explain additional variance. However, individual cannabis use was significantly predicted by school PS in Model 4, whereas the effect of classroom PS became nonsignificant.

Bullying. Of the variance in bullying, 3.9% was at the classroom level and 0.3% was at the school level (see Table 5, note a). Including both classroom PS and school PS led to a significant reduction of residual variance (see note b). The estimates in Model 4 showed that classroom PS and school PS significantly predicted individual bullying. Further analysis revealed that both predictors were equally strong, Wald $\chi^2 = 1.50$, $p = .22$.

Physical Fighting. Of the variance in physical fighting, 1.7% was at the classroom level and 3% at the school level (see Table 6, note a). Changes in the deviance statistic between Models 2 and 4 showed that classroom PS and school PS significantly reduced residual variance (see note b). The estimates in Model 4 showed that school PS but not classroom PS significantly predicted individual physical aggression.

Cross-Level Interaction of Classroom by School Profile Scores

A cross-level interaction (classroom PS × school PS) was added for each outcome in Model 5 (see Tables 2–6). None of the cross-level interactions was significant, and model fit did not significantly improve in Model 5. For all outcomes, effect estimates for classroom and school PSs were similar in Model 5 as in Model 4. Thus, the effects of classroom substance use and aggression on individual behavior were not moderated by behavior at the school level.

DISCUSSION

This study examined (additive) main and interactive behavioral composition effects of two structural peer contexts (classroom and school) on adolescent substance use and

aggressive behaviors. Consistent with expectations and previous research (e.g., Kiesner et al., 2004; Kiesner et al., 2003; Kindermann & Skinner, 2012; McPherson et al., 2001), this study evidenced additive behavioral composition effects (i.e., behavioral similarity to multiple peer contexts) for bullying; that is, both classroom and school context were significantly (and equally strongly) associated with individual bullying. For the other outcome measures, a diverse picture of the association between the two peer contexts and adolescent health-risk behavior emerged.

Average tobacco and alcohol use in the classroom context was significantly associated with adolescent substance use, whereas average tobacco and alcohol use in the school context was not. For individual cannabis use, the significant association with the classroom context in Model 3 changed to a significant association with the school context in Model 4. However, as will be discussed further along, these results should be interpreted with caution given the low prevalence of cannabis use in our sample. Last, physical fighting was associated with the average level of physical fighting in the school context but not in the class context. Thus, in contrast to our expectation, the classroom context—although assumed to be the most proximal and salient peer context—did not always account for significantly stronger behavioral composition effects than the school context.

Finally, despite expectations and previous research (e.g., Verkooijen et al., 2007), there was no evidence for interactive effects. Thus, there was no evidence that individual behavior depended on the combination of behavioral norms in the two peer contexts, unlike expectations that it would (e.g., Kiesner et al., 2004; Kiesnet et al., 2003; Kindermann & Skinner, 2012).

Additive Composition Effects

All three individual substance-use behaviors were significantly associated with classroom substance use. Conforming to classmates' smoking and drinking is likely to enhance one's social standing in the classroom because these behaviors have a high reputational salience (i.e., importance for determining one's social reputation; Brown & Larson, 2009; Prinstein & Dodge, 2008).

Compared to the results for smoking and alcohol use, a relatively weak association between cannabis use in the class context and individual cannabis use was found. An explanation for this weak result may be the low prevalence of cannabis use (especially compared to tobacco and alcohol). Thus, there is limited opportunity for adolescents to actually perceive and attend to, or to know about, classmates' cannabis use, which is a requirement for the classroom context to be recognized as a source of influence on individual cannabis use (Brown et al., 2008). Another explanation may be that tobacco and alcohol use are more accepted among peers than cannabis use and therefore more openly displayed. The stigma surrounding (illicit) cannabis use, the possibility that it could harm one's image, and the risk of conflict with parents or school authorities all may make it less likely for adolescents to display it and communicate about it, which in turn is likely to diminish behavioral composition effects (Hammersley, Jenkins, & Reid, 2001).

It also should to be noted that the results regarding the association between classroom cannabis use and individual cannabis use should be interpreted with caution, given that the classroom effect was weak and even nonsignificant in Model 4 when school context was included. We attribute these variations in estimates between Models 3 and 4 to chance, given the low prevalence of cannabis use in our sample. Moreover, model fit did not significantly improve in Model 4. Hence, the results of Model 4 were not interpreted. Analysis on the

reversed random sample, in which peer context PSs were calculated with the other half of the sample, yielded similar results for this outcome in the interpreted Model 3 (including only the classroom context).

In contrast to our expectations, none of the individual substance use scores were significantly associated with school substance use, despite of evidence from previous research showing that school-level substance use was significantly associated with individual substance use (e.g., Bisset, Markham, & Aveyard, 2007; Botticello, 2009; Kumar, O'Malley, Johnston, Schulenberg, & Bachman, 2002; Kuntsche & Jordan, 2006; Mrug, Gaines, Su, & Windle, 2010). Thus, no additive behavioral composition effects were evidenced for substance use. The hypothesis that sharing a common environment with schoolmates, and thus, sharing background characteristics with other schoolmates increases behavioral similarity between adolescents and their schoolmates was not substantiated for substance use.

Various explanations can be provided for this finding. First, schoolmates—compared to classmates—may not be proximal or salient enough to solicit a unique behavioral composition effect on individual substance use over and beyond the effect of the classroom context. In other words, the school context is unable to explain additional unique variance in individual substance use after controlling for the variance explained by the classroom context. Second, because substance use typically does not occur on or near school premises and interactions with schoolmates are often less frequent than interactions with classmates, schoolmates' substance use may be less visible to adolescents than classmates' substance use.

In contrast to substance use, additive behavioral composition effects were found for bullying. Both the classroom and school context were significantly and—contrary to our expectations—equally strongly associated with individual bullying. This is in line with previous research showing a positive association between classroom aggressive behavior and individual aggressive behavior (e.g., Barth et al., 2004; Salmivalli & Voeten, 2004; Thomas & Bierman, 2006). For physical fighting, only school context had a significant effect on individual physical fighting.

For both aggressive behaviors, characteristics of the school culture may explain why school norms for aggression predict individual aggression. This may be explained by certain aspects of the school culture (i.e., the set of values, beliefs, perceptions, attitudes, rules of a school; e.g., general attitude of student body toward aggressive behaviors, anti-bullying programs, value-added education). Some schools may have a more hostile and aggressive culture than others, making it more common for adolescents to be aggressive in these schools than in other schools. In addition, schoolmates typically share certain sociodemographic characteristics (e.g., social class, education level, urbanicity) that are known to be associated with conduct problems (Dodge & Pettit, 2003) and that may uniquely account—to some degree—for differences in aggressive behavior (McPherson et al., 2001). This also explains why the effect of the classroom context on aggressive behavior weakened after including the school context. For aggressive behaviors, characteristics of the school culture seem to be more predictive of individual behavior than the classroom context.

Interactive Composition Effects

No evidence for the existence of interactive behavioral composition effects was found. There were no significant interactions between classroom and school behavior on individual

behavior. For example, the association between classroom substance use and individual substance use was not strengthened or weakened by school substance use, despite previous evidence that opposing norms between peer contexts inhibit substance use whereas corresponding norms reinforce it (Verkooijen et al., 2007). Again, this may be caused by the fact that the school context is not proximal or salient enough to solicit a moderating effect on individual substance use. To avoid rejection and achieve high social standing (Brown & Larson, 2009; Steinberg, 1999) in the classroom (the most proximal and salient context), adolescents likely prioritize classmates' behaviors to learn which behaviors to adopt and avoid (Prinstein & Dodge, 2008), despite of what is normative at school, at least for substance use. For aggressive behaviors, it may be more important what the general student population does (i.e., level of hostility and aggression in the school culture) than what classmates do.

Limitations and Directions for Future Research

First, a limitation of this study was its cross-sectional nature. Although varying behavioral composition effects were shown for both structural peer contexts on all five adolescent health-risk behaviors, it is important to note that no conclusions can be drawn regarding the direction of the effects. Behavioral similarity implies influence yet longitudinal data is required to investigate the processes responsible for these similarities, for instance, whether behavioral similarity was primarily caused by selection (i.e., adolescents are involuntarily grouped with peers in schools who are highly similar to themselves or they seek out peers they perceive to be similar to themselves) or socialization (i.e., adolescents become more similar to their peers as a result of affiliating with them; Piehler, 2011).

Second, another limitation was that no additional information was available about the dynamics of the investigated peer contexts and their members. Characteristics of peer context members (e.g., their social standing) or relationships (e.g., friendships) among them were not known. These and other (compositional) characteristics of the peer context may affect the processes by which behavioral similarity comes about. For example, it may be that instead of classmates in general, the strongest influence on individual health-risk behavior comes from classmates with whom the adolescent shares a dyadic relationship or classmates with a high social reputation in the classroom (e.g., Dijkstra, Lindenberg, & Veenstra, 2008).

Third, all measures of adolescent health-risk behaviors were self-reported single-item measures. Previous research has shown that adolescents' single-item self-reports of substance use and aggressive behaviors such as physical fighting show adequate reliability and validity (e.g., Brener et al., 1995; Dollinger & Malmquist, 2009; Koning et al., 2010). Nevertheless, a direction for improvement is to use multi-item, multi-informant and/or multimethod procedures to assess adolescent health-risk behaviors.

Fourth and finally, because measures were positively skewed with a preponderance of zeroes (i.e., zero inflation, floor effect), estimating a zero-inflated Poisson (Lambert, 1992) or two-part model (Olsen & Schaffer, 2001) is warranted. For this study, additional analyses estimating a two-part model using Bayes estimation led to similar findings. Estimates from our original analyses using robust normal theory maximum likelihood methodology may have been slightly negatively biased (i.e., smaller than the *true* estimates) because of category threshold asymmetry (Rhemtulla, Brosseau-Liard, & Savalei, 2012), but this bias appears to be negligible. Our approach should thus be considered somewhat conservative.

Given that both methods led to similar findings and that we used a robust sandwich estimator of variance (Huber/White) to control for nonnormality, we choose to report the results of the original analyses. Future studies, however, may benefit from estimating an alternative model more suitable with zero-inflated count data.

CONCLUSION

This study investigated main (additive) and interactive effects of behavioral norms in two nested peer contexts (classroom and school) on adolescent health-risk behaviors employing an innovative analytic approach. The findings clearly indicated the importance of these structural peer contexts for adolescent health-risk behaviors. Individual substance use and bullying were significantly associated with classroom norms. Bullying and physical fighting were significantly associated with school norms. It is important to consider the complexity of these nested peer contexts to fully understand peer influence processes.

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