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Aggression and Violent Behavior

Shared and unique predictors of antisocial and substance use behavior among a nationally representative sample of South African youth

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ABSTRACT

There are well-documented high prevalence rates of violence, aggression, and substance use in South Africa. We examined theoretically salient risk factors for antisocial behavior and substance use identified in high income countries (e.g., abuse and poverty; Shaw & Gross, 2008) and whether they had predictive effects among South African youth, for whom longitudinal research examining predictors of violence is lacking. We collected data from a large, high-risk longitudinal sample of youth from two provinces in South Africa, encompassing rural and urban sites ($N = 3515$; 97% retained at one year; 56.7% female; M age $= 13.45$). We assessed antisocial behavior and substance use using an adapted version of the CBCL-YSR and items from national surveys. Finally, we assessed risk factors using previously-validated indices of risk. Antisocial behavior and substance use were reciprocally related over time. Controlling for this overlap, as well as for relevant demographic covariates, child abuse predicted increases in antisocial behavior over time, and exposure to high levels of community violence predicted increases in both antisocial behavior and substance use one year later. The findings suggest that contextual risk factors underpinning etiological models of antisocial behavior and substance in high income countries are also relevant within the South African context. In particular, both harsh home and community environments were related to the development of youth antisocial and substance use behavior outcomes. We discuss the implications of these findings for preventative interventions to reduce youth engagement in risky antisocial and/or substance use behavior in South Africa.

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1. Introduction

Historically, high rates of physical violence have characterized South African society at a structural-, community-, and interpersonal-level (Barbarin, Richter, & DeWet, 2001; Leoschut & Bonora, 2007; Seedat, Van Niekerk, Jewkes, Suffla, & Ratele, 2009; van der Merwe & Dawes, 2000). A large literature has proposed that this legacy of violence contributes to ongoing high levels of sexual violence against women, use of weapons, and substance use behavior, particularly among young males growing up in deprived communities (Barbarin et al., 2001; Jewkes et al., 2006; Reddy et al., 2010). However, very few empirical studies have examined prospective associations between contextual risk factors for antisocial and substance use among youth in South Africa. The paucity of empirical research examining putative risk factors for antisocial behavior is of concern because young people aged 12–22 years old are increasingly the most likely perpetrators of violence or aggressive crime in South Africa, and around 35% of the country's prison population is under 25 years old (Department of Correctional Services, 2010). In the current study, we examined reciprocal associations between substance use and antisocial behavior in a large, high risk, and national sample of South African youth. Further, we examined whether exposure to violence, child abuse, or poverty predicted increases in antisocial behavior and substance use over time, controlling for their overlap.

Etiological models of antisocial behavior and substance use in high-income countries have been developed through decades of longitudinal research. In particular, prospective longitudinal studies have identified risk factors at the level of the individual (e.g., gender and early-onset conduct problems), family (e.g., abuse or harsh parenting), and community (e.g., living in a high-crime or deprived neighborhood) (see Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998; Murray & Farrington, 2010), all of which increase the likelihood of an individual developing aggressive or violent behavior, or using substances. However, much less is known about whether the same risk factors apply in LMIC (Murray, Cerqueira, & Kahn, 2013), where violence rates are often high, and there is a pressing need for preventive strategies. Qualitative investigations and large-scale cross-sectional surveys of youth in South Africa (mostly in Cape Town) have highlighted the roles of poverty, income disparity, exposure to violence and crime (including at home, school, and in the community), and familial environment in contributing to a culture of antisocial behavior among adolescents (e.g., Burton, 2006; Leoschut, 2009; Leoschut & Bonora, 2007). An important research question is whether the same factors that are reliably identified by prospective, longitudinal empirical studies in high-income countries also predict the development of AB and substance use among youth in South Africa.

To date however, few longitudinal, empirical studies have examined prospective associations between risk factors and antisocial behavior development among the South African youth. In a recent exception, we found that experience of violence in the community predicted youth-reported antisocial behavior four years later, over and above earlier reports of antisocial behavior, age, gender, and demographic factors, including poverty and orphanhood (see Gardner, Waller, Cluver, Maughan, & Boyes, under review). A primary goal of the current study was to try and replicate the same pattern of findings in an independent and much larger sample of high-risk youth from two different provinces in South Africa. However, in addition to high levels of antisocial or aggressive behavior, substance use among South African youth is also an increasing concern (e.g., Plüddemann, Flisher, McKetin, Parry, & Lombard, 2010; Ramsoomar & Morojele, 2012; Reddy et al., 2010).

Previous studies suggest that substance use (including cigarette smoking, alcohol use, and other drug use) and antisocial behavior are highly cross-sectionally inter-related among South African youth (e.g., Carney, Myers, Louw, Lombard, & Flisher, 2013; Morojele et al., 2002; Pahl, Brook, Morojele, & Brook, 2010; Plüddemann et al., 2010). Previous studies have also found that antisocial behavior predicts increased likelihood of engagement in substance use (Bui, Ellickson, & Bell, 2000; Mason & Windle, 2002). Further, a prospective association has been reported between engagement in substance use behavior and later violent behavior (including carrying weapons, bullying, and getting into physical fights) in studies from other developing countries (e.g., Ferguson & Meehan, 2010; Kuntsche, Knibbe, Engels, & Gmel, 2007), although this association has not been consistently replicated among South African youth within cross-sectional (e.g., Bui et al., 2000) or longitudinal (e.g., Carney et al., 2013) studies.

In order to identify how best to intervene with at-risk youth however, empirical evidence is needed from studies that prospectively test associations between putative risk factors and both antisocial behavior development and engagement in substance use. Given the apparent co-occurrence of various forms of substance use and other forms of antisocial or delinquent behavior, interventions that seek to target multiple behaviors may be more efficacious in changing psychosocial outcomes among youth in South Africa. There is thus a need for empirical studies that examine co-occurrence of antisocial and substance use behavior. Co-occurrence between traits is theorized to occur for several reasons — antisocial behavior may be a risk factor for substance use, or antisocial behavior may be a secondary manifestation following substance use; alternatively, substance use and antisocial behavior may share common risk factors (Caron & Rutter, 1991). However, risk factors thought to contribute to risk for these outcomes in a high-income country context (e.g., low-income and bereavement), may be relatively normalized among many youth growing up in deprived communities across different parts of South Africa, and thus not associated with the outcomes in the same way. Further, societal and/or service-level differences between South Africa and other countries may affect relationships between risk factors and antisocial behavior or substance use outcomes.

Indeed, there are risk factors potentially unique to the Southern African context that may put youth at risk of developing antisocial or substance use behavior. For example, approximately 3.7 million youth in South Africa have been orphaned and half of these are estimated to have been orphaned by HIV/AIDS (UNICEF, 2013). Previous studies have shown that youth orphaned by HIV/AIDS in South Africa are vulnerable to a host of chronic internalizing problems over time, including symptoms of anxiety, depression, and post-traumatic stress disorder (Cluver & Gardner, 2007; Cluver, Orkin, Gardner, & Boyes, 2012). However, no previous studies have examined whether orphanhood (by HIV/AIDS versus other causes) is associated with greater likelihood for substance use behavior. Another contextual source of risk important in the South African context is the type of housing, with high rates of violence being noted among informal urban housing settlements (e.g., Housing Development Agency South Africa, 2011; Hunter, 2010). However, no previous studies have assessed the direct effect of housing type or urban living on the development of youth antisocial or substance youth behavior.

In the current study, we had two aims relating to the association between antisocial and substance use behavior and potential shared or unique risk factors for these outcomes among South African youth. *Study aim 1* was to examine the co-occurrence of substance use and antisocial behavior among adolescents in South Africa. We conducted

follow-up assessments with our sample after one year, and were thus able to examine both cross-sectional and longitudinal relations between engagement in substance use and antisocial behavior. *Study Aim 2* was to examine risk factors associated with increases in antisocial behavior and substance use behavior over time. We tested whether experience of abuse (physical, verbal, or sexual), poverty, community violence, or violence in the home was related to increases in antisocial behavior or substance use one year later, controlling for their overlap. In all models, we also examined the influence of salient demographic and contextual child- and family-level factors on outcomes, including gender, age, housing type, urban living, and orphan status. Strengths of the current study include the very large sample, drawn from urban and rural sites in two different provinces of South Africa, which increases generalizability of findings. Further, we examined substance use and antisocial behavior using continuous variables, whereas one previous study that has examined longitudinal associations between both substance use and antisocial behavior among South African youth tested ordinal and binary outcome variables (Carney et al., 2013).

2. Methods

2.1. Procedures

The study was based on a longitudinal community-based survey, conducted in two provinces of South Africa: The Western Cape and Mpumalanga.[1] In contrast to Western Cape, Mpumalanga has previously been an under-researched region, and both government officials and NGO collaborators encouraged its inclusion in this study. Across both Western Cape and Mpumalanga, sites comprised rural, peri-urban, urban, and urban-homeland areas with high HIV-prevalence. Spoken languages in study sites were Xhosa, Shangaan, Sotho, and Swati. Within these sites, stratified random sampling of census enumeration areas (or designated tribal areas in rural areas) and door-to-door consecutive household sampling was used, thus ensuring inclusion of both school-attending and non-attending children. Participants included one randomly selected child from all those aged 10–17 years per household ($N = 3515$; mean age = 13.45, $SD = 2.14$), with data collection from 2010–2011. Children were interviewed at home, in community centers, or in a private room in their school. One-year longitudinal follow-up from 2011–2012 achieved 97% retention rate ($n = 3401$ youth). Differences in baseline sociodemographic characteristics of youth lost to follow-up were noted using Chi-squared tests and one-way ANOVAs. Youth lost to follow-up were more likely to be living in informal housing ($\chi^2(1) = 10.04$, $p < .01$; $\varphi = .05$), be from the Western Cape province ($\chi^2(1) = 54.15$, $p < .001$; $\varphi = .12$), and be older in age ($F(1,3512) = 5.93$, $p < .05$, partial $\eta^2 = .002$). However, youth lost to follow-up were not found to be any more antisocial or any more likely to engage in substance use behavior at baseline.

Ethical approval was given by the University of Oxford, University of Cape Town, University of KwaZulu-Natal, and Provincial Health Departments of Western Cape, Mpumalanga, and KwaZulu-Natal. Both children and primary caregivers gave written informed consent, with 97.2% response rate. Confidentiality was maintained, except where children were at risk of significant harm, in which case referrals to health and social services were made. With the assistance of experienced interviewers, children completed 40- to 60-minute questionnaires in the language of their choice, including reports of antisocial behavior, substance use, and hypothesized risk factors. All survey items had been piloted with a child advisory group of 14 youth, independently piloted in further child focus groups, and were translated and back-translated into Xhosa, Zulu, Swati, Sotho, and Shangaan. Copies of all scales and items used in the study are available at www.youngcarers.org.za/about/ (also see Cluver et al., 2013). No participant incentives were given, apart from refreshments and certificates.

2.2. Measures

2.2.1. Sociodemographic factors

Child gender (0 = female; 1 = male), child age (continuous), type of housing (0 = informal, including living in an informal shack or hut; 1 = formal, including living in a block of flats), orphan status (0 = no; 1 = yes, orphaned), recruitment province (0 = Western Cape; 1 = Mpumalanga) and site (i.e., within recruitment province; rural = 0; urban = 1) were measured using various questionnaire items, including census items (Statistics South Africa, 2001). These items were included as covariates in models (Study aim 2).

2.2.2. Youth outcome — antisocial behavior

Youth antisocial behavior was assessed at times 1 and 2 using the 11-item delinquency subscale of the Child Behavior Checklist Youth Self-report (CBCL-YSR, Achenbach & Rescorla, 2001; e.g., 'I steal from the home' and 'I truant from school'), the 5-item conduct problem subscale of the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997; e.g., 'I get in fights' and 'I lie or cheat'), and two additional antisocial behavior items added to questionnaires for the project to index more severe outcomes relevant to the South African context ('I carry a gun' and 'I carry a knife'). Items for all questionnaires were rated on a three-point Likert scale (0 = not true; 1 = somewhat true; 2 = definitely true). There was an overlap in item content between the CBCL-YSR and SDQ items assessing stealing and lying, so these were collapsed into one item in questionnaires. In addition, low inter-item correlation led to removal of the SDQ-item, 'I usually do as I am told'. Further, the CBCL-YSR assessing the use of alcohol or drugs was removed to reduce content overlap with the measure of substance use behavior, which was assessed separately. A composite 14-item antisocial behavior was created by summing items, with good internal consistency at time 1 ($\alpha = .71$) and time 2 ($\alpha = .65$). We validated this measure in a previous study examining antisocial behavior in a different sample of adolescents in Cape Town (Gardner et al., under review).

2.2.3. Youth outcome — substance use behavior

Substance use behavior was assessed at times 1 and 2. First, to assess alcohol use, youth were asked about their drinking frequency in the last year (0 = never; 1 = monthly; 2 = weekly; 3 = several times a week; 4 = daily). Second, we asked youth about their use (0 = no; 1 = yes) of seven specific substances in the last year ('dagga' (marijuana), mandrax, glue, petrol, 'tik' (crystal methamphetamine), heroin, or benzene). We summed responses for these seven substances. Finally, to create an overall composite score for youth substance use, we standardized and summed scores for the alcohol and substance use scales at time 1 and time 2.

2.2.4. Hypothesized risk variables assessed at time 1

(*a*) *Poverty* was measured using a cut-off score of two or more days a week for two separate scales from the South African National Food Consumption Survey (Labadarios et al., 2003) assessing past-week hunger at the child level and past-week insufficient food at the household level, and lack of any employment in the household; (*b*) *Child abuse* was the sum of experiencing *physical*, *emotional*, or *sexual abuse* using UNICEF scales for sub-Saharan Africa with conservative cut-offs for severe abuse (Cluver, Orkin, Boyes, Gardner, & Meinck, 2011; Snider & Dawes, 2006): *Physical abuse* was weekly or more frequent beating with an object or deliberate harm; *Emotional abuse* was weekly or more frequent exposure to verbal abuse, threats to evict children from home, or invoking evil spirits against children; *Sexual abuse* was unwanted genital contact or rape; (*c*) *Home violence* was a summed

[1] The current study is part of a larger project conducted in three South African provinces: The Western Cape, KwaZulu-Natal, and Mpumalanga ($N = 6002$; see Cluver et al., 2013). Follow-up data was only collected in Western Cape and Mpumalanga and thus the current study focuses on data collected from these regions only in order to examine longitudinal associations between variables.

score assessing frequency of exposure to past-week verbal violence and physical violence between adults in the household; (*d*) *Exposure to community violence* was measured using four items from the Child Exposure to Community Violence Checklist (Richters & Martinez, 1993). This scale has been used previously with Xhosa-speaking children in Cape Town (Heath & Kaminer, 2004), and was adapted to reflect common types of violence in South African townships. This was further modified after pre-piloting to increase the variance detected (for example, 'I have heard shooting in my neighborhood' had a 100% positive response rate in samples from Cape Flats). In order to allow for already-extreme levels of community violence in the study area, we thus conservatively assessed violence exposure as witnessing of or victimization by the province's four most common community crimes: robbery, assault, stabbings, and shootings (SAPS South African Police Services, 2004).

2.3. Analytic strategy

All analyses were carried out in SPSS v.19.1.

2.3.1. Aim 1: to examine the co-occurrence of substance use and antisocial behavior

To address our first study aim, we computed descriptive statistics for all study variables (Table 1). We examined zero-order associations between substance use and antisocial behavior both cross-sectionally and longitudinally (Table 2).

2.3.2. Aim 2: to examine risk factors associated with antisocial behavior and substance use behavior

To address our second study aim, we first computed zero-order associations between time 1 risk factors and antisocial behavior and substance use behavior at times 1 and 2. Next we tested the prediction of youth antisocial and substance use behavior using multiple regression analyses. We ran models separately for the dependent variables of antisocial behavior versus substance use behavior but entered the same independent variables into both models. Specifically, both models tested the effect of demographic factors (age, gender, province recruited from, site, orphan status, and housing type); earlier youth behavior (both time 1 antisocial and substance use behavior); and time 1 risk variables (child abuse, poverty, home violence, and community violence) on outcomes assessed at time 2. In a final step in each model, we also examined the effect of also controlling for *concurrent* antisocial or substance use behavior. Thus we were able to examine the unique effect of the risk factors on our outcomes of interest, controlling for both *earlier* youth behavior and the *concurrent* overlap of substance use and antisocial behavior.

Table 1
Descriptive statistics of study variables.

	Categories	*n*	% of sample
Demographic variables (time 1)			
Recruitment province	Western Cape = 0	1851	52.6
	Mpumalanga = 1	1664	47.3
Site	Rural = 0	1737	49.4
	Urban = 1	1778	50.6
Gender	Female = 0	1992	56.7
	Male = 1	1523	43.3
Orphan status[a]	Not an orphan = 0	2701	76.8
	Orphan = 1	804	22.9
Housing	Informal = 0	1124	32.0
	Formal = 1	2391	68.0
	n	*M*	*SD*
Age	3514	13.45	2.14
Main study variables			
Youth risk outcome variables (time 1 and time 2)	*n*	*M*	*SD*
Time 1 AB	3504	2.58	2.97
Time 2 AB	3385	2.81	2.74
Time 1 substance use behavior	3515	.00	1.45
Time 2 substance use behavior	3397	.00	1.63
Risk variables (time 1)			
Poverty	3510	1.35	.64
Child abuse	3511	.28	.58
Home violence	3510	.37	.66
Community violence	3515	1.05	1.02

[a] *Note*. Analyses were re-run using a different orphan status binary variable (orphaned by HIV/AIDS versus not) and the overall pattern of findings was unchanged.

3. Results

3.1. Descriptive statistics

Descriptive statistics for the sample and all variables of interest are presented in Table 1.

3.1.1. Aim 1: to examine the co-occurrence of substance use and antisocial behavior

To address our first aim, we examined zero-order associations between substance use and antisocial behavior (Table 2). Both antisocial behavior and substance use showed only modest stability from time 1 to time 2 (antisocial behavior, $r = .14$, $p < .001$; substance use, $r = .16$, $p < .001$). There was some overlap in antisocial behavior and substance use behavior within assessments at time 1 ($r = .16$, $p < .001$) and time 2 ($r = .29$, $p < .001$). Finally, there was evidence of reciprocity in the association between antisocial behavior and substance use over time as antisocial behavior at time 1 was related to substance use behavior at time 2 ($r = .13$, $p < .001$) although not vice versa.

3.1.2. Aim 2: to examine risk factors associated with AB and substance use behavior

To address our second study aim, we first computed zero-order associations between time 1 risk factors and youth antisocial and substance use behavior at times 1 and 2. There were modest–moderate cross-sectional associations at time 1 between risk factors and youth reports of antisocial and substance use behavior, particularly for experience of abuse (range $r = .13$–$.20$, $p < .001$) and exposure to community violence (range $r = .20$–25, $p < .001$). Longitudinal zero-order associations were more modest and in some cases, non-significant, with the exception of the association between time 1 community violence and time 2 substance use ($r = .19$, $p < .001$).

Next we examined prediction of outcomes (antisocial behavior and substance use behavior) in multiple regression models (Tables 3 and 4) to test the *unique* effect of the different risk factors on outcomes, controlling for their overlap, earlier youth behavior, and relevant covariates. We found that experience of abuse ($\beta = .04$, $p < .05$) and community violence ($\beta = .07$, $p < .001$) at time 1 predicted antisocial behavior at time 2, controlling for earlier antisocial behavior ($\beta = .07$, $p < .001$), substance use at time 1 ($\beta = .04$, $p < .05$), and relevant covariates (see Model 2, Table 3). There were also significant effects of various demographic factors on increases in antisocial behavior at time 2, including being of older age ($\beta = .12$, $p < .001$), male gender ($\beta = .04$, $p < .05$), and being recruited from Mpumalanga ($\beta = .18$, $p < .001$). In a final model to test the prediction of antisocial behavior at time 2, we also included time 2 substance use as a covariate (Model 3, Table 3). Antisocial behavior and substance use were moderately related ($\beta = .27$, $p < .001$) at time 2, even controlling for earlier antisocial behavior and substance use, and other variables in the model. Nevertheless, the overall pattern of findings for risk factors remained unchanged, particularly the predictive effects of community violence and child abuse, suggesting that there was specificity in the associations between risk factors and antisocial behavior beyond overlap with substance use.

Table 2
Bivariate correlations between main study variables.

	Antisocial behavior (T1)	Antisocial behavior (T2)	Substance use (T1)	Substance use (T2)	Poverty (T1)	Child abuse (T1)	Home violence (T1)
Antisocial behavior (T2)	.14***						
Substance use (T1)	.16***	.01					
Substance use (T2)	.13***	.29***	.16***				
Poverty (T1)	.08***	.01	.06***	.03†			
Child abuse (T1)	.20***	.07***	.13***	.05**	.22***		
Home violence (T1)	.13***	.05**	−.04*	.001	.11***	.18***	
Community violence (T1)	.20**	.04*	.25***	.19***	.14***	.26***	.02

T1 = time 1; T2 = time 2.
† $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

We also tested prediction of time 2 substance use behavior by risk factors in multiple regression models (see Model 2, Table 4). Of the time 1 risk factors, only community violence was significantly related to increases in substance use behavior over time ($\beta = .10$, $p < .001$), controlling for earlier substance use ($\beta = .07$, $p < .001$) and earlier antisocial behavior ($\beta = .08$, $p < .001$). There were also significant direct effects of relevant demographic factors on increases in substance use, including living in *formal* housing ($\beta = .07$, $p < .001$), male gender ($\beta = .08$, $p < .001$), older age ($\beta = .13$, $p < .001$), and being recruited from Cape Town ($\beta = -.12$, $p < .001$). As before, controlling for the association between antisocial and substance use behavior at time 2 in a final model (see Model 3, Table 4), saw a broadly similar pattern of findings, suggesting specificity in associations for substance use beyond concurrent overlap with antisocial behavior.

4. Discussion

4.1. Overview of findings

The current study examined cross-sectional and longitudinal associations between antisocial and substance use behavior, and potential shared and unique risk factors for each in a large sample of South African youth. We examined contextual and family risk factors associated with increased risk for antisocial and substance use behavior over time. This is the first known study in South Africa to test associations using continuous outcome measures of both antisocial behavior and substance use to assess potential differential prediction by salient risk factors at the child-, family-, and community-level controlling for overlap in youth antisocial and substance use behaviors. Importantly, we assessed a very large, high-risk sample from two different provinces, with high retention over a one year follow-up, which increases the generalizability of our findings.

4.2. Study aim 1: co-occurrence of substance use and antisocial behavior

In relation to our first study aim, we found co-occurrence of antisocial behavior and substance use both cross-sectionally and longitudinally in zero-order associations. Our results are thus in line with previous studies of South African youth suggesting reciprocity in youth engagement in risky antisocial and substance use behaviors (e.g., Bui et al., 2000; Carney et al., 2013). It was interesting that we continued to find reciprocal effects between earlier antisocial behavior and substance use on later youth behavior even when we considered associations within multivariate analyses controlling for risk factors and demographic covariates. This pattern of findings fits with other studies that have reported that antisocial behavior precedes engagement in substance use behaviors (e.g., Bui et al., 2000; Mason & Windle, 2002) and suggests that development of these two risky outcomes may go

Table 3
Summary of sequence of multiple linear regression models predicting AB at time 2.

		Model 1		Model 2		Model 3	
		B (*SE*)	β	*B* (*SE*)	β	*B* (*SE*)	β
Risk variables (time 1)	Poverty	−.06 (.08)	−.01	−.002 (.07)	.001	−.003 (.07)	−.001
	Child Abuse	.27 (.09)	.06**	.21 (.09)	.04*	.22 (.08)	.05**
	Violence in the home	.17 (.07)	.04*	−.03 (.07)	−.01	−.03 (.07)	−.01
	Community violence	.07 (.05)	.03	.18 (.05)	.07***	.10 (.05)	.04*
Covariates	Time 1 AB			.07 (.02)	.07***	.05 (.02)	.05**
	Time 1 substance use behavior			.07 (.04)	.04*	.04 (.03)	.02
	Province			.98 (.13)	.18***	1.16 (.13)	.21***
	Site			.11 (.09)	.02	.08 (.09)	.02
	Type of house			.22 (.12)	.04†	.11 (.12)	.02
	Orphan status			.01 (.11)	.002	−.02 (.11)	−.004
	Gender			.34 (.09)	.06***	.22 (.09)	.04*
	Age			.15 (.02)	.12***	.11 (.02)	.09***
Unique effect	Concurrent (time 2) substance use behavior					.47 (.03)	.27***
	R^2	.01*		.07***		.14***	

Note: Model 1 includes time 1 risk variables. Model 2 includes time 1 antisocial and substance use behavior, and demographic covariates (province recruited from, urban/rural location, age, gender, formal/informal housing, and orphan status). Model 3 includes time 2 (i.e., concurrent) substance use behavior to examine the unique effects of time 1 factors on increases in antisocial behavior over time, even controlling for substance use at both time points.
† $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 4
Summary of sequence of multiple linear regression models predicting substance use behavior at time 2.

		Model 1		Model 2		Model 3	
		B (*SE*)	*β*	*B* (*SE*)	*β*	*B* (*SE*)	*β*
Risk variables (time 1)	Poverty	.01 (.04)	.002*	−.001 (.04)	.001	.001 (.04)	.001
	Child abuse	.02 (.05)	.01†	−.03 (.05)	−.001	−.06 (.05)	−.02
	Violence in the home	−.01 (.04)	−.01	.01 (.04)	.01	.01 (.04)	.01
	Community violence	.30 (.03)	.18***	.16 (.03)	.10***	.13 (.03)	.08***
Covariates	Time 1 AB			.04 (.01)	.08***	.03 (.01)	.06**
	Time 1 substance use behavior			.07 (.02)	.07***	.07 (.02)	.06**
	Province			−.39 (.08)	−.12***	−.54 (.07)	−.17***
	Site			.07 (.05)	.02	.04 (.05)	.01
	Type of house			.25 (.07)	.07***	.22 (.07)	.06**
	Orphan status			.07 (.06)	.02	.07 (.06)	.02
	Gender			.25 (.05)	.08***	.19 (.05)	.06***
	Age			.10 (.01)	.13***	.07 (.01)	.10***
Unique effects	Concurrent (time 2) AB					.16 (.01)	.27***
	R^2	.04***		.08***		.15***	

Note: Model 1 includes time 1 risk variables. Model 2 includes time 1 antisocial and substance use behavior, and demographic covariates (province recruited from, urban/rural location, age, gender, formal/informal housing, and orphan status). Model 3 includes time 2 (i.e., concurrent) AB to examine the unique effects of time 1 factors on increases in substance use over time, even controlling for AB at both time points.
† $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

somewhat hand-in-hand. However, in the only other longitudinal examination of reciprocal associations between antisocial behavior and substance use over time among South African youth, Carney and colleagues reported that inter-relations between alcohol use, cigarette smoking, and drug use were not consistently related to delinquency over time (although they were related cross-sectionally). Future studies are therefore needed to examine more precisely how these risky behaviors interact, taking advantage of multiple assessment waves.

4.3. Study aim 2: shared/unique risk factors for antisocial behavior and substance use

To address our second study aim, we computed multiple regression models to examine the prediction of later antisocial behavior and substance use by experience of child abuse, poverty, violence in the home, and community violence. First, we found that high levels of exposure to community violence predicted *increases* in both antisocial behavior and substance use over the one year assessment period, controlling for earlier youth behavior, demographic covariates, and the other indices of risk (i.e., poverty, violence in the home, and child abuse). This finding fits with results of a previous cross-sectional study of South African youth (van der Merwe & Dawes, 2000), as well as the findings of studies examining violence in samples of adolescents from urban areas in developed countries (e.g., DuRant, Cadenhead, Pendergrast, Slavens, & Linder, 1994; Ho, 2008). Further, this finding also replicates our results from a previous study assessing a different sample from Cape Town, which had broadly focused on AIDS-affected children, but used the same four-item measure of community violence (Gardner et al., under review).

A number of theories have been put forward to explain the link between community violence and youth antisocial behavior in this context, including (a) the notion that chronic exposure to community violence increases the likelihood of children becoming uncaring and emotionally desensitized (Osofsky, Werers, Hann, & Fick, 1993), (b) experience of community violence resulting in a persistent state of defensiveness and high levels of arousal (and reduces prosociality), and (c) community violence producing high numbers of aggressive role models and lack or prosocial role models, increasing the likely reproduction/imitation of such behaviors by youth (Bandura, 1973). However, while the current study supports a link between community and youth violence, we did not test for mediational effects, so explanations for the association remain speculative.

Second, we found that experience of child abuse predicted increases in antisocial behavior. This finding is in line with a large body of empirical evidence from studies that have examined the development of antisocial behavior in high countries (e.g., Herrenkohl & Herrenkohl, 2007; Smith & Thornberry, 1995; Stouthamer-Loeber, Loeber, Homish, & Wei, 2001). In particular, it may have been that this variable acted as a proxy for harsh parenting, which is a well-evidenced risk factor associated with increased risk for youth antisocial behavior development (see Patterson, 1982; Shaw & Gross, 2008). In particular, a unique aspect of Patterson's framework is the focus on understanding the escalation and maintenance of antisocial behavior within the context of coercive parent–child interchanges in which both the parent and child are active participants. For example, harsh parenting practices are thought to escalate aversive child behaviors (e.g., hitting, physical attacks) rather than eliminate them, fostering an increasingly negative pattern of parent–child interactions and laying the foundation for children to adopt similarly hostile and coercive social interactions in their relationships beyond the home (e.g., school and community). In terms of unique associations, it is interesting that there was an effect of child abuse on antisocial behavior but not substance use once we controlled for their overlap in models. Thus, interventions that seek to reduce abuse or harsh forms of discipline (i.e., physical punishment) may be effective in specifically reducing antisocial behavior.

Beyond the effects of community violence and child abuse, it is interesting to note that neither poverty nor witnessing violence in the home predicted antisocial behavior or substance use outcomes in regression models. This pattern of findings is in line with the findings of our previous study of a separate sample of youth from Cape Town (Gardner et al., under review), but is somewhat surprising in the context of a large literature in the developed world that has reported a link between poverty and parental conflict and the development of antisocial behavior (Shaw & Gross, 2008). One important consideration for interpreting these effects is context. Indeed, the fact that poverty and witnessing violence in the home did not predict outcomes in this study supports the notion that some risk factors that we would expect to identify in a high-income country context (e.g., low-income), may be relatively normalized among many youth growing up in deprived communities across different parts of South Africa, and thus not associated with the outcomes of antisocial behavior or substance use in the same way. At the same time, the striking effect of exposure to community violence on later outcomes highlights the stark reality of many of the young people in our sample and the importance of targeting this broader influence to

prevent the transmission of severe forms of violence and aggression within communities.

4.4. Demographic factors and consideration of context

In relation to context, it was noteworthy that we found a divergent effect of recruitment province on outcomes — youth recruited in Mpumalanga showed greater increases in antisocial behavior over time whereas youth recruited in Cape Town showed greater increases in substance use over time. While we view our inclusion of the two regions as a strength in relation to the generalizability of our findings, this divergent pattern of effects highlights the potential for somewhat separate etiologic pathways to antisocial behavior, which may be context-dependent (e.g., greater access or availability of substances in Cape Town). However, Mpumalanga is a previously understudied region in South Africa relative to Cape Town, and the current study highlights the need for further qualitative and quantitative examination of putative risk factors and psychosocial outcomes of youth in lower-resourced and more rural areas, such as Mpumalanga. At the same time, the fact that we found higher levels of youth-reported substance use among our Western Cape sample fits with previous studies that have highlighted increasing concerns surrounding methamphetamine use in Cape Town, which has been linked to aggressive behavior among youth (e.g., Plüddemann et al., 2010).

Beyond differences by recruitment province, we found other *expected* effects of covariates on outcomes. Specifically, male gender and older age were both linked to greater risk for antisocial behavior and substance use over time. The effects of gender and age are consistent with well-established models of antisocial behavior development (Loeber et al., 1998). Interestingly however, being an orphan (either an orphan by any cause or orphaned specifically by HIV/AIDS) was not associated with increased risk for antisocial behavior or engaging in substance use. This finding is in line with what we have reported in a previous study (Gardner et al., under review), but contrasts with some early hypotheses in the literature (e.g., Schönteich, 1999). It is noteworthy that while this subgroup does not appear to be engaging in externalizing or delinquent behaviors, they are nevertheless a high risk group in terms of their long term mental and physical health outcomes. For example, studies that have examined the psychosocial outcomes of youth orphaned by HIV/AIDS in this and other samples have suggested that they are at greater risk of a host of internalizing problems, including showing high levels of symptoms related to anxiety, depression, and post-traumatic stress disorder (e.g., Cluver & Gardner, 2007; Cluver et al., 2011). Taken together, these findings suggest that for the significant subgroup of youth in South African who are orphans, a focus on internalizing (rather than externalizing) behavioral outcomes is warranted.

4.5. Strengths and limitations

There were a number of strengths to the current study, including the very large sample size, unusually high follow-up over the assessment period, and the representativeness of youth from different provinces, sites (i.e., rural and urban), and housing (i.e., informal housing and formal housing types), all of which increase the generalizability of our findings. We also replicated findings from a previous study of a different sample, using an identical index of experience of community violence. At the same time, the results of the study should be considered alongside several limitations. First, all measures were derived from youth self-report thus there may have been some social desirability effects, which led to under-reporting of antisocial behavior by youth. At the same time, we tried to minimize the effect of social desirability by including antisocial behavior items on a separate tear-off sheet within questionnaires that was marked 'confidential'. Nevertheless, future studies are needed to examine alternative measurement approaches and methods to assess these constructs among youth within this context. Second, relatedly, our measure of antisocial behavior was derived from well-validated scales based on studies in high-income countries. However, it may be that some items were not culturally valid or appropriate indices of antisocial behavior within this context. For example, in a previous study we had changed the CBCL item from 'sets fires' to 'vandalism' as pre-piloting had indicated that the original CBCL item was perceived as part of the day-to-day routine of many children in our sample (see Gardner et al., under review). Future studies are therefore needed to develop and examine the validity of antisocial behavior measures within the South African context. Finally, it should be noted that the effect sizes and the variance in youth behavior explained by models were modest, which should be considered alongside findings.

5. Conclusions

The results of the current study demonstrated reciprocity in the engagement in antisocial behavior and substance use over a one year period among high risk South African adolescents. In addition, we demonstrated an empirical link between experience of community violence and child abuse and the development of antisocial behavior and between experiences of community violence and increased risk for substance use. That these associations were found over and above the effects of poverty and violence in the home (i.e., both well-documented predictors of antisocial behavior) is striking, and highlights the need for interventions that target violence and abuse at both community and family levels. It is notable that orphanhood (whether by AIDS or other causes) was not a risk factor for antisocial behavior, suggesting that this group would not need specific targeting for antisocial behavior prevention. Our data suggest that preventive efforts should focus at two levels. First, strategies to reduce family violence towards children and young people should be developed and tested, drawing on well-established parenting interventions, which are beginning to be tested in low and middle income countries (Knerr, Gardner, & Cluver, 2013) Second, new strategies need to be developed and tested for preventing violence at a community and peer group level based on evidence-based interventions tested in high-income countries (e.g., whole-school programs; Waasdorp, Bradshaw, & Leaf, 2012). However, adaptation and rigorous testing are required to assess the effects of these and other interventions in deprived low and middle income country contexts (Knerr et al., 2013).

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