

# The Geography of Normative Climates: An Application to Adolescent Substance Use

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**Abstract** The existing research on risk factors for adolescent substance use highlights the importance of peers' direct influence on risky behaviors, yet two key limitations persist. First, there is considerably less attention to the ways in which peers shape overall (e.g., school-level) normative climates of attitudes and expectations about substance use, and, second, the role of the broader geographic contexts in which these climates are embedded is essentially neglected. In light of shifting trends in geographic differences in adolescent substance use, the current study uses data from the 2007 Nebraska Risk and Protective Factor Student Survey ( $n = 26,647$ ; 80 % non-Hispanic White; 51 % female) to (a) explore whether geographic context shapes the character (permissiveness) and consistency (homogeneity) of normative climates and (b) examine the consequences (effects) of such climates on adolescent substance use risk across the rural–urban continuum. Normative climates are a consistent predictor of substance use, yet the geographic context in which schools are located matters for both the nature and influence of these climates, and the patterns differ between normative climates about alcohol and marijuana. These findings illustrate that school normative climates do indeed matter for substance use behavior, and the ways in which they do depend on their broader, geographic context. Thus, future research on youth's substance use should be attuned to these more nuanced distinctions.

**Keywords** Normative climate · Schools · Adolescence · Peers · Substance use · Urban/rural

## Introduction

Alcohol, marijuana, and tobacco are the three substances abused most frequently among teens and adolescents. According to recent data from the nationally representative *Monitoring the Future* survey (Miech et al. 2015), two out of three high school students have consumed alcohol by the end of high school, half of twelfth graders have been drunk at some point in their lifetime, and 20 % report binge drinking during the past 2 weeks. About 20 % of Americans ages 12 and over report past month marijuana use, and almost half of youth ages 12–17 report that it would be easy to obtain marijuana if they wanted it (Substance Abuse and Mental Health Services Administration 2011). Also concerning is that attitudes about the harmfulness of substance use have been declining. For instance, in 2014, only 36 % of high school seniors perceived regular marijuana use as harmful, a percentage that is its lowest in 37 years (Miech et al. 2015). Youth's beliefs about substance use—presumed risks, assumed acceptability, etc.—are shaped by the attitudes, expectations, and objective behaviors of their peers. It is during the critical developmental phase of adolescence where more distal contexts such as peer groups, schools, and even neighborhoods become central, with peer substance use emerging as a key risk factor for one's own use (de la Haye et al. 2013; Garnier and Stein 2002). However, much less is known about how peers themselves shape the larger contexts and climates—such as school-level norms—to which all youth are exposed, and which influence behavior, even beyond the attributes of individuals and their closest friends.

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Furthermore, these normative climates—which capture and reflect group-level attitudes, behaviors, and values—do not exist within a vacuum. Rather, they are influenced by the various (interacting) socio-ecological dimensions within which they are embedded (Bronfenbrenner 1979).

Although scholarship on adolescent problem behaviors recognizes the need to explore the connections between individuals and the social groups in which they are situated (Jessor 1993), few studies adequately bridge adolescents and their *multiple* key social environments. That is, while there is extensive research on the consequences of interpersonal relationships for substance use risk, there is much less attention to the broader social contexts in which those interactions occur (Kumar et al. 2002), or the place-based nature of social networks (Mason et al. 2010). One area where more contextualization is needed is in examining the role of geography (Rountree and Clayton 1999) because, while there is research linking permissive normative climates about substance use with adolescents' own use (Allison et al. 1999; Wright et al. 2014), this work has either been attuned exclusively to urban areas, or neglected geography altogether (Mrug et al. 2010; Wright et al. 2014). Therefore, we utilize data from the 2007 Nebraska Risk and Protective Factor Student Survey (NRPFSS) with Rural–Urban Continuum Codes (RUCC) to assess geographic variation in the overall character (permissiveness), the consistency (homogeneity), and the consequences (effect) of school-level normative climates about substance use. The contribution of this study is that it extends research on the etiology of adolescent substance by bridging normative climates and their respective geographic context, exploring the ways in which school climates may vary by place.

### Peers and Peer Climates as Risk Factors for Adolescent Substance Use

During adolescence, as youth begin to exert increasing independence from parents and families, peers become particularly influential, especially for problem behaviors (Warr 2002). Adolescents are highly influenced by the beliefs, actions, and decisions of their peers (Cleveland et al. 2008; Mason and Windle 2001; Schinke et al. 2008). Exposure to peers who themselves use substances (de la Haye et al. 2013; Maxwell 2002), and even perceptions about peers' substance use, are both significant risks for youth's use. Substance-using peers provide opportunities (and perhaps also pressure, e.g., Santor et al. 2000) for adolescents themselves to engage in such behavior (Cleveland and Wiebe 2003). Also, the extent to which youth even just perceive that their peers approve of substance use influences their own risk of substance use (Gale et al. 2012). As suggested by the theory of reasoned action

(Ajzen and Fishbein 1980; Bonell et al. 2013), behavior is significantly influenced by beliefs—about that behavior, specifically, but also beliefs about the normative expectations of peers. Thus in addition to direct associations between peer use (or perceived use), peers influence adolescent substance using behavior by shaping the values, norms, and culture of the larger context (e.g., schools, neighborhoods) to which youth are exposed—that is, by shaping the character and content of that context's normative climate. Normative climates are aggregate attitudes shared by members of a social group (Butler 2005) that exist independent of and apart from individually held attitudes (Mollborn 2010; Warner et al. 2011). Normative climates influence decision-making through their effect on individuals' own value systems and personal assessments of what counts as acceptable/desirable behavior. The normative climates of schools are particularly salient in adolescence, since schools are a focal developmental context during this stage of the life course (Warr 2002; Giordano 2003; Hartup 1996).

Scholars have begun documenting the influences of normative climates shaped by adolescents' behaviors, as well as their attitudes (e.g., school-level proportion of substance-using students, school-level approval of substances, Mrug et al. 2010; Cleveland and Wiebe 2003; Eisenberg et al. 2014). Keyes et al. (2011), using data from *Monitoring the Future* and examining population-level norms about marijuana use (among birth cohorts), found that youth in birth cohorts where fewer than half of persons disapproved of marijuana use had over three times the odds of use than youth in cohorts with majority disapproval. Studying youth in high-risk, urban neighborhoods, Wright et al. (2014) found that exposure to neighborhood-level norms favorable toward drug use reduced youth's perceptions about the harmfulness of drug use, which in turn increased their risk of use. Additionally, Allison et al. (1999) found that adolescents who attended schools with climates more favorable to substance use were more likely to engage in drug and alcohol use (see also Leifheit et al. 2015). Normative climates are important in assessing not only direct peer influences, but also influence from more distal peers, who are also influential, even though only indirectly connected (Payne and Cornwell 2007).

### Putting School-Level Peer Climates in (Geographic) Context

Despite increasing attention to normative climates as important contextual risk factors for adolescent substance use, our understanding of their effect is limited by a tendency among scholars to neglect the broader contexts in which these climates are situated, contexts which exert their own influence on the climates (and thus individuals)

themselves. In discussing the links between peers and school-level variation in substance use, Ennett et al. (1997) describe two processes that may explain why substance use rates vary across schools. According to the contagion (or epidemic) model, interaction with substance-using peers spawns the spread of substance using norms and behaviors through peer networks within a school (via modeling and reinforcement). A contagion model alone, however, is not sufficient for explaining school-level variation in substance use because it cannot account for the initial emergence of pro-drug norms within a school. Thus a second (and complementary) explanation for school-level differences in substance use recognizes the ways in which students are affected similarly by the sociodemographic characteristics of their environments (Ennett et al. 1997). This explanation draws largely from the tenets of social disorganization theory (Shaw and McKay 1942), which highlights how structural disadvantage undermines a community's ability to maintain effective social control and prevent/deter the emergence and spread of problem behaviors, but it is also consistent with Bronfenbrenner's ecological systems theory (1979), which advocates examining the ways in which individuals are influenced by the various (interacting) socio-ecological dimensions within which they are embedded (other similar perspectives include the theory of triadic influence and the ecodevelopmental model; Szapocznik and Coatsworth 1999; Flay 1999). As Mason et al. (2004) note, research on adolescent substance use employing a traditional risk and protective factor model, despite recognizing the focal domains for youth—e.g., family, peer, school, and neighborhood—tends to examine what occurs *within* a domain (focusing on one domain at a time), but often fails to contextualize the interactive effects among domains. One area where more contextualization is needed involves geographic contexts, especially extending beyond simple urban/rural dichotomies to explore potential heterogeneity within rural and urban contexts (Rountree and Clayton 1999).

### Rural–Urban Differences in Adolescent Substance Use

There has generally been less attention to substance use in rural places, or among rural youth, as researchers have historically presumed that urban youth were more likely to engage in substance use (Gfroerer et al. 2007; Lambert et al. 2008; Scaramella and Keyes 2001) given their (assumed) greater access to substances and more frequent contact with alcohol, marijuana, and other illicit drug users. Adolescents in rural areas have been assumed to be protected from substance use by a “rural idyll” that shielded them from the hazards and risks of urban areas (Scaramella and Keyes 2001); however, recent data suggests that trends

in substance use between rural and urban youth have converged, with some studies finding that rural adolescents are now more likely to use tobacco regularly, drink alcohol frequently, and use illicit substances (Atav and Spencer 2002; Gfroerer et al. 2007; Lambert et al. 2008). Other studies (e.g., Levine and Coupey 2003) have found no significant differences in substance use risk between urban and non-urban youth, but this may be due to collapsing places into an urban versus rural dichotomy, assuming homogeneity among areas that may differ quite significantly in terms of demographics, economic opportunities, and resources. In fact, a few recent studies have documented variation in substance use patterns across rural contexts. For instance, Shears et al. (2006) found that rates of substance use varied across rural contexts, with adolescents in remote communities having higher rates of drunkenness, those in remote and medium-rural communities having higher rates of inhalant use, and those in large rural and metro areas having more involvement with marijuana (see also Edwards et al. 2011). Other research found that alcohol, smokeless tobacco, inhalant, and other illicit drug use was more prevalent among high school-aged youth living on farms compared to those living in towns (Rhew et al. 2011). Given these observed (although sometimes contradicting) associations between geographic context and actual substance use behavior, it seems likely that geography may also shape the school-level peer climates that facilitate the transmission of pro- (or anti-) drug attitudes and values. Further, we argue that geography may actually shape three separate dimensions of school-level normative climates: its overall character (that is, level of permissiveness), its internal consistency (that is, the degree of agreement [homogeneity] in norms among students in a school), and its consequences (that is, the effect of normative climate on actual behavior). We discuss each of these dimensions below.

### Geographic Variation in the Character of Normative Climates: Permissive to Disapproving

Exposure to normative climates favorable to substance use is a risk factor for engaging in such use; however, these climates may not be similarly favorable toward (or discouraging against) substance use across all of the geographic contexts in which they are embedded. Rather, adolescent normative climates may first vary across places in their overall character—that is, whether the climate is supportive/encouraging of substance use, or discouraging of such use. Despite the traditional characterizing of rural communities as exhibiting less anonymity, greater control and cohesion, and more prosocial peer groups (than urban communities)—which would translate to lower use and less permissive norms

about use (Martino et al. 2008)—there are reasons to expect more permissive normative climates in rural places. Much of the research informing our understanding of geographic differences in attitudes draws from work on high poverty, urban communities, such as Wilson's (1987) social isolation theory, which suggests that residents of concentrated poverty neighborhoods are likely to be isolated from middle-class or mainstream groups (and as such, mainstream values), creating contexts in which “oppositional cultures” (Fordham and Ogbu 1986) may emerge. Although this theory focuses on urban neighborhoods and extreme poverty, the idea (and consequences) of such isolation may be applicable to youth in rural areas, themselves also often isolated (physically and socially) from the same middle-class, mainstream groups (Jensen et al. 2003). Singh and Dika (2003) note that this very theme—close within-community connections but perceived isolation from other communities—emerged in focus groups with rural youth, and Gale et al.'s (2012) analysis of 12–17 year olds in the National Survey of Drug Use and Health (NSDUH) found that rural youth were less likely than their urban peers to disapprove of youth drinking, and rural youth also perceived their families and peers as less disapproving of youth drinking than did their urban peers.

Further, living in an area where substances are more readily available influences norms about behavior as well as actual behavior (Kuntsche and Jordan 2006)—thus, geographic differences in either perceived or actual availability of substances may contribute to geographic differences in norms about substance use. Recent data suggests that drug availability in rural areas may be increasing as these areas provide new markets for the oversupply of drugs in metropolitan areas (Martino et al. 2008). The extent to which this potential increase in availability has translated into more permissive norms about substance use, however, is not yet known. Finally, normative climates in rural schools may be more permissive toward substance use (or at least less discouraging) given that the economic and social stratification of rural communities translates into school-level resource disadvantages, such as fewer institutional resources and opportunities for advanced coursework and extracurricular or recreational activities (Singh and Dika 2003)—the very types of things protective against substance use. Shears et al. (2006) note that educational involvement and achievement may be less important among rural youth—e.g., rural youth have lower college aspirations (attributable to lower institutional resources, fewer opportunities, and socioeconomic disadvantage; see Singh and Dika 2003); therefore, rural youth may be at an increased risk of engaging in, and adopting norms favorable toward, risky behaviors such as substance use.

### **Geographic Variation in the Consistency of Normative Climates: Homogeneous Versus Heterogeneous**

Not only may geography influence the overall character of normative climates about youth substance use, but the consistency of these climates—that is, the extent to which students' attitudes about substance use are similar (or different) within a given school—may be influenced by the social and structural characteristics of the broader environment from which those students are drawn. Independent of average school-level approval (or disapproval) toward substance use, the attitudes of individual students within a school (which comprise its overall climate) may be highly variable, fairly similar, or somewhere in between. Stemming again from social disorganization theory (Shaw and McKay 1942) is the idea that urban, distressed, communities are characterized by a number of different systems of values, or what Harding (2007) more recently described as “cultural heterogeneity” (as opposed to a single, dominant, oppositional culture). In a study focused on youth cultural scripts about sexual behavior, Harding (2007) found that rather than being dominated by one “oppositional” culture, disadvantaged, urban neighborhoods were better characterized by a wide array of competing and conflicting values (see also the discussion of “decent” and “street” cultures in Anderson 1999), likely due in large part to the heterogeneity (racial/ethnic and particularly socioeconomic) of its residents. Rural communities tend to be more homogeneous, with denser acquaintanceships, fewer conflicts in values, greater emphasis on conforming behaviors, and less tolerance of deviant activity (Scheer et al. 2000). As McGloin et al. (2014) note, highly dense networks provide more consistent norms (and reinforcement), are more effective for imposing conformity, and are better able to buffer outside influences; thus, they are more insular and controlled. Given this, we may expect normative climates to be more internally consistent (homogeneous) within rural schools and less so within urban schools.

### **Geographic Variation in the Consequences of Normative Climates: Influential or Ignorable?**

In addition to differences in the overall character and internal consistency of school normative climates about substance use, the consequences of such climates—their effect on actual behavior—may be influenced by geography. That is, the effect of normative climates on substance use may be stronger depending on whether the school is in a rural area, or a more urban area. For instance, Mennis and Mason (2011) found that not only was adolescent substance use higher in perceived “risky” neighborhoods (e.g., those that were highly distressed, with commercial activity), but the effect of substance using peers was exacerbated in those neighborhoods. Urban

environments may contain more opportunities for risky experimentation, and fewer opportunities for prosocial behavior (Mason et al. 2004). Larger schools tend to have more physical space in need of supervision, and thus more unsupervised spaces where risk behaviors can take place (Stewart 2003)—where the effects of permissive normative climates may be enhanced. Alternatively, the population decline experienced by a number of rural areas leads to reduced population density, greater spatial isolation from neighbors, and decreased informal social control (Spano and Nagy 2005)—if so, rural youth are more isolated from watchful guardians, and as such, may be more likely (given increased opportunity) to engage in deviant/risky behaviors such as substance use. Also, social networks in rural areas are often denser and contain more long-term, rather than short-term, relationships (Beggs et al. 1996; Crockett et al. 2000). Denser social networks in rural places (e.g., because of smaller student body sizes in local schools) may be protective (Spano and Nagy 2005), or may lead to increased peer pressure for problem behavior. In a test of social bond theory, Gardner and Shoemaker (1989) found that attachment to peers was positively associated with drug use among rural youth, but not urban youth, and conventionality of peers was protective against use among rural youth, but not their urban counterparts. More recently, Wilson and Donnermeyer (2006) found peer marijuana use was more influential for overall substance use among rural youth (compared to their urban peers), while peer alcohol use was less influential.

Further, a consequence of the potential heterogeneity in norms across types of places (described above) means that it may be harder for adolescents to choose between competing options and easier to switch between options if a chosen course of action is not working out; it may also mean that the overall association between climates and behavior will be weaker (Harding 2007). Alternatively, individuals exposed to a single, cohesive set of normative values may then only see one course of action when faced with opportunities to engage in (pro- or anti-social) behavior (McGloin et al. 2014). Extending McGloin et al.' (2014) work on the (dis)agreement between peer and school-mate norms, we might expect that, to the extent that there is dissimilarity within a normative context, the effect of that context on behavior will be dampened, since there are multiple “normative repertoires” from which to choose; conversely, to the extent that there is consistency with the normative context, the effect of that context may be enhanced.

## Research Questions

There is little debate about the importance of peers for adolescents' risk of substance use (Brechwald and Prinstein 2011). Youth are influenced by the attitudes and behaviors

of not just close friends, but also peers with whom they may not be directly connected, such as school-mates. These peers and school-mates shape the values and norms—that is, the overall climate—of the larger school context to which youth are exposed; but, as an ecological perspective (Bronfenbrenner 1979) illustrates, school climate is nested in its own geographic context/location, and as such, these climates may vary across places. The purpose of the current study was to explore the dimensions by which normative climate may vary across the rural–urban continuum (Rountree and Clayton 1999). Because, as discussed above, the existing literature on the links between risky behaviors, peers, norms, and rurality/urbanicity presents competing and/or conflicting perspectives, the current study was exploratory in nature, and guided by three research questions. First, we asked how geographic context shapes the character of school-level substance use normative climates—that is, are climates in rural schools more (or less) permissive toward substance use? Rural places have traditionally been characterized as more conventional and conservative (Lichter and Brown 2011), suggesting that normative climates would be disapproving of problem behaviors; however, risk factors confronting rural places, such as physical/social isolation and structural disadvantage (e.g., poverty), may create a context for permissive attitudes to arise and take hold.

Second, to what extent does the consistency of school-level normative climates vary by school geographic context—for instance, are climates in urban schools more heterogeneous than normative climates in rural schools? Rural communities tend to be more homogeneous, with denser acquaintanceships and fewer conflicts in values (Scheer et al. 2000); however, recent research (Edwards et al. 2011; Shears et al. 2006; Rhew et al. 2011) has documented considerable variation in actual use within rural places, which may correspond with heterogeneity in attitudes about such use. Urban communities, on the other hand, have been characterized as either being dominated by an “oppositional” culture (Fordham and Ogbu 1986) or as having a wide array of competing and conflicting values regarding risky behaviors (Harding 2007). Finally, our third research question asked if geographic context affects the consequences of school-level normative climates—that is, does the effect of normative climate vary across the urban–rural continuum? Normative climates in rural places may be more influential, since highly dense networks provide more consistent norms (and reinforcement) and are more effective for imposing conformity (McGloin et al. 2014). To the extent that there is heterogeneity in the individual attitudes comprising a school normative climate (as there may be in urban schools), individuals have more choice, which may either weaken the overall effect of school-level climates on substance use risk or strengthen its effect, if urban students have

greater options to select into networks of pro-drug peers. By addressing these research questions, the current study expands upon our existing understanding of school-level climates by incorporating the role of geographic context. It provides a more nuanced portrait of the content of normative climates and the ways in which they might both “look” and “act” differently, depending on the broader context in which they are embedded.

## Data and Methods

The current study used data from the 2007 Nebraska Risk and Protective Factor Student Survey (NRPFS). Coordinated by the Nebraska Department of Education and the Nebraska Department of Health and Human Services, the NRPFS is a school-based public health survey designed to measure adolescent substance use, delinquency, and gambling, and the risk and protective factors for such problem behaviors among students in sixth, eighth, tenth, and twelfth grades throughout Nebraska. All Nebraska schools, public and private, were eligible and could choose to participate. Within participating schools, all students in eligible grades were asked to complete the survey. Omaha and Lincoln public school districts (the two largest in Nebraska) declined to participate in the study; however, the data do contain other metropolitan counties, as well as a sizeable representation of gradations in rural counties, making these data ideal for exploring heterogeneity across rural contexts.

Overall, 32 % of students in Nebraska in grades 6, 8, 10, and 12 completed the survey, resulting in a sample size of 30,844 adolescents. Although this percentage seems low, the NRPFS was designed to provide community-level estimates directly to participating schools, rather than be representative at the state level. Of these 30,844 respondents, we excluded respondents with missing data on the outcomes of interest ( $n = 1042$  [3.38 %]), independent variables ( $n = 390$  [1.26 %]), and demographic and control variables ( $n = 3073$  [9.96 %, with socioeconomic status accounting for over 8 %]), and respondents from schools with fewer than five total survey participants ( $n = 24$  [0.08 %]). These exclusions were not cumulative, resulting in a final analytic sample of 26,647 students attending 287 schools (with an average of 93 students per school).

## Measures

### *Substance Use*

We tested the effect of normative climate on three indicators of substance use. Alcohol use was measured via the

following question: “On how many occasions have you had beer, wine, or hard liquor to drink in the past 30 days?” Binge drinking was measured with the question, “...how many times [over the past 2 weeks] have you had five or more alcoholic drinks in a row?” Marijuana use was measured as the number of occasions respondents used marijuana in the past 30 days. Response options for all three measures ranged from 0 = 0 times to 6 = 40+ times. Although it is not unusual to dichotomize such measures, given their skewed nature (e.g., Warner 2016; Eisenberg et al. 2014), we retain the original coding in order to avoid minimizing our ability to detect nuanced differences in the effect of geography.

### *Normative Climate*

Because students’ attitudes about marijuana use (an illegal substance) may differ from their attitudes about alcohol use, we created two separate indicators of the school-level normative climates for alcohol and marijuana use. Permissive normative climate about alcohol was measured from the question, “How wrong do you think it is for someone your age to drink beer, wine, or hard liquor (for example, vodka, whiskey, or gin) regularly (at least once or twice a month)?” Permissive normative climate about marijuana was measured from the question, “How wrong do you think it is for someone your age to smoke marijuana?” Response options for both questions were 0 = very wrong, 1 = wrong, 2 = a little bit wrong, and 3 = not wrong at all, where higher scores correspond with more permissive attitudes regarding adolescent alcohol and marijuana use. Students’ responses to both questions were aggregated to their school, and each student was assigned his/her school-level mean score. To capture the heterogeneity in students’ attitudes (Research Question 2), the range of student responses to both questions was aggregated to their school, and each student was assigned his/her school-level range. Both measures were grand-mean centered in all analyses. As noted above, schools with fewer than five survey participants were excluded from the analysis (24 respondents across 6 schools).

### *Geography: Urbanicity to Rurality*

We captured geographic location with a series of five (5) dummy variables, defined using the Office of Management and Budget’s Rural–Urban Continuum Code (RUCC) assigned to each participating NRPFS school, based on characteristics of the county within which the school was located. Based on these codes, metropolitan counties are classified by the population of their metro areas, while non-metropolitan counties are classified by both their level of urbanization and their proximity to a metropolitan area.

Schools assigned a RUCC code of 2 were in metropolitan counties with a population between 250,000 and 1 million residents<sup>1</sup>; these schools were coded as (1) *medium urban areas*. Schools assigned a code of 3 are in metropolitan counties that have a population of less than 250,000 residents; schools in these counties were coded as (2) *small urban areas*. Schools assigned a code of 4 or 5 are in non-metropolitan counties that contain an urban center with a population between 20,000 and 49,999 residents; schools in these counties were coded as (3) *mixed urban/rural areas*. Schools assigned a code of 6 or 7 are in non-metropolitan counties that contain an urban center with a population between 2500 and 19,999; these schools were coded as (4) *mostly rural areas*. Finally, schools assigned a code of 8 or 9 are located in non-metropolitan counties that are considered to be completely rural and contain no urban center with a population above 2500. These schools were coded (5) *completely rural areas*. The only distinction between the combined RUCC categories (4–5, 6–7, and 8–9) is their adjacency to a county containing a metropolitan area; to account for this, the analyses also included a dichotomous measure of *adjacency*.

To further isolate the effect of geography and permissive normative climates on adolescents' substance use, analyses controlled for additional school- and individual-level characteristics that may also be associated with adolescents' attitudes about substance use and/or actual substance use behaviors.

### Demographics

Respondents' gender was measured with a dummy variable for female (= 1). Age was a continuous measure ranging from 11 (and younger) to 18 (and older) and was centered in all analyses. Respondents' race/ethnicity was measured with two dummy variables for Hispanic and non-Hispanic other (non-Hispanic White served as the reference category). The NRPFS did not include any individual indicators of student or family socioeconomic status; therefore, as a proxy, analyses included a school-level measure of the percentage of students in the school who were eligible for a free or reduced lunch.

### School Engagement

Respondents' school engagement was measured using a six-item mean rating scale comprised of questions assessing students' commitment to, investment in, and value of their current education (e.g., "how often did you enjoy

being in school?", "...did you try to do your best work in school?"). Responses ranged from 0 = never to 5 = almost always, with higher scores indicating greater school engagement (Cronbach's alpha = 0.82).

### Individual Attitudes

Consistent with past research (e.g., Kumar et al. 2002) and to more effectively partition the variance between individuals and their social contexts (Wilcox 2003), we also controlled for individual-level attitudes toward alcohol and marijuana use, measured via the same questions comprising school-level normative climate, and group-mean centered in all analyses.

### Analytic Strategy

Two-level hierarchical generalized linear models (HGLM) were used to adjust for the complex structure of the clustered data, since adolescents were nested within schools. We specified a negative binomial link function for all outcomes (alcohol use, marijuana use, binge drinking), given their count nature, and to account for overdispersion. The level-1 model captures the within-school variation in adolescents' substance-using behavior, while the level-2 model captures variation between-schools. Although schools were nested in counties, a level-3 equation was not possible given the small number of schools in most counties, with many counties containing only one school.

## Results

### Descriptive Statistics

Table 1 presents descriptive characteristics of the respondents and schools in the analytic sample ( $n = 26,647$  and  $n = 287$ , respectively). Although the means for the continuous measures of substance use are fairly low (given the range from 0 times to 40+ times), dichotomizing the measures into no use/any use (not shown) indicates that approximately one-fifth (20.67 %) of all respondents reported past 30-day alcohol use, 12.25 % reported past 2-week binge drinking, and 6.02 % reported past 30-day marijuana use. The average school-level permissive normative climates about alcohol and marijuana use were 0.74 and 0.36, respectively (on a 0–3 scale), indicating fairly conservative attitudes overall regarding adolescent substance use.

With respect to the compositional characteristics of the sample, the schools were primarily distributed across *medium urban* (28.09 %), *mixed urban/rural* (28.55 %), and *mostly rural* (29.44 %) counties. Just over 10 % of

<sup>1</sup> There were no schools in the current analysis with a RUCC of 1 (because there are no cities in Nebraska with populations exceeding 1 million).

**Table 1** Descriptive characteristics of analytic sample

	Mean/%	SD <sup>a</sup>	Range
Substance use			
Past month alcohol use	0.40	0.97	0–6
Binge drinking (past 2 weeks)	0.25	0.82	0–6
Past month marijuana use	0.16	0.76	0–6
Level-2 indicators			
School normative climates <sup>b</sup>			
Alcohol permissiveness	0.74	0.98	0–3
Marijuana permissiveness	0.36	0.79	0–3
School geography			
Medium urban	28.09		
Small urban	3.39		
Mixed urban/rural	28.55		
Mostly rural	29.44		
Completely rural	10.53		
Adjacency	13.85		
Socioeconomic status			
Percent students eligible for free/reduced lunch	31.31	14.49	0–100
Level-1 indicators			
Individual attitudes <sup>c</sup>			
Alcohol permissiveness	0.74	0.98	0–3
Marijuana permissiveness	0.36	0.79	0–3
Demographics			
Female	50.72		
Age <sup>b</sup>	14.44	2.21	10–19
Non-Hispanic White	79.90		
Non-Hispanic other	7.63		
Hispanic	12.25		
School engagement	2.59	0.73	0–4

Source: Nebraska Risk and Protective Factor Student Survey, 2007 (n = 26,647 students, 287 schools)

<sup>a</sup> Standard deviations and ranges not shown for dichotomously coded variables

<sup>b</sup> Measures grand mean centered (across all schools) for multivariate analyses

<sup>c</sup> Measures group mean centered (within schools) for multivariate analyses

schools were in *completely rural* counties. In addition, 13.85 % of the schools were located in non-metropolitan counties adjacent to counties with a metropolitan area. The sample was nearly evenly split by gender (51 % female), predominantly white (80 %), and respondents were 14 years old, on average. Across the schools, on average, just over 30 % of students were eligible for free or reduced lunch.

### Normative Climates: Character and Consistency

Our first and second research questions explored how geographic context might shape the character and consistency of school-level normative climates—their overall permissiveness and within-school heterogeneity. Table 2 presents means of alcohol and marijuana normative climates across

the rural–urban continuum, along with rates of substance use (both for the full sample and subset to respondents reporting any lifetime use). As shown, schools in *mixed urban/rural* areas had the most conservative attitudes toward alcohol use (mean = 0.69), while schools in *small urban* areas had the most permissive attitudes (mean = 0.84). Contrary to what we may expect based on assumptions about rural areas, schools in *completely rural areas*, did not have the most conservative attitudes about alcohol use; however, regarding marijuana climates, the most conservative attitudes were found among *the completely rural* schools (mean = 0.25) and the most permissive in *medium* and *small urban* schools (mean = 0.42 and 0.41). The group means were compared via an ANOVA, which indicated that all means were significantly different from each other (with one exception: marijuana normative climates did not differ between *medium* and *small urban* schools).



**Table 2** Rates of substance use and the character and consistency of school-level normative climates by school geographic context

	Alcohol use			Marijuana use		
	% Any lifetime alcohol use	Avg. past 30 day alcohol use (drinkers) <sup>a</sup>	Avg. past 2 week binge drinking	% Any lifetime marijuana use	Avg. past 30 day marijuana use (users) <sup>a</sup>	
Medium urban	43.61	0.35 (0.80)	0.22 (0.50)	14.10	0.18 (1.33)	
Small urban	53.43	0.44 (0.82)	0.27 (0.51)	14.05	0.16 (1.17)	
Mixed urban/rural	45.43	0.39 (0.86)	0.25 (0.55)	14.68	0.19 (1.26)	
Mostly rural	51.96	0.43 (0.84)	0.27 (0.52)	12.52	0.13 (1.01)	
Completely rural	53.51	0.45 (0.83)	0.28 (0.53)	8.87	0.08 (0.91)	

	Alcohol permissiveness			Marijuana permissiveness		
	Mean <sup>b,c</sup>	SD	Inter-quartile range <sup>e</sup>	Mean <sup>b,d</sup>	SD	Inter-quartile range <sup>e</sup>
Medium urban	0.73	0.45	0.91	0.42	0.33	0.64
Small urban	0.84	0.41	0.86	0.41	0.29	0.60
Mixed urban/rural	0.69	0.41	0.80	0.39	0.29	0.51
Mostly rural	0.80	0.43	0.84	0.35	0.25	0.40
Completely rural	0.77	0.39	0.51	0.25	0.20	0.19

<sup>a</sup> For alcohol, value in parentheses reports the means among youth reporting any lifetime alcohol use; for marijuana, value in parentheses corresponds to the means subset to youth reporting any lifetime marijuana use

<sup>b</sup> Mean comparisons tested via analysis of variance (ANOVA) adjusted for multiple comparisons (via Bonferroni adjustment)

<sup>c</sup> Means significantly different across all group comparisons

<sup>d</sup> Means significantly different across all group comparisons except medium urban versus small urban

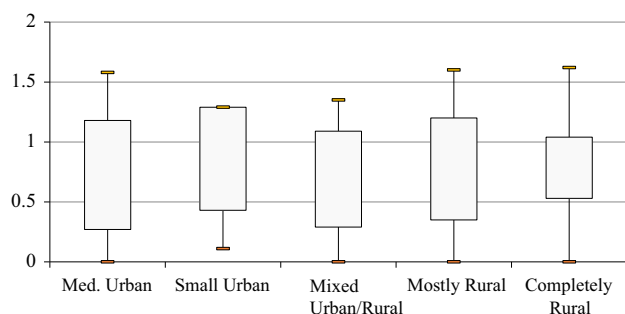
<sup>e</sup> Levene’s test confirmed unequal variances by geographic designation

With respect to the consistency of normative climates by school geography, Figs. 1 and 2 present boxplots and Table 2 presents interquartile ranges (IQR) for school-level normative climates about alcohol and marijuana use by geographic classification (Research Question 2), both indicators of the variability of attitudes across each type of school geography. As these results illustrate, although the normative climates of *completely rural* schools were not the most conservative concerning alcohol use, they were the most internally consistent (IQR = 0.51), whereas the attitudes comprising the normative climates of *medium urban* schools were the most heterogeneous (IQR = 0.91). Regarding marijuana normative climates, as both the IQR results and the boxplots (in particular) illustrate, students in *completely rural* schools were considerably more similar in their attitudes about marijuana (generally disapproving) compared to peers in *medium urban* schools (IQR = 0.19 vs. IQR = 0.64, respectively). A Levene’s test for equality of variance confirmed that the variances were not equal across the five geographic classifications. Therefore, schools’ geographic location does appear to influence not only the overall permissiveness of its normative climate about substance use but also the level of internal agreement in norms among students.

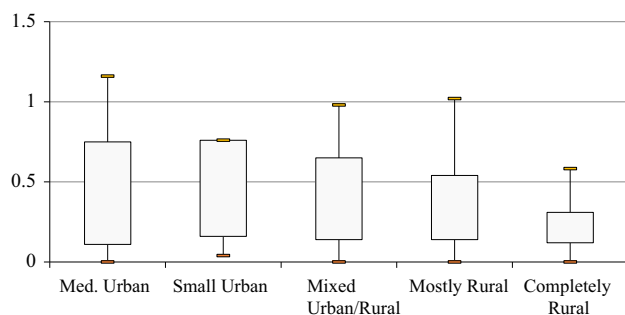
### Geographic Location and the Consequences of Normative Climates

Having established differences in both the character and consistency of school-level normative climates across the rural–urban continuum, our final research question explored the extent to which the effect of normative climate on actual substance use behavior may be differentially influenced by schools’ geographic location. Toward that end, we also assessed the overall effect of normative climate, the effect of heterogeneity in normative climate, and the effect of school geography. Tables 3, 4 and 5 present a series of nested models (with focal covariates entered as blocks) examining the effects of permissive (alcohol and marijuana) normative climate and geography on adolescents’ frequency of past 30-day alcohol use, past 2-week binge drinking, and past 30-day marijuana use (Research Question 3). All models used *mixed urban/rural* as the reference category (to allow for comparisons [a] within rural places and [b] between urban and rural places).

Consistent across all three outcomes (alcohol use, binge drinking, and marijuana use), school-level permissive normative climate is a robust predictor of adolescent



**Fig. 1** Boxplot of permissive normative climate: alcohol by school geography



**Fig. 2** Boxplot of permissive normative climate: marijuana by school geography

substance use, even controlling for individuals' own attitudes (Model 2, Tables 3, 4, 5). Also interesting is that exposure to variability in the normative climate—that is, a more heterogeneous (less internally consistent) climate—is a risk factor for alcohol and marijuana use. For instance, a one-unit increase above the mean in the range of alcohol permissiveness increases the rate of past month alcohol use by a factor of 36 % ( $[\exp(b) - 1] \times 100$ ; Model 2, Table 3), past 2 week binge drinking by a factor of 45 % (Model 2, Table 4), and past month marijuana use by a factor of 55 % (Model 2, Table 5). When students are exposed to climates with an array of attitudes, they are more likely to use substances—this is consistent with McGloin et al.' (2014) finding that networks with more consistent norms were more effective at imposing conformity. Further, preliminary analyses indicated that controlling for the heterogeneity in normative climates did not significantly dampen the overall effect of the climate itself (the coefficient for normative climate was not substantially reduced [analyses not shown]).

The addition of school-level geographic context revealed some differences in frequency of use (Model 3, Tables 3, 4, 5). For instance, youth from *medium urban*, *small urban*, and *mostly rural* schools reported less frequent alcohol use compared to peers in *mixed urban/rural schools*, whereas the effect of being in a *completely rural*

school trended toward a positive association with alcohol use. A similar pattern emerged for binge drinking, with youth from *completely rural* schools engaging in more frequent binge drinking than peers in *mixed urban/rural* schools. Regarding marijuana use, youth from *medium urban* and *mostly rural* schools reported a lower frequency of use; for instance, attending school in a *mostly rural* area decreased the frequency of marijuana use by a factor of about 25 % (Model 3, Table 5). Interestingly, adjacency is significantly associated only with marijuana use, where attending school in county geographically adjacent to a metropolitan area increasing the frequency of marijuana use by a factor of 28 % (Model 3, Table 5).

The analyses presented in Models 4 and 5 (Tables 3, 4, 5) directly test whether the consequences of normative climate differ by school geography. We tested this via a series of interaction terms between normative climate and school geography (Model 4) and then added demographic control variables to assess whether the observed relationships between normative climate, geography, and substance use may be attributable to some other correlate(s) (Model 5). The findings indicated that normative climate does have different consequences for individual substance use behavior depending on school geographic context. For instance, in Model 4 (Table 3) for alcohol use, the coefficient for normative climate represents the effect of normative climate for youth in *mixed urban/rural* schools (the reference category). The significant negative interaction between normative climate and *small urban*, *mostly rural* and *completely rural* indicates that the normative climate is less influential for alcohol use behavior among students in these types of schools than it is for peers in *mixed urban/rural* areas—this indicates both a rural–urban difference as well as difference within rural places (this latter finding would have been obscured if the analyses had used a simple urban/rural dichotomization). These interactions indicate that the effect of permissive normative climate is weaker in these areas because the base rate of alcohol use is already higher—e.g., approximately 54 % of respondents in *completely rural* schools reported any lifetime alcohol use, the highest across the geographic categories (Table 2). Thus the effect of permissive normative climate is actually dampened for students in *small urban* and *mostly* and *completely rural* schools. This means that other risk factors (e.g., structural disadvantages, lack of opportunities for prosocial activity, greater access to/availability of substances, etc.) are likely driving the high base rate of alcohol use among youth from these schools (we revisit this below in the “Discussion” section).

What is also interesting to note with respect to this finding is that the normative climates among students in *small urban* and *mostly rural* schools were both more permissive and more heterogeneous than the climate for

**Table 3** The consequences of permissive normative climate for alcohol use by geography, negative binomial regression coefficients from random effects hierarchical generalized linear models

	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)	Model 4 <i>b</i> (SE)	Model 5 <i>b</i> (SE)
Intercept	−1.585*** (0.030)	−1.283*** (0.044)	−1.225*** (0.054)	−1.255*** (0.056)	−1.401*** (0.078)
Level-2 indicators					
School permissive normative climate					
Alcohol permissiveness <sup>a</sup>	1.910*** (0.053)	1.896*** (0.059)	1.880*** (0.057)	2.086*** (0.109)	1.488*** (0.103)
Alcohol permissiveness (range) <sup>a</sup>	0.437*** (0.079)	0.309*** (0.078)	0.351*** (0.080)	0.389*** (0.083)	0.237** (0.079)
School geography					
Medium urban area			−0.182** (0.057)	−0.176** (0.060)	−0.064 (0.060)
Small urban area			−0.198 <sup>†</sup> (0.117)	−0.079 (0.130)	0.080 (0.114)
Mixed urban/rural area (ref.)			–	–	–
Mostly rural area			−0.101 <sup>†</sup> (0.052)	−0.054 (0.057)	−0.019 (0.051)
Completely rural area			0.116 <sup>†</sup> (0.062)	0.199** (0.068)	0.110 <sup>†</sup> (0.063)
Adjacency			0.059 (0.057)	0.055 (0.055)	0.093 <sup>†</sup> (0.049)
Socioeconomic status					
Students eligible for free/reduced lunch					0.242 (0.152)
Interactions					
Medium urban area × permissive normative climate				−0.138 (0.145)	−0.169 (0.129)
Small urban area × permissive normative climate				−0.618* (0.316)	−0.647* (0.270)
Mixed urban/rural area × permissive normative climate (ref.)				–	–
Mostly rural area × permissive normative climate				−0.301* (0.139)	−0.264* (0.123)
Completely rural area × permissive normative climate				−0.500** (0.180)	−0.210 (0.165)
Level-1 indicators					
Individual alcohol permissiveness <sup>b</sup>		1.037*** (0.012)	1.037*** (0.012)	1.036*** (0.012)	0.959*** (0.013)
Demographics					
Female					0.038 (0.024)
Age <sup>a</sup>					0.168*** (0.009)
Hispanic <sup>c</sup>					0.156*** (0.039)
Non-Hispanic other <sup>c</sup>					0.001 (0.046)
School engagement <sup>a</sup>					−0.133*** (0.017)

Source: Nebraska Risk and Protective Factor Student Survey, 2007 (n = 26,647 students, 287 schools)

<sup>a</sup> Grand mean centered in all analyses

<sup>b</sup> Group mean centered in all analyses

<sup>c</sup> Reference category is non-Hispanic White

<sup>†</sup>  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$  (two-tailed)

youth in *mixed urban/rural* schools (Table 2)—the alcohol climate was least permissive for students in *mixed urban/rural* schools. Students in *completely rural* areas consumed alcohol more frequently ( $b = 0.199$ ,  $p < 0.01$ ; Model 4

[Table 3]), but their frequent use was not exacerbated by exposure to a permissive normative climate, perhaps not surprising, given that alcohol normative climates were the most conservative and least variable for these youth.

**Table 4** The consequences of permissive normative climate for binge drinking by geography, negative binomial logistic regression coefficients from random effects hierarchical generalized linear models

	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)	Model 4 <i>b</i> (SE)	Model 5 <i>b</i> (SE)
Intercept	−2.535*** (0.040)	−2.705*** (0.049)	−2.648*** (0.064)	−2.714*** (0.069)	−2.967*** (0.102)
Level-2 indicators					
School normative climate					
Alcohol permissiveness <sup>a</sup>	2.265*** (0.072)	2.303*** (0.079)	2.304*** (0.078)	2.549*** (0.150)	1.857*** (0.145)
Alcohol permissiveness (range) <sup>a</sup>	0.603*** (0.137)	0.369** (0.138)	0.431** (0.140)	0.551*** (0.146)	0.314* (0.142)
School geography					
Medium urban area			−0.195** (0.073)	−0.215* (0.086)	−0.058 (0.089)
Small urban area			−0.372* (0.147)	−0.356 <sup>†</sup> (0.203)	−0.163 (0.187)
Mixed urban/rural area (ref.)			–	–	–
Mostly rural area			−0.095 (0.067)	−0.003 (0.080)	0.033 (0.074)
Completely rural area			0.167* (0.081)	0.366*** (0.095)	0.237** (0.090)
Adjacency			0.035 (0.073)	0.027 (0.070)	0.089 (0.062)
Socioeconomic status					
Students eligible for free/reduced lunch					0.403* (0.203)
Interactions					
Medium urban area × permissive normative climate				0.040 (0.205)	−0.109 (0.189)
Small urban area × permissive normative climate				−0.131 (0.454)	−0.218 (0.411)
Mixed urban/rural area × permissive normative climate (ref.)				–	–
Mostly rural area × permissive normative climate				−0.411* (0.194)	−0.390* (0.179)
Completely rural area × permissive normative climate				−0.869*** (0.246)	−0.485* (0.231)
Level-1 indicators					
Individual alcohol permissiveness <sup>b</sup>		1.176*** (0.018)	1.175*** (0.018)	1.174*** (0.018)	1.063*** (0.020)
Demographics					
Female					−0.048 (0.033)
Age <sup>a</sup>					0.217*** (0.013)
Hispanic <sup>c</sup>					0.290*** (0.052)
Non-Hispanic other <sup>c</sup>					0.096 (0.062)
School engagement <sup>a</sup>					−0.212*** (0.023)

Source: Nebraska Risk and Protective Factor Student Survey, 2007 (n = 26,647 students, 287 schools)

<sup>a</sup> Grand mean centered in all analyses

<sup>b</sup> Group mean centered in all analyses

<sup>c</sup> Reference category is non-Hispanic White

<sup>†</sup>  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$  (two-tailed)

A similar pattern emerged for binge drinking (Table 4): youth from *medium* and *small urban* schools binge drank less frequently than peers from *mixed urban/rural* schools, and normative climate was less influential for youth from *mostly rural* schools. Here again, the most isolated youth—

those in *completely rural* schools—were the most likely to binge drink (with an increased frequency of about 27 % [Model 5, Table 4]), yet this behavior was not exacerbated by permissive normative climate, given their already high base rate of binge drinking. Permissive attitudes about

**Table 5** The consequences of permissive normative climate for marijuana use by geography, negative binomial regression coefficients from random effects hierarchical generalized linear models

	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)	Model 4 <i>b</i> (SE)	Model 5 <i>b</i> (SE)
Intercept	−3.772*** (0.057)	−4.081*** (0.070)	−3.973*** (0.085)	−3.955*** (0.092)	−4.153*** (0.145)
Level-2 Indicators					
School normative climate					
Marijuana permissiveness <sup>a</sup>	3.101*** (0.110)	2.780*** (0.126)	2.737*** (0.128)	2.676*** (0.221)	2.273*** (0.227)
Marijuana permissiveness (range) <sup>a</sup>	0.756*** (0.149)	0.440** (0.147)	0.433** (0.146)	0.420** (0.146)	0.325* (0.148)
School geography					
Medium urban area			−0.157 <sup>†</sup> (0.083)	−0.141 (0.108)	−0.020 (0.120)
Small urban area			−0.012 (0.173)	−0.163 (0.247)	−0.111 (0.245)
Mixed urban/rural area (ref.)			–	–	–
Mostly rural area			−0.283** (0.084)	−0.267** (0.101)	−0.289** (0.101)
Completely rural area			−0.184 (0.124)	−0.262 <sup>†</sup> (0.139)	−0.353* (0.140)
Adjacency			0.249** (0.092)	0.218* (0.092)	0.261** (0.090)
Socioeconomic status					
Students eligible for free/reduced lunch					0.297 (0.288)
Interactions					
Medium urban area × permissive normative climate				−0.045 (0.296)	−0.072 (0.292)
Small urban area × permissive normative climate				0.628 (0.717)	0.463 (0.705)
Mixed urban/rural area × permissive normative climate (ref.)				–	–
Mostly rural area × permissive normative climate				−0.051 (0.331)	0.003 (0.330)
Completely rural area × permissive normative climate				0.680 (0.439)	0.803 <sup>†</sup> (0.330)
Level-1 indicators					
Individual marijuana permissiveness <sup>b</sup>		1.442*** (0.024)	1.443*** (0.024)	1.443*** (0.024)	1.376*** (0.025)
Demographics					
Female					−0.141 (0.046)
Age <sup>a</sup>					0.113*** (0.018)
Hispanic <sup>c</sup>					0.201** (0.069)
Non-Hispanic other <sup>c</sup>					0.193* (0.076)
School engagement <sup>a</sup>					−0.165*** (0.031)

Source: Nebraska Risk and Protective Factor Student Survey, 2007 (n = 26,647 students, 287 schools)

<sup>a</sup> Grand mean centered in all analyses

<sup>b</sup> Group mean centered in all analyses

<sup>c</sup> Reference category is non-Hispanic White

<sup>†</sup>  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$  (two-tailed)

drinking are less consequential for shaping drinking behavior among youth from the most rural areas. These relationships persisted independent of individual-level attitudes and other demographic correlates of substance using behavior. Finally, as Table 5 shows, school

marijuana climate is a significant correlate of marijuana use, as is heterogeneity in normative climate; however, there is less evidence of different effects by school geography, with one exception. Although youth attending schools in *completely rural* areas consume marijuana less

frequently than peers in *mixed urban/rural* schools (at average levels of normative climate), the interaction of *completely rural* and normative climate approaches significance ( $b = 0.803$ ,  $p = 0.085$ ), suggesting that while permissive attitudes toward marijuana use are associated with increased use for students across all types of schools, this effect may be particularly amplified among the most geographically isolated students.

## Discussion

With the increasing autonomy of adolescence comes an increasing importance of peers, who influence others' risk behaviors via both their beliefs and actions (Cleveland et al. 2008; Mason and Windle 2001). These interpersonal relationships do not exist in a vacuum; rather, adolescents are embedded in multiple, interacting environments, such as schools and communities. School contexts, in particular, can become a reservoir for a range of norms and values, and such school-level "normative climates" shape adolescents' own value systems and personal assessments of what counts as acceptable/desirable behavior. Through reciprocal processes of peer selection and socialization, the school-level normative climate to which an adolescent is exposed may encourage his/her adoption of more permissive (or conservative) attitudes toward a host of risky behaviors (e.g., substance use), and thus influence subsequent behaviors (Allison et al. 1999; Keyes et al. 2011; Leifheit et al. 2015; Mrug et al. 2010). Yet these climates exist within specific geographic locations which themselves may influence the content of the climate, as well as its effect on behavior.

To more thoroughly bridge adolescents and their multiple key social environments, the current study used survey data from the 2007 Nebraska Risk and Protective Factor Student Survey (NRPFSS) and explored the effect of geography on the character, consistency, and consequences of school-level normative climates about substance use. We extended prior research on normative climates that has focused exclusively on urban areas, utilized dichotomous geographic distinctions (e.g., urban vs. rural), or neglected geography altogether. The analyses revealed that school geography had implications for the character and consistency of normative climates, and for alcohol use in particular, in some unexpected ways. For instance, the permissiveness of school normative climate toward alcohol use did not increase in a linear fashion along the rural–urban continuum: youth in *completely rural* schools were not the most conservative—their peers in *mixed urban/rural* schools were (but *completely rural* youth were the most homogeneous). Likewise, youth in the most urban of schools in our sample (*medium urban*) were

not the most permissive—their peers in *small urban* schools were (although *medium urban* youth were the most varied in their attitudes). The character of marijuana normative climates, on the other hand, was most conservative (and most homogeneous) in the most rural of schools and most permissive (and most heterogeneous) among the most urban schools in our sample.

Regarding the role of geography for the consequences of normative climate on substance use behaviors, the findings illustrate both that the effect of normative climate differed across different school geographies and that rural areas are not homogeneous contexts. Thus, more nuanced analyses of geographic variation in adolescent outcomes are warranted. Permissive attitudes toward alcohol use were a significant risk factor for drinking among youth from *mixed urban/rural* schools, but the effect of normative climate was actually weaker for youth in *small urban*, *mostly rural*, and *completely rural* schools. Youth from *completely rural* schools had particularly high rates of alcohol use and binge drinking, such that the effect of permissive normative climate was actually weaker for youth from these areas. This finding warrants future research into identifying the risk factors associated with the higher rates of alcohol use and abuse among these youth. Is this behavior a response to structural disadvantages, lack of opportunities, increased availability of substances, and/or decreased perceptions of harm? Further, although youth from *completely rural* schools used marijuana less frequently, there was evidence suggesting that the effect of permissive marijuana climates may be exacerbated for these youth. Given our observation of geographic differences in actual substance-using behavior, future research would also benefit from exploring a measure of normative climate comprised of *both* students' attitudes toward the acceptability of substance-using behavior and their actual use behaviors.

## Limitations

In light of the findings discussed above, there are a few limitations to note. First, the NRPFSS is limited to only one state; thus, the data are not generalizable outside of Nebraska. Further, because the survey was designed to provide community-specific estimates, its generalizability to the state of Nebraska is also limited. Rather than providing population-level estimates, the current study can be understood as providing evidence that—more generally—speaks to processes of normative climates and adolescent substance use outside of core metropolitan areas. Second, as noted above, the two largest metropolitan school districts in Nebraska—the Lincoln and Omaha school districts—declined to participate in the NRPFSS; thus any inferences about substance use in *medium urban* areas should be made with caution, since (as noted above) the

*medium urban* schools in our sample may be biased toward more socioeconomically advantaged (i.e., suburban) schools.<sup>2</sup> Third, the NRPFS did not collect individual-level data on socioeconomic status—a key correlate of adolescent substance use. We attempted to address this by including school-level proportion of students receiving free/reduced lunch, but recognize that this is an imperfect proxy. Finally, the current study is cross-sectional, thus limiting our ability to draw any strong causal statements regarding the association between normative climates and substance use. Our measure of substance-using outcomes referenced either past 30-day (alcohol or marijuana) or past 2-week (binge drinking) use, while normative climate was based on respondents' general assessment at the time of the survey—thus it is entirely possible that youth's substance-using behaviors influence their perceptions regarding the wrongfulness of alcohol and marijuana use. Future research would greatly benefit from incorporating additional waves of NRPFS data in order to assess more clearly the temporal relationship (at least with respect to trends) between attitudes and behavior.

### Strengths

Notwithstanding these limitations, the current study makes a number of contributions to existing research on the factors shaping school climates about substance use, and the factors influencing how climates affect adolescent substance use behaviors. We add to the existing research on normative climates by assessing the extent to which these climates are embedded in, and thus influenced by, larger geographic contexts. We move beyond the rural/urban dichotomy by distinguishing gradations of urbanicity and rurality. These findings could be expanded through a number of avenues of future research. For instance, while neighborhood effects research has identified various neighborhood characteristics that act as risk factors for substance use (e.g., disadvantage, lack of prosocial activities, substance accessibility, Brenner et al. 2011; Steen 2010), research has not yet examined whether these risk factors operate similarly between different types of urban and rural areas. This is a particularly pressing issue given the high rates of problem behavior among the most geographically isolated youth. Also, the current analysis explored the effect of youth's attitudes about substance use, but we did not assess the normative climate of actual *behavior*. Future work (as noted above) would benefit from comparing the consistency between youth's attitudes toward substances and their actual use of substances, and assessing if it is a normative climate shaped by attitudes or

shaped by behaviors that is most influential for adolescents' own risk of use.

### Conclusion

The persistent use (and especially abuse) of licit and illicit substances by adolescents remains a critical public health concern, as such behavior—occurring during a critical period of development—has long-term consequences for health, well-being, and successful transitions to adulthood. Although research highlights a number of individual risk factors for substance use, less is known about the risks associated with less proximate contexts—such as schools or neighborhoods. Additionally, despite significant scholarship attuned to peer effects on substance use, less is known about the ways in which peers themselves shape and reinforce the larger cultural climate to which all youth are exposed. The current study addressed both of these limitations, with attention to geographic risks that moved beyond the traditional urban–rural dichotomy and that also explored the character, consistency, and consequences of peer normative climates across varying degrees of urbanicity and rurality. The results of the multivariate, multilevel analyses revealed surprising variation in both normative climates and substance use behaviors. These findings speak to the need for prevention and intervention strategies to address not just individual-level risks for substance use, but also the broader climates (e.g., school-level attitudes about substance use) to which youth are exposed, and toward which they may attempt to align their own risk behaviors.

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**Author Contributions** C.T. conceived of the study, and executed the analyses, interpreted the results, and drafted the manuscript. TW assisted with conceptual model for the study, assisted in manuscript writing (including providing critical revisions to all sections), and aided in model design and interpretation of results. Both C.T. and T.W. have read and approve the final manuscript.

**Conflict of interest** C. Thrash declares that she has no conflicts of interest. T. Warner declares that she has no conflicts of interest.

**Ethical Approval** This study was an analysis of secondary data. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration

<sup>2</sup> The NRPFS does not include any indicators of school type; therefore we are unable to distinguish between public, private, and/or parochial schools.

and its later amendments or comparable ethical standards. Both authors CT and TW affirm that the manuscript is in compliance with the ethical standards outlined by the Committee on Publication Ethics (COPE).

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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