



HHS Public Access

Author manuscript

J Community Psychol. Author manuscript; available in PMC 2015 April 01.

Published in final edited form as:

J Community Psychol. 2015 April ; 42(3): 299–315. doi:10.1002/jcop.21611.

Geospatial Ecology of Adolescent Problem Behavior: Contributions of Community Factors and Parental Monitoring

Maria Gartstein, Ph.D.,

Washington State University, P.O. Box 644820, Pullman, WA 99164-4820

Erich Seamon, M.S., and

Regional Approaches to Climate Change for Pacific Northwest Agriculture (REACCH), University of Idaho, Agric. Sci. 242A, Moscow, ID 83844-2339

Thomas J. Dishion, Ph.D.

Arizona State University, P.O. Box 871104, Tempe, AZ 85287-1104

Abstract

Addressed the ecology of deviant peer involvement, antisocial behavior and alcohol use, utilizing publically available information for indices of community risk/protective factors. A geospatial model was developed, combining geographic data (census, crime proximity, race/ethnicity, transportation accessibility) with information gathered for individual adolescents/household, geo-coded by home address. Adolescent-report of delinquency, association with deviant peers, substance use, and parental monitoring was obtained, along with parent-report of demographic characteristics. Deviant peer involvement was predicted by the Crime Proximity Index, with closeness of crime being associated with more deviant peer affiliation, as well as the Transportation Index, with greater accessibility leading to more involvement with troubled peers. Antisocial behaviors also increased with greater access to transportation. Adolescent alcohol use was lower in communities with a higher proportion of a non-Caucasian population, and increased with greater transportation access. Adolescent outcomes were associated with different prediction models, yet parental monitoring emerged as a consistent contributing factor.

Keywords

Adolescence; Community; Behavior Problems; Monitoring

There has been a growing interest in understanding the antecedents and correlates of adolescent antisocial behavior and frequently associated early substance use, largely due to the significant cost to society associated with these difficulties (Molero Samuelson, et al., 2010; Yoshikawa, 1994). Sociologists and criminologists have shown that the majority of juvenile crime occurs in densely populated urban neighborhoods, namely those nearest the city center and those characterized by poverty, low economic opportunity, high residential mobility, physical deterioration, and disorganization (Shaw & McKay, 1942; Simcha-Fagan

& Schwartz, 1986). The frequency of more serious antisocial behaviors increases in adolescence, a developmental period when substance use also emerges as a part of the problem behavior repertoire (Lacourse et al., 2011; Nock, Kazdin, Hiripi, & Kessler, 2006; Dishion & Patterson, 2006). Of interest, neighborhood risk factors have been determined to be more influential on adolescent adjustment than maternal psychopathology (Luthar & Cushing, 1999) or individual household socio-economic attributes (Kalff et al., 2001). Neighborhood resources, or a lack thereof (i.e., deprivation) were also shown to influence youth acting-out behaviors irrespective of family SES-related factors (e.g., parental education, occupation, etc.; Kalff et al, 2001).

Parental monitoring is typically described as parental awareness for the children's whereabouts and activities, and represents an important component of effective family management (Patterson & Southamer-Loeber, 1984). Monitoring has been consistently linked with youth aggression, defiance, and other acting-out/externalizing problems, with deficits in parental supervision shown to lead to the proliferation of these maladaptive acts (e.g., Dishion, 1990; Dishion, Patterson, Stoolmiller, & Skillner, 1991; Loeber & Dishion, 1983). For adolescents, inadequate monitoring is also predictive of involvement with a deviant peer group (Dishion et al., 1991) and early substance use (e.g., Baumrid, Moselle, & Martin, 1985; Brown, Mounts, Lamborn, & Steinberg, 1993; Fletcher, Darling, & Steinberg, 1995). Insufficient monitoring of the adolescent's activities provides opportunities for exposure to deviant peers, expected to further enhance the youngster's antisocial behavior repertoire, frequently the basis for affiliation (Dishion, 1990; Dishion, Loeber, Stouthamer Loeber, & Patterson, 1984; Shaw & Bell, 1993).

Community/neighborhood factors have become central in explaining adolescent problematic behaviors (Forehand, et al., 2000; Sampson, 1997), consistent with the ecological perspective, which emphasizes the importance of the community context in shaping developmental trajectories of difficulties for youth (Dishion, French, & Patterson, 1995; Patterson, Reid, & Dishion, 1992). Neighborhoods represent an important and influential component of the youth's environment, especially in adolescence, when one's experience of the neighborhood is less filtered through parental interventions (Aber, Gephart, Brooks-Gunn, & Connell, 1997). Communities mold the experiences of youth and parents by outlining the resources and opportunities (e.g., schools, employment possibilities), as well as many of the risks and boundaries, such as dangerousness and transportation access (Sampson, Morenoff, & Gannon-Rowley, 2002). According to the social disorganization theory, disadvantaged communities often relay their negative effects on children and families through their association with a decreased ability for neighborhood residents to act together to realize goals of socialization and safety (Wilson, 1987). Exposure to community crime in particular is consistently linked with greater conduct difficulties for adolescents (e.g., externalizing problems/aggression, antisocial behaviors, substance use; Bacchini, Miranda, & Affuso, 2011; Fowler et al., 2009). Repeated exposure to high levels of violence may cause children and adolescents to become uncaring toward others, desensitizing them toward future violent events. Durant et al., (1994) found that previous exposure to violence was the strongest predictor of current use of violence, similar to Osofsky et al., (1993), who also reported a significant relationship between exposure to chronic community violence and youth aggressive behaviors.

Importantly, parental monitoring was shown to moderate the effect of youth's exposure to neighborhood crime/violence. Pettit et al., (1999), for example, found that unsupervised peer contact predicted increases in externalizing behaviors (i.e., aggressive and delinquent acts) among adolescents who were supervised less and lived in a neighborhood perceived by parents as unsafe. Beyers et al., (2003) noted that a decrease in externalizing problems (e.g., aggression, delinquency) resulting from higher levels of parental monitoring was significantly more pronounced for youth in neighborhoods with more residential instability, linked with neighborhood disadvantage. More recently, exposure to violent crime in the community was linked with greater conduct difficulties for adolescents, when parents provided less supervision (Bacchini, et al., 2011). Thus, community factors may be conceptualized as influencing adolescent antisocial behavior differentially as a function of parental monitoring, with parental supervision moderating this impact.

The present study is expected to make a contribution to the existing literature in a twofold manner. First, we anticipate that the results of this study will shed additional light on issues related to community and family correlates of adolescent antisocial behavior, deviant peer involvement, and alcohol use. Second, the geospatial approach utilized in the context of measurement development and our analytic strategy is intended to serve as an illustration of a strategy, wherein data addressing family and child adjustment are addressed in tandem with existing geospatial information, collected by municipalities, community and government agencies. Specifically, a structured geo-spatial model was used to produce indices for the community-level independent variables (i.e., proximity to crime, ethnic diversity, and transportation access), linked with each of the study's participants on the basis of their residence location. Unique/independent contributions of these community level predictors were subsequently examined, along with parental monitoring as a moderator of their respective effects. The neighborhood geospatial predictors, along with parental monitoring, were expected to make independent contributions, accounting for a significant portion of the variance in adolescent antisocial behavior, deviant peer involvement, and/or alcohol use. Significant moderator effects were expected for monitoring, with parental supervision shaping the effects of community crime, ethnic diversity, and transportation access, with respect to adolescent antisocial behavior, deviant peer involvement, and/or alcohol use.

Method

Participants

Families of 714 adolescents agreed to participate in the Adolescent Transition Project (ATP) study, aimed at preventing and reducing adolescent problem behavior and substance use (Dishion, Bullock, et. al., 2002; Dishion & Kavanagh, 2003; Dishion, Kavanagh, Schneiger, Nelson & Kaufman, 2002). This program and the associated investigation of adolescent conduct problems and substance use were carried out in an ethnically diverse area of the Northwestern US (U.S. Census Bureau, 2010). All 6th grade students in the selected geographic area were approached regarding participation, with a 90 % recruitment rate for the two Cohorts providing the data analyzed for the purposes of this study (Connell & Dishion, 2008; Dishion, Véronneau, & Myers, 2010), to study the impact of the Family

Check-Up, a brief intervention wherein assessment results addressing child, parent, and family functioning, are provided to participants in order to prevent more serious difficulties. Adolescents were about equally distributed in terms of gender: males (53.8%) and females (46.2%), representing the racial diversity of the recruitment area: African American (40.8%) and European American (59.2%). Participants took part in 6 longitudinal follow-up evaluations, with the information from the final phase of data collection (2001–2003) utilized in this study. Youth were between 15 and 19 years of age at the time they took part in this study. The vast majority of the sample was attending High School at the time of this data collection; however, 1.1% indicated they were in college and 8.3% of the sample reported not being in school. The ethical guidelines of the American Psychological Association were followed in conducting this research, with all participants providing informed consent prior to taking part in this study.

Measures

Adolescent Report—Adolescents responded to a series of interview questions, providing information regarding their own Deviant Peer Involvement, Antisocial Behavior, and Alcohol Use, which served as the dependent variables in the present investigation. The Deviant Peer Involvement scale was made up of 11 items, for example: “How many your friends have cheated?”; “How many your friends have stolen?”; “How many your friends have been aggressive or destructive?” ($\alpha = .83$). The Antisocial Behavior scale consisted of 8 items, addressing truancy, property damage, aggressive behavior, etc. ($\alpha = .73$). The Alcohol Use scale was based on 9 questions about the frequency with which the youngster generally got “buzzed”, gone to school under the influence of alcohol or had lost consciousness (i.e., passed out) from drinking alcohol, etc. ($\alpha = .72$). Finally, the adolescent participants were also asked regarding Parental Monitoring, responding to 6 items, for example: “How often do your parents know what you do away from home?”; “How often do your parents know what you are doing after school?”; “How often do your parents know what you have planned for the next day?” ($\alpha = .84$).

Parent Report—Parents also responded to a series of questions providing information regarding Family Resources, including: (1) caregiver education; (2) gross annual household income; (3) type of housing (single family home, apartment, etc.); (4) housing status (rent, own, etc.), and (5) Food Stamp status.

Geospatial Model Development

Our geospatial model utilized for data reduction and hypothesis testing relied on two forms of input: (1) household-level psychosocial data and (2) community-level regional/local geospatial information. Each psychosocial variable was geo-coded, based on the home address of the participants, so that interpolated geographic data layers could be created for each of these indicators. GIS data available for the Portland, OR area were used to create interpolated geographic data layers for the community-based independent variables, with each layer defined by a composite index (crime proximity, transportation access, and race/ethnicity), which in turn could be associated with each participant, assigning a value based on the location of the residence. Specifically, (1) 2000 Census block and tract; (2) 2004 City of Portland Crime Incidents; (3) 2004 City of Portland Transportation; and (4) 2000 Census

race and ethnicity information, dataset were used to create interpolated geographic data layers for each of the independent (transportation access, crime proximity, and racial/ethnic diversity) and dependent (antisocial behavior, deviant peer behavior, and alcohol use) variables across the entire sample area (Murray et. al., 2000, English et. al., 1999), referencing each participant's location. Thus, we were able to visually examine the geography of associations between geospatial and psychosocial variables (once the latter were geo-coded and the former were interpolated to conform to the location parameters of the present sample), if these emerged as statistically significant in the course of hypothesis testing via correlational analyses. It should also be noted that point and areal interpolation methods were used to apply point and polygon values to locations of interest that represent participants' residences (point interpolation for crime proximity and areal interpolation for transportation and diversity, respectively).

Crime Proximity Index (CPI) was developed, incorporating crime frequency and severity, utilizing data from the City of Portland, Multnomah County, and related government agencies (City of Portland Corporate GIS, 2004). Specifically, crime incident information over a one year time period was used in combination with each participant's location to develop our CPI reflecting the impact of criminal activities in the proximity of the participant's home. Crimes were rank-ordered, based on their severity with respect to the victim, with higher numbers reflecting greater severity, so that we could weigh crime events (homicide, assault, sex crimes, larceny, robbery, burglary, and car theft) in terms of their contributions to the outcomes examined in this study (Craiglia, Haining, Wiles, 2000). Thus, the CPI summarized the proximity to various crime events, in turn weighted by their relative severity, producing an average distance (as the crow flies) to crimes within a 1000 foot radius (Murray et al, 2001) (Figure 1; yellow represents higher levels of crime proximity/severity, whereas blue represents lower levels).

$$CPI = \frac{1 + N(\text{distance to crime event} * \text{severity factor})}{\text{Total number of crime events within 1000 feet of participant residence}}$$

Transportation Index (Ti) was developed on the basis of the road and street network geometry (City of Portland Corporate GIS, 2004), creating 1000 foot buffered polygons that represent variability in transportation access (Briggs et al, 2000). Specifically, each street segment, or a buffered polygon (i.e., geographic unit, into which each roadway under consideration has been segmented), was assigned a weighted value corresponding to the associated transportation/roadway category (alley, street, arterial, highway, freeway), with transportation arteries supporting greater and more varied traffic receiving a higher rating. The Ti value was thus assigned to each participant via a spatial containment technique (Murray, et al 2001), with values varying as a function of the number and types of streets within a 1000 foot buffer of the participant, and higher values representing greater access to streets with more significant transportation loads.

$$Ti = \text{Weighted transportation street value} * \text{number of streets within 1000 feet}$$

Diversity Index (Di) incorporated race/diversity information obtained from 2000 Census block data (U.S. Census Bureau, 2000). The overall race/diversity index is a ratio of total multi-racial population (including all non-Caucasian groups) as a percentage of the total white population. Specifically, summarized ethnic population categories per block were used to assign index values for each participant residence location:

$$Di = \frac{\text{Total non-Caucasian population per 2000 Census block}}{\text{Total Caucasian population per 2000 Census block}}$$

Analytic Strategy

Outcome indicators (i.e., deviant peer association, antisocial behaviors, and alcohol use) were subjected to a logarithmic transformation in order to conduct analyses with scores more closely approximating the normal distribution. All of the independent variables were centered for the Hierarchical Multiple Regression (HMR) analyses (Aiken & West, 1991). HMR was utilized to address individual contributions of the different independent variables examined in this study, as well as the hypothesized moderation effects, involving parental monitoring. Child sex, age, ethnicity, as well as the indicator of Socio-economic status (i.e., the Family Resources composite), were included as covariates in all of the regression equations. However, covariates that failed to account for a significant amount of variance were subsequently “trimmed” from the HMR equations (Cohen, Cohen, West, & Aiken, 2002), in order to increase the power to detect hypothesized effects. Covariates, with the exception of the Family Resources index, were eliminated because of their failure to make a statistically significant contribution. The geospatial independent variables were entered second, as a block, following the FR covariate, which was entered in the first step. The parental monitoring indicator and the interaction terms (CPI*Monitoring; Ti*Monitoring; Di*Monitoring) followed. An HMR model including these predictors was evaluated for each of the dependent variables (association with delinquent peers, antisocial behaviors, and alcohol use). Follow-up analyses were conducted for unique significant effects that involved an association between a geospatial independent variable and an adolescent functional outcome. Thus, a series of mapping applications was developed in order to convey the geographic bases for select observed associations.

Results

First, descriptive statistics were computed for the variables included in this study (Table 1). Second, simple correlations were calculated for parental responses to the items addressing Family Resources (FR): caregiver education, gross annual household income, type of housing, housing status, Food Stamp status, leading to generally statistically significant indices of association (Table 2). Thus, in the interest of data reduction, these scores were combined in the FR composite, utilized as a covariate in subsequent analyses. Third, simple correlations between the independent and dependent variables were examined, with multiple significant results (Table 3). For example, deviant peer involvement was significantly associated with all other variables included in this study, with correlations ranging from .60 for alcohol use and .55 for antisocial behavior, to .09 for FR. Alcohol use was significantly

associated with community-level indicators and parental monitoring (r 's range from .10 to -.22), with the exception of Crime Proximity.

Hierarchical multiple regression procedures performed next provided support for a unique contribution of monitoring, and a number of the geospatial indicators examined in the study. All of the geospatial indicators (Crime Proximity, Transportation, and Diversity indices), as a block, explained a significant amount of variance for the delinquent peer affiliation outcome (Table 4), after taking into account the significant contribution of our covariate. Notably, higher levels of deviant associations were observed for youth in closer proximity to areas affected by crime (Figure 2; dark blue represents lower levels of Deviant Peer Affiliation, whereas red represents higher levels), as well as those with greater transportation access (i.e., proximity to more substantial transportation arteries). Parental monitoring also made a significant contribution to explaining deviant peer affiliation.

Adolescents' antisocial behavior was also predicted transportation access, with proximity to transportation leading to a higher number of self-reported antisocial behaviors (Table 4), after accounting for the contribution of family resources. Parental monitoring made a significant contribution as well, with more extensive monitoring being linked with fewer/antisocial activities.

A linear combination of all of the geospatial indicators (Crime Proximity, Transportation, and Diversity indices) explained a significant amount of variance for the alcohol use dependent variable (Table 4), after accounting for the covariate. Specifically, a unique contribution of community diversity was observed, with a higher proportion of the non-Caucasian population being linked with lower levels of alcohol use (Figure 3; yellow – higher levels of diversity, blue – lower levels; dark blue represents lower levels of alcohol use and red represents higher levels). On the other hand, transportation accessibility in the community was linked with greater self-reported use of alcohol. The alcohol use outcome was also associated with parental monitoring, wherein higher levels of monitoring were linked with lower levels of alcohol use.

None of the interaction terms resulted in statistically significant effects, suggesting that parental monitoring was critical with respect to the outcomes examined in this study regardless of the community-level factors.

Discussion

Results of the present study were in part consistent with our hypotheses, with all of the community-level predictors explaining a significant portion of the variance in at least one of the three conduct-related outcomes examined in this study: deviant peer affiliation, antisocial behaviors, and alcohol use. Two of the geospatial variables, the CPi and the Ti made unique contributions to explaining deviant peer affiliation, with greater proximity of more significant reported crimes leading to higher levels of deviant peer affiliation, and greater access to transportation also contributing to more extensive involvement with troubled peers. Greater access to transportation was also related to more self-reported antisocial behaviors. Unexpectedly, exposure to greater ethnic diversity in the neighborhood

emerged as protective factor with respect to alcohol, with greater diversity being linked with lower levels of early drinking. As anticipated, significant effects of parental monitoring were consistent across our dependent variables, with greater supervision playing a protective role with respect to deviant peer affiliation, antisocial behaviors, and alcohol use.

Overall, the observed pattern of results is consistent with the literature indicating the importance of considering community risk/protective factors when examining adolescent conduct-related problems, and the ecological model of problematic behavior (Bronfenbrenner, 1986). Our findings also provide support for the social disorganization theory (Wilson, 1987), in so far as exposure to proximal community violence, which represents the failure of the surrounding neighborhood to ensure safety for its residents, emerged as an important predictive factor with respect to adolescent problem behaviors. To our knowledge, prior research has not aggregated community-level crime data in making connections between community risk, and exposure to violence in particular, and teen conduct difficulties. Thus, the results of the present study provide additional support to the existing literature and represent an important contribution, linking publically available crime data to individual outcomes, examined via adolescent self-report. Our results are also in line with the developmental framework proposed to explain the association between neighborhood factors and youth antisocial behavior presented by Ingoldsby and Shaw (2002), wherein community disadvantage and exposure to violence lead to increased opportunities for interaction with antisocial peers. The present findings support the importance of this mechanism, indicating that greater proximity of more significant crime is related to increased contact with deviant peers.

Proximity of more significant criminal behavior in the neighborhood emerged as a reliable predictor for deviant peer involvement, but not the other dependent variables examined in this study. Thus, deviant peer affiliation appears to be more sensitive to the impact of criminal activity in the surrounding community, relative to the other adolescent problem outcomes examined in this study. As such, deviant peer affiliation may serve as a “gate-keeper” for acceleration of difficulties in the other domains, namely antisocial behavior and alcohol use. That is, impacted by surrounding criminal activity in the community, deviant peer involvement may overtime lead to higher levels of antisocial behavior as well as alcohol use. Future research should examine this possibility of mediation via longitudinal designs, evaluating potential links between dependent variables considered in this study.

It should be noted that ethnic diversity emerged as a protective factor with respect to alcohol use in adolescence, indicating that exposure to a more diverse neighborhood leads to lower levels of difficulties with early drinking. This pattern of results was not anticipated and should be interpreted with caution, as it awaits replication in future studies. It will also be important for future studies to examine the racial/ethnic composition of the community in greater detail, evaluating the impact of exposure to different groups, and to address potential mechanisms responsible for this effect. Nonetheless, these results suggest that exposure to diversity may play a protective role with respect to an important adolescent outcome, possibly because greater access to peers from different racial/ethnic backgrounds increases opportunities for activities other than problematic behaviors that tend to emerge in adolescence (e.g., alcohol use). Another unanticipated finding involved the contribution of

greater family economic resources to increasing the risk for deviant peer involvement and early alcohol use. Although lower socio-economic status is generally viewed as a risk factor, it is possible that great access to economic resources does not confer ubiquitous protections, but is rather associated with context bound effects.

The pattern of results observed in this study suggests that each of the adolescent conduct-related outcomes was associated with a somewhat different pattern of risk, although greater accessibility to transportation, not commonly examined in prior research, and parental monitoring, emerged as consistent predictors. It should be noted that transportation related effects have not been widely investigated, and their consideration thus far, has been largely in the context of obesity prevention efforts (e.g., Hume, et. al., 2009; Mota, Ribeiro, Carvalho, & Santos, 2010). The present findings suggest that transportation access may be particularly important as adolescents gain greater autonomy in their activities, and begin to utilize various transportation services, especially in urban settings where these are more readily available.

We did not find support for the notion of parental monitoring as a moderator of the community-level predictors examined in this study, and our results are not consistent with prior research suggesting moderation as a mechanism explaining the impact of caregivers' supervision (e.g., Bacchini, et al., 2011). There are a number of potential explanations for this discrepancy, including significant differences in methodological approaches. Importantly, our results indicate that parental supervision represents a significant protective factor with respect to all of the problematic adolescent outcomes examined in this study, regardless of the nature of the surrounding community. Thus, all youngsters benefited from their caregivers being aware of their friends, whereabouts, etc., irrespective of crime proximity, transportation access, or the racial/ethnic composition of the community. These results provide further support for the existing studies noting the critical role of parental monitoring in protecting adolescents against problem behaviors (Crouter & Head, 2002; Fosco, Stormshak, Dishion, & Winter, 2012).

Despite a potentially important contribution to the existing literature, a few limitations should be noted. First, there is the issue of reliance on adolescent self-report in assessing parental monitoring as well as our outcome variables. Although this source of information is critical for the outcomes examined in this study, and prior research has indicated adolescent, and not parent reports, are more likely to be associated with negative behavioral outcomes (Peiser & Heaven, 1996), future studies should attempt to develop multi-source constructs for the variables examined in this investigation. Nonetheless, as previously noted, results of the present study are impressive in so far as indicators based on publically available geospatial information predicted adolescent self-report outcomes. Second, the focus on conduct related problems can be described as another limitation, and future research should address additional problem and adjustment-related outcomes, including internalizing type problems, in the context of geospatial contributors obtained from publically available sources. Third, the relationships examined in this study should be evaluated within additional communities, because our focus on a single municipality represents an additional limitation, to be addressed in future research. Ideally, future studies would be able to examine similar variables/relationships in a variety of communities, which themselves differ

in a meaningful way (i.e., along the urban/rural dimension). Finally, the sample included in this study represents a relatively balanced mix of Caucasian and African-American participants, yet reflects a narrow definition of diversity, not including Hispanics, Asians, or Native Americans, who should be invited to take part in future research.

Conclusions

Community prevention/intervention and methodological implications of this research should be noted as well. That is, observed relationships between geospatial variables, derived from multiple publically available sources of data, and adolescent conduct-related problems suggest that considering such geospatial indicators in the context of additional developmental outcomes and periods would be of interest in future research. In fact, the present study, and our methodological approach in particular, can be thought of as an illustration of combining existing data from public sources and from federally funded previously collected data sets in the interest of conducting secondary data analyses not envisioned at the outset of the grant-supported investigation. Utilizing existing and publically available data represents a viable and a cost-effective approach to addressing important research questions, and geospatial modeling could be of particular use in this context. It should also be noted that to our knowledge, the instruments utilized in the present investigation have not been widely employed with diverse samples of youth in previous studies. Thus, our demonstration of their reliability and validity with a relatively diverse group of adolescents represents another potentially significant contribution to the existing literature. In terms of applied implications, our findings suggest that it would be possible to leverage publically available data in implementing prevention/intervention efforts, identifying “at-risk” groups for the purposes of such programs. For example, an index similar to the CPi constructed in this study could be applied to generate a map and/or list of locations considered most at-risk for problems with deviant peer affiliation, which in turn could be targeted for development of youth community programs. In addition, because similar data are widely publically available for different locations, an algorithm could be developed and utilized for such risk identification purposes across different communities.

References

- Aber, J Lawrence; Gephart, MA.; Brooks-Gunn, J.; Connell, JP. Development in Context: Implications for Studying Neighborhood Effects. In: Brooks-Gunn, J.; Duncan, GJ.; Aber, JL., editors. *Neighborhood Poverty: Contexts and Consequences for Children*. Vol. 1. New York: Russell Sage Foundation; 1997. p. 44-61.
- Aiken, LS.; West, SG. *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage; 1991.
- Attar B, Guerra N, Tolan P. Neighborhood disadvantage, stressful life events, and adjustment in urban elementary-school children. *Journal of Clinical Child Psychology*. 1994; 23:391-400.
- Bacchini D, Miranda MC, Affuso G. Effects of parental monitoring and exposure to community violence on antisocial behavior and anxiety/depression among adolescents. *Journal of Interpersonal Violence*. 2011; 26:269-292. [PubMed: 20234055]
- Baumrind D, Moselle K, Martin JA. Adolescent drug abuse research: A critical examination from a developmental perspective. *Advances in Alcohol and Substance Abuse*. 1985; 4:41-67. [PubMed: 4013874]
- Bell CC, Jenkins EJ. Traumatic stress and children. *Journal of Health Care for the Poor and Underserved*. 1991; 2:175-188. [PubMed: 1685908]

- Bell CC, Jenkins EJ. Community violence and children on Chicago's Southside. *Psychiatry: Interpersonal and Biological Processes*. 1993; 56:46–54.
- Beyers JM, Bates JE, Pettit GS, Dodge KA. Neighborhood structure, parenting processes, and the development of youths' externalizing behaviors: A multilevel analysis. *American Journal of Community Psychology*. 2003; 31:35–53. [PubMed: 12741688]
- Briggs DJ, de Hoogh C, Gulliver J, Wills J, Elliott P, Kingham S, Smallbone K. A regression based method for mapping traffic-related air pollution: application and testing in four contrasting urban environments. *Science of the Total Environment*. 2000; 253:151–167. [PubMed: 10843339]
- Brody G, Dorsey S, Forehand R, Armistead L. Unique and compensatory processes to adjustment among African American children. *Child Development*. 2002; 73:274–286. [PubMed: 14717257]
- Bronfenbrenner U. Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*. 1986; 22:723–742.
- Brown B, Mounts N, Lamborn S, Steinberg L. Parenting practices and peer group affiliation in adolescence. *Child Development*. 1993; 64:467–482. [PubMed: 8477629]
- Bush NR, Lengua LJ, Colder CR. Temperament as a moderator of the relation between neighborhood and children's adjustment. *Journal of Applied Developmental Psychology*. 31:351–361. [PubMed: 20948973]
- City of Portland, Corporate GIS. City of Portland Crime Incidents (2004). 2004. Retrieved July 16, 2008, <http://www.portlandonline.com/cgis>
- City of Portland, Corporate GIS. City of Portland Transportation. 2004. Retrieved July 16, 2008, <http://www.portlandonline.com/cgis>
- Cohen, J.; Cohen, P.; West, DG.; Aiken, LS. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. Lawrence Erlbaum Inc; 2002.
- Compass BE, Howell DC, Phares V, Williams RA, Giunta CT. Risk factors for emotional/behavioral problems in young adolescents: A prospective analysis of adolescent and parental stress and symptoms. *Journal of Consulting and Clinical Psychology*. 1989; 57:732–740. [PubMed: 2600244]
- Connell A, Dishion TJ. Reducing depression among at-risk early adolescents: Three-year effects of a family-centered intervention embedded within schools. *Journal of Family Psychology*. 2008; 22:574–585. [PubMed: 18729671]
- Craglia M, Haining R, Wiles P. A Comparative Evaluation of Approaches to Urban Crime Pattern Analysis. *Urban Studies*. 2000; 37:711–729.
- Crouter, AC.; Head, MR. Parental monitoring and knowledge of children. In: Bornstein, MH., editor. *Handbook of Parenting: Vol. 3: Being and becoming a parent*. 2. Mahwah, NJ: Erlbaum; 2002. p. 461-483.
- Dishion, TJ. The peer context of troublesome child and adolescent behavior. In: Leone, P., editor. *Understanding Troubled and Troublesome Youth*. Beverly Hills, CA: Sage; 1990. p. 128-153.
- Dishion, TJ.; Bullock, BM. Parenting and adolescent problem behavior: An ecological analysis of the nurturance hypothesis. In: Borkowski, JG.; Ramey, SL.; Bristol-Power, M., editors. *Parenting and the child's world: Influences on academic, intellectual, and social-emotional development*. Mahwah, NJ: Erlbaum; 2002. p. 231-249.
- Dishion, TJ.; French, DC.; Patterson, GR. The development and ecology of antisocial behavior. In: Cicchetti, D.; Cohen, D., editors. *Manual of Developmental Psychopathology*. New York: Wiley; 1995. p. 421-471.
- Dishion, TJ.; Kavanagh, K. *Intervening with Adolescent Problem Behavior: A Family-centered Approach*. New York: Guilford; 2003.
- Dishion, TJ.; Kavanagh, K.; Schneiger, A.; Nelson, S.; Kaufman, N. Preventing early adolescent substance use: A family-centered strategy for public middle school. In: Spoth, RL.; Kavanagh, K.; Dishion, TJ., editors. *Prevention Science*. Vol. 3. 2002. p. 191-201. Universal family-centered prevention strategies: Current findings and critical issues for public health impact [Special Issue]
- Dishion TJ, Loeber R, Stouthamer-Loeber M, Patterson GR. Skill deficits and male adolescent delinquency. *Journal of Abnormal Child Psychology*. 1984; 12:37–54. [PubMed: 6715693]
- Dishion TJ, Loeber R. Adolescent marijuana and alcohol use: The role of parents and peers revisited. *American Journal of Drug and Alcohol Abuse*. 1985; 11:11–25. [PubMed: 4061428]

- Dishion TJ, McMahon RJ. Parental monitoring and the prevention of child and adolescent problem behavior: A conceptual and empirical formulation. *Clinical Child and Family Psychology Review*. 1998; 1:61–75. [PubMed: 11324078]
- Dishion, T.J.; Patterson, GR. The development and ecology of antisocial behavior in children and adolescents. In: Cicchetti, D.; Cohen, DJ., editors. *Developmental Psychopathology: Vol. 3: Risk, disorder, and adaptation*. 2. Hoboken, NJ: John Wiley & Sons Inc; 2006. p. 503-541.
- Dishion TJ, Patterson GR, Stoolmiller M, Skinner M. Family, school, and behavioral antecedents to early adolescent involvement with antisocial peers. *Developmental Psychology*. 1991; 27:172–180.
- Dishion TJ, Véronneau MH, Myers MW. Cascading peer dynamics underlying the progression from problem behavior to violence in early to late adolescence. *Development and Psychopathology*. 2010; 22:603–619. [PubMed: 20576182]
- Dubrow NF, Garbarino J. Living in the war zone: Mothers and young children in public housing development. *Journal of Child Welfare*. 1989; 68:3–20.
- Durant DH, Cadenhead C, Pendergast RA, Slavens G, Linder CW. Factors associated with use of violence among urban black adolescents. *American Journal of*. 1994
- English P, Neutra R, Scalf R, Sullivan M, Waller L, Zhu L. Examining associations between childhood asthma and traffic flow using a geographic information system. *Environmental Health Perspectives*. 1999; 107:761–767. [PubMed: 10464078]
- Fingerhut LA, Kleinman JC. International and interstate comparisons of homicide of among you males. *Journal of the American Medical Association*. 1990; 265:3292–3295. [PubMed: 2348540]
- Fletcher, AC.; Darling, N.; Steinberg, L. Parental supervision and peer influences on adolescent substance use. In: McCord, J., editor. *Coercion and punishment in long-term perspectives*. New York: Cambridge University Press; 1995. p. 259-288.
- Forehand R, Brody GH, Armistead L, Dorsey S, Morse E. The role of community risks and resources in the psychosocial adjustment of at-risk children: An examination across two community contexts and two informants. *Behavior Therapy*. 2000; 31:395–414.
- Fowler PJ, Tompsett CJ, Braciszewski JM, Jacques-Tiura AJ, Baltes BB. Community violence: A meta-analysis on the effect of exposure and mental health outcomes of children and adolescents. *Development and Psychopathology*. 2009; 21:227–259. [PubMed: 19144232]
- Furstenberg, FF., Jr; Hughes, ME. The influence of neighborhoods on children's development: a theoretical perspective and a research agenda. In: Brooks-Gunn, J.; Duncan, GJ.; Aber, JL., editors. *Neighborhood Poverty: Policy Implications in Studying Neighborhoods*. Vol. 2. Russell Sage Foundation; New York: 1997.
- Greenberg MT, Lengua LJ, Coie JD, Pinderhughes EE, Bierman K, Dodge KA, Lochman JE, McMahon RJ. Predicting developmental outcomes at school entry using a multiple-risk model: Four American communities. *Developmental Psychology*. 1999; 35:403–417. [PubMed: 10082011]
- Hirschi, T.; Selvin, HS. *Delinquency Research: An Appraisal of Analytic Methods*. New York: Free Press; 1967. p. 1967
- Hume C, Timperio A, Salmon J, Carver A, Giles-Corti B. Walking and cycling to school predictors of increases among children and adolescents. *American Journal of Preventive Medicine*. 2009; 36:195–200. [PubMed: 19162431]
- Ingoldsby EM, Shaw DS. The role of neighborhood contextual factors on early-starting antisocial behavior. *Clinical Child and Family Psychology Review*. 2002; 6:21–65. [PubMed: 11993544]
- Junger-Tas, J.; Terlouw, GJ.; Klein, MW. *Delinquent behavior among young people in the Western world: First results of the international self-report delinquency study*. Amsterdam: Kugler; 1994.
- Kalff AC, Kroes M, Vles JSH, Hendriksen JGM, Feron FJM, Steyaert J, van Zeben TMCB, Jolles J, van Os J. Neighborhood level and individual level SES effects on child problem behavior: A multilevel analysis. *Journal of Epidemiology and Community Health*. 2001; 55:246–250. [PubMed: 11238579]
- Kerr M, Stattin Håkan. What parents know, how they know it, and several forms of adolescent adjustment: Further support for a reinterpretation of monitoring. *Developmental Psychology*. 2000; 36:366–380. [PubMed: 10830980]

- Kupersmidt JB, Griesler PC, de Rosier ME, Patterson CJ, Davis PW. Childhood aggression and peer relations in the context of family and neighborhood factors. *Child Development*. 1995; 66:360–75. [PubMed: 7750371]
- Kochanska G, Murray KT, Harlan ET. Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology*. 2000; 36:220–232. [PubMed: 10749079]
- Lacourse E, Baillargeon R, Dupe'ré V, Vitaro F, Romano E, Tremblay R. Two-year predictive validity of conduct disorder subtypes in early adolescence: a latent class analysis of a Canadian longitudinal sample. *Journal of Child Psychology and Psychiatry*. 2011; 51:1386–1394. [PubMed: 20695929]
- Loeber R, Dishion TJ. Early predictors of male delinquency: A review. *Psychological Bulletin*. 1983; 94:68–99. [PubMed: 6353467]
- Loeber, R.; Stouthamer-Loeber, M. Prediction. In: Quay, HC., editor. *Handbook of juvenile delinquency*. New York: Wiley; 1987. p. 325-382.
- Luthar SS, Cushing G. Neighborhood influences and child development: A prospective study of substance abusers' offspring. *Development and Psychopathology*. 1999; 11:763–784. [PubMed: 10624725]
- Marans, S.; Cohen, D. Children and inner-city violence: Strategies for intervention. In: Leavitt, L.; Fox, N., editors. *Psychological effects of war and violence on children*. Hillsdale, NJ: Erlbaum; 1993. p. 281-302.
- Molero Samuelson Y, Hodgins S, Larsson A, Larm P, Tengström A. Adolescent antisocial behavior as predictor of adverse outcomes to age 50: A follow-up study of 1,947 individuals. *Criminal Justice and Behavior*. 2010; 37:158–174.
- Mota J, Ribeiro JC, Carvalho J, Santos MP. The physical activity behaviors outside school and BMI in adolescents. *Journal of Physical Activity & Health*. 2010; 7:754–760. [PubMed: 21088306]
- Murray AT, McGuffog I, Western JS, Mullins P. Exploratory spatial data analysis techniques for examining urban crime. *British Journal of Criminology*. 2001; 41:309–329.
- Nock MK, Kazdin AE, Hiripi E, Kessler RC. Prevalence, subtypes, and correlates of DSM-IV conduct disorder in the national comorbidity survey replication. *Psychological Medicine*. 2006; 36:699–710. [PubMed: 16438742]
- Nuckols JR, Ward MH, Jarup L. Using geographic information systems for exposure assessment in environmental epidemiology studies. *Environmental Health Perspectives*. 2004 Jun.112:1007–1015. [PubMed: 15198921]
- Osofsky JD, Wewers S, Hann DM, Fick AC. Chronic community violence: What is happening to our children? *Psychiatry*. 1993; 56:36–45. [PubMed: 8488211]
- Patterson GR, Dishion TJ, Yoerger K. Adolescent growth in new forms of problem behavior: Macro- and micro-peer dynamics. *Prevention Science*. 2000; 1:3–13. [PubMed: 11507792]
- Patterson, GR.; Reid, JB.; Dishion, TJ. *Antisocial boys*. Eugene, OR: Castalia; 1992.
- Patterson GR, Southamer-Loeber M. The correlation of family management practices and delinquency. *Child Development*. 1984; 55:1299–1307. [PubMed: 6488958]
- Peiser NC, Heaven PCL. Family influences on self-reported delinquency among high school students. *Journal of Adolescence*. 1996; 19:557–68. [PubMed: 9245307]
- Pettit GS, Bates JE, Dodge KA, Meece DW. The impact of after-school peer contact on early adolescent externalizing problems is moderated by parental monitoring, perceived neighborhood safety, and prior adjustment. *Child Development*. 1999; 70:768–778. [PubMed: 10368921]
- Plybon L, Kliewer W. Neighborhood types and externalizing behavior in urban school-age children: Tests of direct, mediated, and moderated effects. *Journal of Child and Family Studies*. 2001; 10:419–437.
- Pryor-Brown L, Cowen EL. Stressful life events, support, and children's school adjustment. *Journal of Clinical Child Psychology*. 1989; 18:214–220.
- Sampson RJ, Morenoff JD, Gannon-Rowley T. Assessing "Neighborhood Effects": Social Processes and New Directions in Research. *Annual Review of Sociology*. 2002; 28:443–478.
- Sampson RJ, Raudenbush S, Earls F. Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. *Science*. 1997; 277:918–924. [PubMed: 9252316]

- Shakoor B, Chalmers D. Co-victimization of African American children who witness violence and the theoretical implications of its effects on their cognitive, emotional, and behavioral development. *Journal of National Medical Association*. 1991; 83:233–238.
- Shaw, CR.; McKay, Henry D. *Juvenile Delinquency in Urban Areas*. Chicago: University of Chicago Press; 1942.
- Shaw DS, Bell RQ. Developmental theories of parental contributors to antisocial behavior. *Journal of Abnormal Child Psychology*. 1993; 21:493–518. [PubMed: 8294650]
- Simcha-Fagan O, Schwartz JE. Neighborhood and Delinquency: An Assessment of Contextual Effects. *Criminology*. 1986; 24:667–699.
- Simons RL, Lin K, Gordon LC, Rand D Conger, Lorenz FO. Explaining the Higher Incidence of Adjustment Problems among Children of Divorce Compared with Those in Two-Parent Families. *Journal of Marriage and Family*. 1999; 61:1020–1033.
- Simons RL, Johnson C, Beaman J, Conger RD. Parents and peer group as mediators of the effect of community structure on adolescent problem behavior. *American Journal of Community Psychology*. 1996; 24:145–171. [PubMed: 8712184]
- Steinberg LD, Silverberg SB. The vicissitudes of autonomy in early adolescence. *Child Development*. 1986; 57:841–851. [PubMed: 3757604]
- Tolan PH. Delinquent behaviors and male adolescent development: A preliminary study. *Journal of Youth and Adolescence*. 1988; 17:413–427. [PubMed: 24277668]
- U.S. Census Bureau. State & county Quickfacts: Multnomah County, OR. 2010 Apr 1. Retrieved April 1, 2012 from <http://quickfacts.census.gov>
- US Census Summary File 3. Census block and tract (2000). Retrieved July 16, 2008 from www.census.gov
- US Census Summary File 3. Census race and ethnicity information (2000). Retrieved July 16, 2008 from www.census.gov
- U.S. Department of Justice Office of Justice Programs Bureau of Justice Statistics. Homicide Trends in the United States, 1980–2008; Annual Rates for 2009 and 2010. Patterns and Trends. 2011 Nov. 2011.
- Vau A, Ruggerio M. Stressful life change and delinquent behavior. *American Journal of Community Psychology*. 1983; 11:169–183. [PubMed: 6869324]
- Wagner BM, Compass BE, Howell DC. Daily and major life events: A test of an integrative model of psychosocial stress. *American Journal of Community Psychology*. 1988; 16:189–205. [PubMed: 3407632]
- Wilson, WJ. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago, IL: The University of Chicago Press; 1987.
- Xue Y, Leventhal T, Brooks-Gunn J, Earls FJ. Neighborhood Residence and Mental Health Problems of 5- to 11-Year-Olds. *Archives of General Psychiatry*. 2005; 62:554–563. [PubMed: 15867109]
- Yoshikawa H. Prevention as cumulative protection: Effects of early family support and education on chronic delinquency and its risks. *Psychological Bulletin*. 1994; 115:28–54. [PubMed: 8310099]

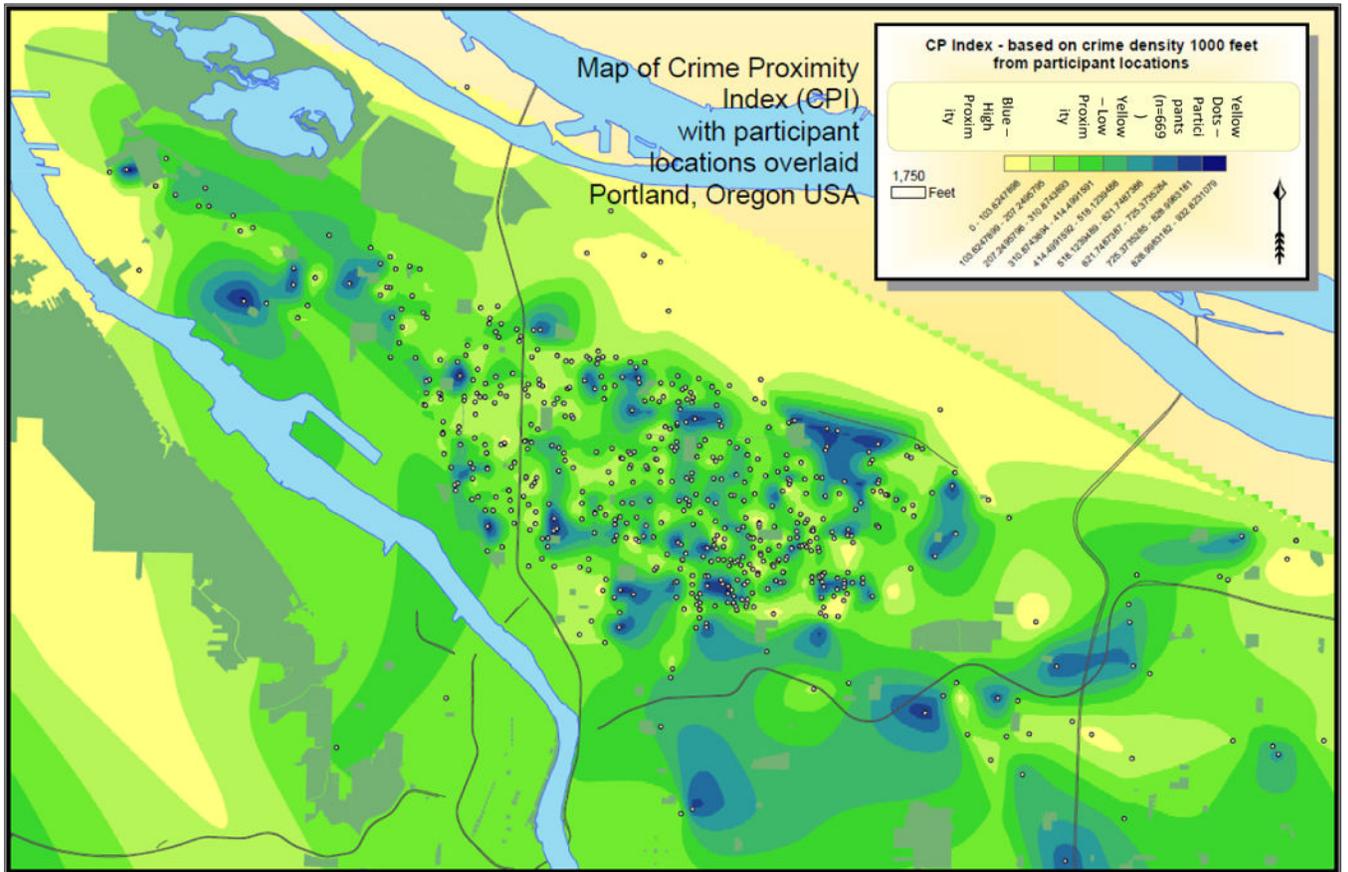


Figure 1. Crime Proximity Index: 1000 feet from participant locations.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

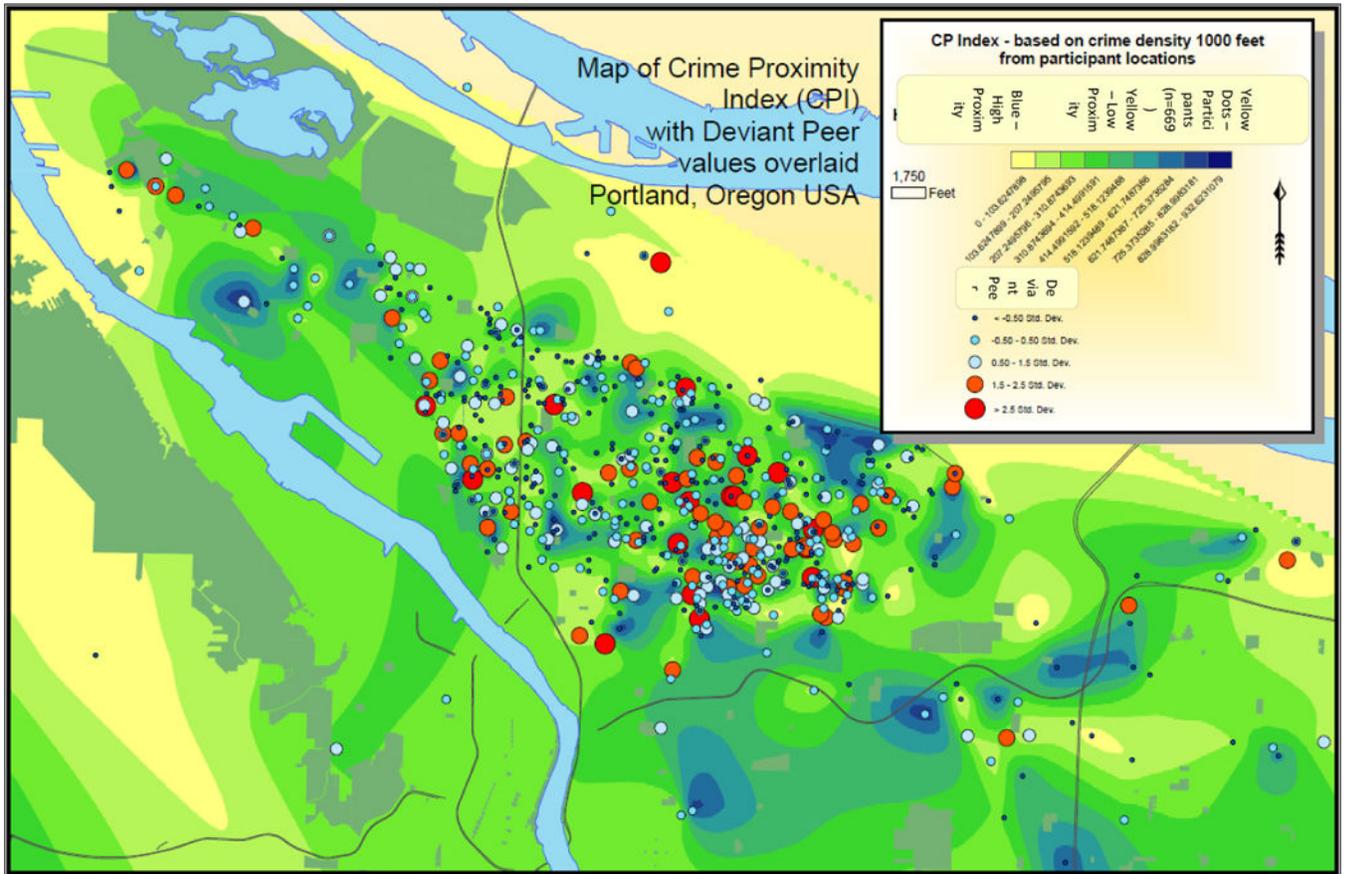


Figure 2. Crime Proximity Index mapped with Deviant Peer Affiliation scores

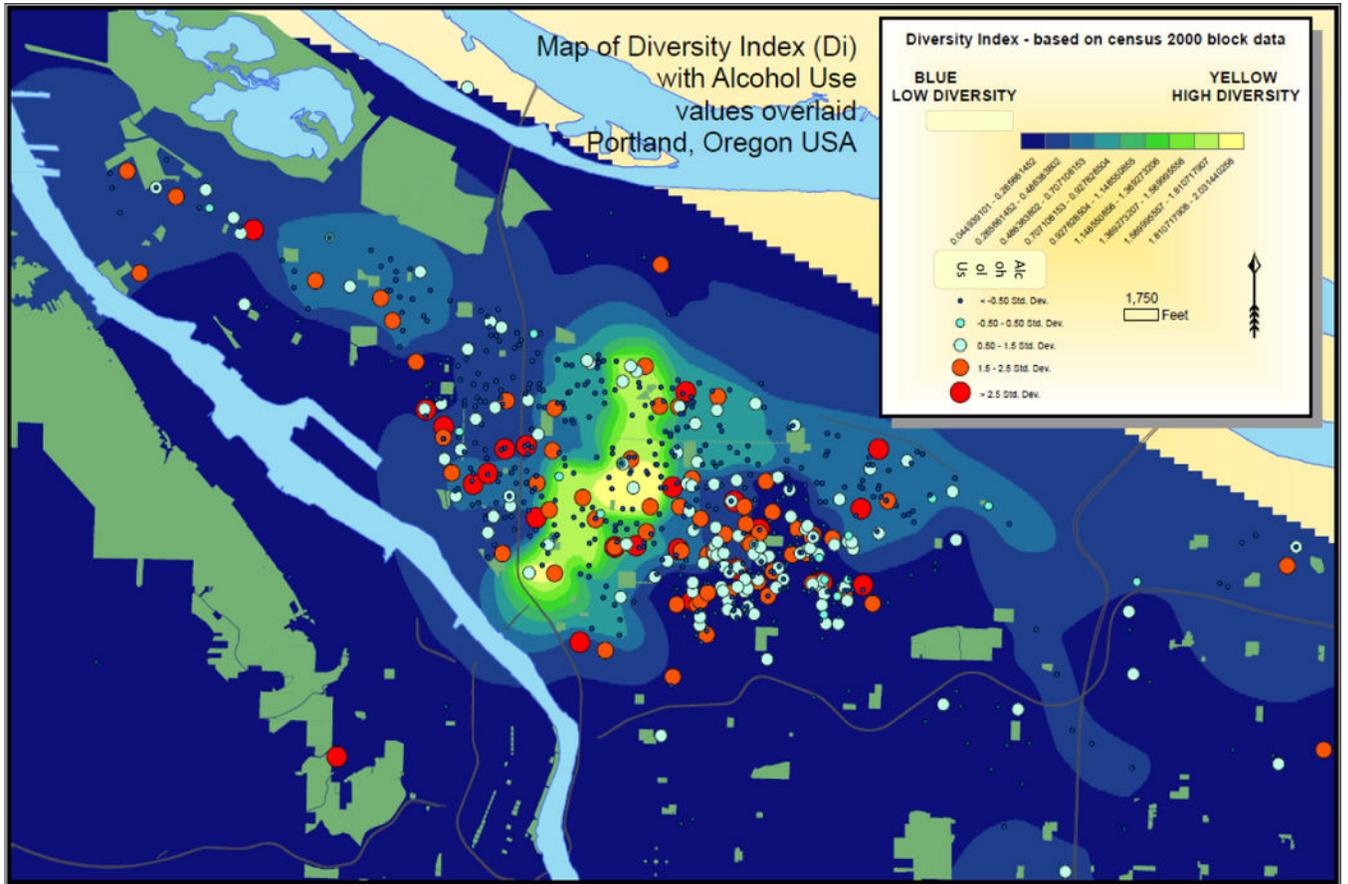


Figure 3.
Diversity index with Alcohol use values

Table 1

Descriptive Statistics: Psychosocial and Geospatial Neighborhood Variables.

Variable	Mean	S.D.	Range
Deviant Peer Involvement	.662	.883	5.000
Antisocial Behavior	.252	.375	4.220
Alcohol Use	1.550	2.502	9.000
Crime Proximity Index	1258.610	514.213	1876.280
Transportation Index	366.342	239.406	996.460
Ethnic Diversity Index	.530	.475	2.020
Parental Monitoring	2.702	1.002	4.000
Family Resources	13.804	5.509	27.000

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Simple correlations: Family resources indicators.

	1	2	3	4	5
1.	—				
2.	.095*	—			
3.	-.273**	-.002	—		
4.	.488**	.164**	-.465**	—	
5.	-.254**	-.130**	-.314**	-.571**	—

* $p < .05$,

** $p < .01$

Note:

- 1. Caregiver Education
- 2. Type of Housing
- 3. Housing Status
- 4. Gross Annual Household Income
- 5. Food Stamp Status

Table 3

Simple Correlations: Psychosocial and Geospatial Neighborhood Variables.

	1	2	3	4	5	6	7	8
1.	—							
2.	.554**	—						
3.	.601**	-.373	—					
4.	-.113**	-.051	-.056	—				
5.	-.093**	.029	-.118**	.004	—			
6.	.100**	.059	.098**	-.039	-.023	—		
7.	-.222**	-.330**	-.216**	.029	-.054	-.064	—	
8.	.091*	-.024	.155**	-.026	-.391**	.149*	.010	—

* $p < .05$.

** $p < .01$

- 1. Deviant Peer Involvement
- 2. Antisocial Behavior
- 3. Alcohol Use
- 4. Crime Proximity Index
- 5. Diversity Index
- 6. Transportation Accessibility
- 7. Parental Monitoring
- 8. Family Resources

Table 4
 Hierarchical Multiple Regression Equations: Deviant Peer Involvement, Antisocial Behavior, and Alcohol Use.

Deviant Peer Involvement					
Variable	R	R ²	R ² change	F change	Beta
Model 1	FR	.112	.012	5.98	.112 ^{#/}
Model 2	CPI	.190	.036	3.737 [*]	-.090 [*]
	Ti				.103 [*]
	Di				-.068
Model 3	Monitoring	.339	.115	41.907 ^{**}	-.284 ^{**}
Model 4	CPI*Monitor	.345	.119	.746	.016
	Ti*Monitor				-.058
	Di*Monitor				.024
Antisocial Behavior					
Variable	R	R ²	R ² change	F change	Beta
Model 1	FR	.011	.00	.057	-.011
Model 2	CPI	.127	.016	2.537 [*]	-.039
	Ti				.091 [*]
	Di				.082
Model 3	Monitoring	.432	.187	97.935 ^{**}	-.416 ^{**}
Model 4	CPI*Monitor				-.029
	Ti*Monitor				.026
	Di*Monitor				.026
Alcohol Use					
Variable	R	R ²	R ² change	F change	Beta
Model 1	FR	.167	.028	13.430 ^{**}	.167 ^{**}
Model 2	CPI	.219	.048	3.318 [*]	.020
	Ti				.090 [*]

Deviant Peer Involvement

Variable	R	R2	R2change	F change	Beta	
Di					-.121 *	
Model 3	Monitoring	.332	.110	.062	32.498 **	-.251 **
Model 4	CPI *Monitor					.004
	TI *Monitor					.048
	Di *Monitor					-.028

** $p < .01$,

* $p < .05$

I All standardized coefficients presented from the models obtained when the variables were first entered in to the equations.

Note. FR – Family Resources composite; CPI – Crime Proximity Index; TI – Transportation Index; Di – Diversity Index.