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The Geography of Intimate Partner Abuse Experiences and Clinical Responses

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Abstract
Existing intimate partner abuse (IPA) research has focused on individual differences that affect women's risk of exposure and posttraumatic symptoms with little consideration of the influence of proximal environments. In this study, we examine links between geographic context and characteristics of clinical reactions to IPA. We used raster analyses, which address methodological limitations in many geographic information system studies in the social sciences (e.g., reliance on arbitrary boundaries), to examine links between proximal environments and women's ($N = 192$) reports of IPA characteristics, posttraumatic symptoms, and social support. Psychological-aggression severity varied spatially, which suggests that communities differ in tolerance of this form of IPA. Observed links between spatial characteristics, posttraumatic stress disorder/depression symptom severity, and social support were consistent with the so-called Latino paradox. Women living in areas with greater concentrations of Latinos reported less severe clinical symptoms and greater social support. Living in Latino communities was advantageous in terms of lower depression symptoms regardless of women's own ethnic group membership.

Keywords
victimization, posttraumatic stress disorder, GIS

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Intimate partner abuse (IPA), which includes psychological and physical aggression, is a prevalent and costly public-health problem (Centers for Disease Control, 2003). Beyond the harmful physical consequences of IPA are serious psychological consequences, including posttraumatic stress disorder (PTSD) and depression symptoms (e.g., Coker et al., 2002). Although IPA has received unprecedented attention in the past decade, clinical researchers have largely examined women's individual risk factors for experiencing IPA (e.g., Jones, Hughes, & Unterstaller, 2001) or women's responses to the IPA, including clinical symptoms (e.g., Alhabib, Nur, & Jones, 2010; Kaysen, Resick, & Wise, 2003). Studies of individual differences have emphasized the victim, with a focus on factors ranging from women's demographic characteristics (Jones et al., 2001) to their appraisals of the event itself (e.g., DePrince, Chu, & Pineda, 2011). Understanding individual factors in IPA exposure and responses is important for numerous reasons, including informing the development of effective interventions; however, a singular focus on victims misses potentially important ecological factors in risk for exposure and clinical responses to IPA. Improved understanding of ecological factors involved in IPA exposure and clinical responses has the potential to provide a critically important route to intervention.

Women exposed to IPA are situated in multiple contexts. Building on Bronfenbrenner's (1977) oft-cited ecological theory, these contexts can range from interpersonal to community and geographic. The contexts within which women are situated may be linked to IPA-exposure characteristics (such as severity) or to clinical responses (such as PTSD and depression symptoms) separate from

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the risk conferred by individual factors (such as demographics or appraisals). For example, at the interpersonal level, a large literature has documented that social support promotes resilience and well-being in the aftermath of trauma, including IPA (Jones et al., 2001), whereas lack of social support increases risk of new IPA exposure (Kapadia, Saleem, & Karim, 2010; Levendosky et al., 2004). Basic research documenting links between social support, exposure risk, and clinical responses has informed the development of interventions that seek to increase social support for women exposed to IPA. A randomized control trial revealed that compared with IPA-exposed women without an advocate, IPA-exposed women assigned a supportive victim advocate on leaving a domestic violence shelter reported less revictimization by abusers and better quality of life (Bybee & Sullivan, 2002; Sullivan & Bybee, 1999).

In terms of community context, community-level responses may also affect women's risk of IPA exposure or responses to IPA. For example, bystander-intervention models have garnered increasing research and practice attention because these models acknowledge the role that people outside the victim-offender dyad have in facilitating or disrupting violence (see Banyard, 2011). Furthermore, on the basis of the premise that community-level responses should have an effect on IPA exposure and responses, researchers, policymakers, and practitioners have called for community-coordinated responses to IPA. Community-coordinated responses bring together community-based service providers (e.g., domestic violence shelters, legal advocacy programs) and criminal justice system–based agencies (e.g., prosecuting attorneys, police) to coordinate victim advocacy for IPA intervention and prevention (Klevens, Baker, Shelley, & Ingram, 2008). Relative to treatment as usual, women randomized to receive community-based outreach as part of a community-coordinated response program following a police-reported incident of IPA reported lower PTSD and depression symptom severity 1 year later, which illustrates the important role that community can have in ameliorating the negative psychological costs of IPA (e.g., DePrince, Labus, Belknap, Buckingham, & Gover, 2012).

Given the fruitfulness of research on interpersonal and community contexts to IPA interventions, an important next step is to examine links between geographic context and clinical responses to the IPA. The importance of geographic context to violence exposure is clear in sociological research (Sampson, 2011). For example, in early spatial studies of violence, researchers examined crime rates in relation to neighborhood demographics in attempts to evaluate social processes and mechanisms (Morenoff, Sampson, & Raudenbush, 2001). Building on this early work, researchers have produced a host of studies that document links between neighborhood disadvantage (using variables such as ethnic composition, percentage of single parents, and percentage of homeowners/renters) and rates of violence, including IPA (for a review, see Pinchevsky & Wright, 2012). Sociologists have also begun to document links between environmental factors, such as proximity to other violent crimes, and individual responses, such as victims' distress and perceptions of the crime (Elo, Mykyta, Margolis, & Culhane, 2009; Sampson, Morenoff, & Gannon-Rowley, 2002). In addition, neighborhood social support, socioeconomic status, and ethnic composition contribute to victim attitudes about crime (Elo et al., 2009). Despite this emphasis in sociology, in psychological science, little consideration has been given to how geographic context influences clinical responses to crimes, such as IPA.

Examining the local environments in which women live may expose mechanisms underlying IPA characteristics (such as severity of IPA) and clinical responses (such as PTSD and depression). In an era of limited clinical resources, understanding the influence of geographic context on characteristics of and clinical responses to IPA can be critical to effectively deploying intervention and prevention services. For example, the extent to which IPA characteristics, such as severity, vary across geographic space can inform decisions by prevention scientists and policymakers regarding how to target prevention resources geographically. In addition, links between clinical responses and characteristics of the environments in which women live can inform the placement of clinical and victim advocacy services as well as point to ecological considerations that should be integrated into traditional interventions.

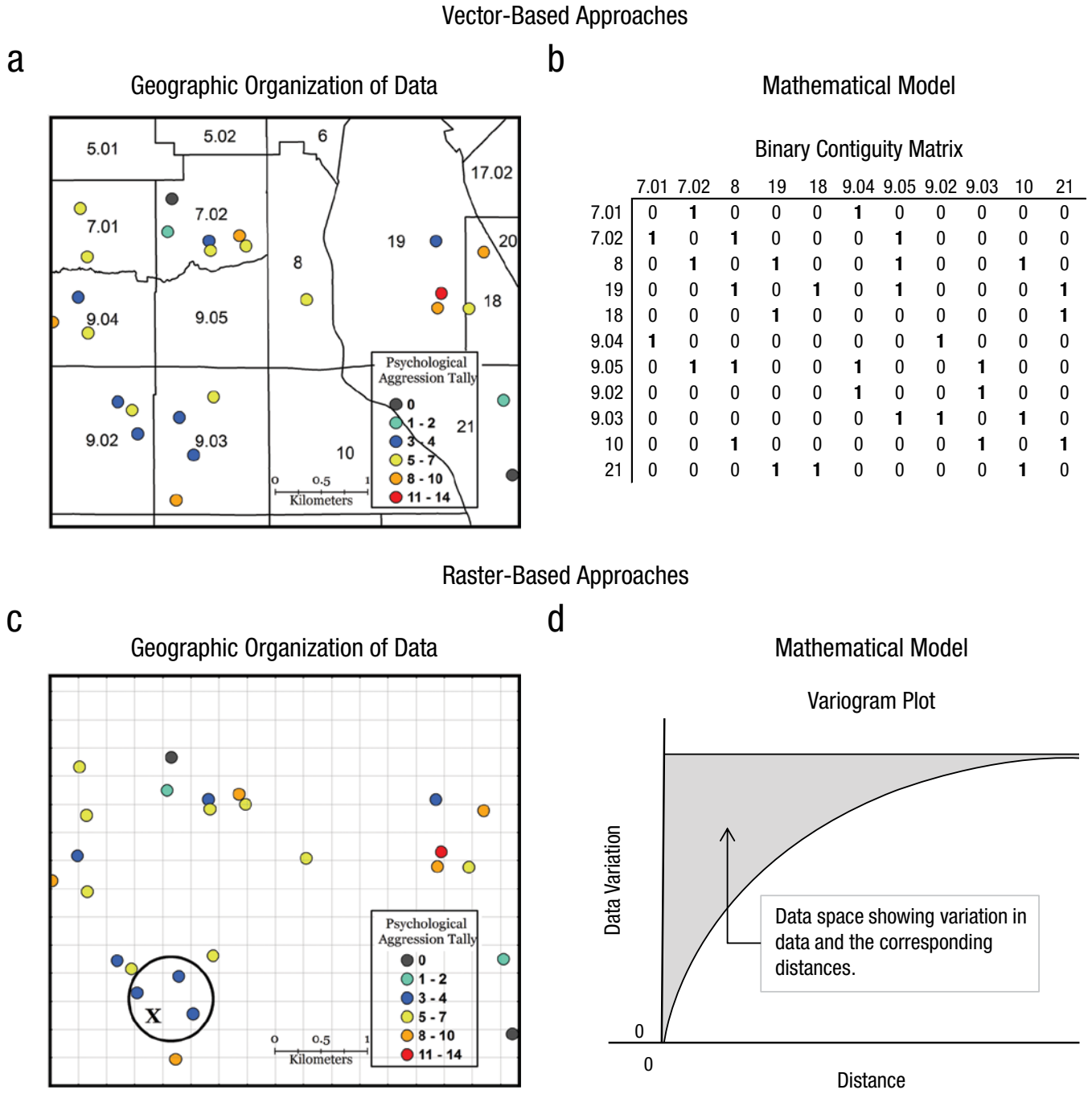
Sociological and epidemiological approaches to studies of geography and IPA have often defined *neighborhoods* as geographic spaces bounded by census tracks or zip codes that encompass several square miles of homes (Pinchevsky & Wright, 2012). However, psychological approaches interested in clinical responses to IPA may require the application of more immediate or more proximal boundaries to geographic space. Individuals experience their neighborhoods as areas where they regularly walk or pass through; thus, identifying with a neighborhood requires some phenomenological understanding of an area (Coulton, Korbin, & Su, 1996). Individuals are more likely to be aware of litter, crime, or other indicators of disadvantage in the spaces proximal to their homes relative to spaces miles away though still in the same census tract. Therefore, a psychological approach to understanding clinical responses to IPA requires the refinement of measurements from census tract/block scales to more proximal areas around individuals' homes.

One of the few available studies of the proximal environments in which women live and of women's responses to IPA has illustrated the potential value of this line of inquiry. Using self-report methods, Beeble, Sullivan, and Bybee (2011) found that the inverse relationship between changes in women's perceptions of their neighborhoods' disorder over time and their quality of life was mediated through the women's fear. On the basis of these findings, Beeble et al. suggested new points of potential intervention to support women subsequent to IPA exposure (e.g., programs to ensure access to safe housing options) as well as additional research on the environments in which women live and IPA. Moving beyond reliance on self-report alone, geographic information system (GIS) technology offers a powerful tool to examine a broad range of ecological factors (e.g., census data, crime data). As noted by Beeble et al., however, previous studies in which researchers have examined ecological variables (vs. self-reported perceptions of neighborhoods) have sometimes failed to reveal links between neighborhood characteristics (defined, for example, by census blocks) and victims' clinical responses to violence, such as depression (e.g., community violence as studied by Curry, Latkin, & Davey-Rothwell, 2008). Such null findings have led researchers to caution against the application of objective measures of space in relation to clinical responses (Beeble et al., 2011).

Before null findings dampen enthusiasm for inquiry into links between responses to violence (including IPA specifically) and the places where people live, several methodological issues in studies of geographic context in social science should be considered, some of which may have discouraged active research in this area. For example, GIS studies in the social sciences tend to rely on aggregate population data (e.g., number of crimes per police district, number of alcohol outlets per census tract), spatial demographics (e.g., number of married residents by census block/tract), and rates of events (e.g., number of child abuse reports per county) in the absence of individual-level data. Such approaches increase the risk of ecological fallacy. In addition to reliance on aggregate population data, several methodological approaches compromise spatial-data interpretation. For example, researchers commonly apply arbitrary boundaries (e.g., census tracts, police districts, zip codes) to geographic data sets to infer something about neighborhoods. A review of more than 40 studies of neighborhood and the presence of IPA revealed reliance on artificially defined neighborhoods, most often in terms of census tracts (Pinchevsky & Wright, 2012). These represent proscribed spaces, not necessarily neighborhoods. The terms *neighborhood* and *neighborhood effects* are problematic in this context (for a related discussion, see Sampson et al., 2002). Large, arbitrarily defined areas are unlikely to capture social-psychological processes or experiences that may be more proximal (Basta, Richmond, & Wiebe, 2010; Morenoff et al., 2001). By way of example, one could live on the edge of a proscribed "neighborhood" as defined by a census tract; however, the immediate environs for this individual may actually include the adjacent tract, which could differ in important ways from the environs on the opposite side of the tract to which the person is assigned. Thus, for the purposes of this work, we focus on measuring the environments in which women live without using arbitrarily defined neighborhoods. We refer to this geographic space as the *proximal environment*, thereby illustrating that we are neither making inferences about perceptions of neighborhoods nor using spaces proscribed by artificial boundaries, such as census tracts or zip codes.

A method problem related to the use of arbitrary boundaries to define important space is reliance on polygons as a unit of measure for spatial analyses. The use of polygons reflects a vector-based approach that defines data using points, lines, and polygons. Figures 1a and 1b illustrate a vector approach relative to the alternative gridded-data approach shown in Figures 1c and 1d that examine data along continuous surfaces, such as rasters. Many published GIS studies in the social sciences have reported on vector-based approaches (Cunradi, Caetano, Clark, & Schafer, 2000; Freisthler, Lascala, Gruenewald, & Treno, 2005; Livingston, 2010), binning data into polygons, such as census tracts/blocks, zip codes, or counties (see census tract boundaries in Figure 1a). The quantitative analyses possible with vector-based approaches are limited. For example, GIS studies that aggregate data into census tract polygons often focus on whether polygons differ significantly from adjacent polygons (Livingston, 2010). In addition, vector data limit analysis to a specific spatial scale (e.g., based on the size of the arbitrarily defined polygon), whereas in reality spatial relations exist on multiple scales (Sampson, 2011).

Reliance on vector-based data may contribute to poor understanding and application of the concept of spatial autocorrelation, with researchers often treating spatial autocorrelation as a statistical nuisance (e.g., Pinchevsky & Wright, 2012) rather than as a potentially important phenomenon. In the physical sciences, Tobler's First Law is the essence of autocorrelation, which states that things closer to each other are more similar to each other than is each to a distant thing (Miller, 2004). Thus, two soils sampled closer to one another will likely be more similar compared with a sample from farther away. Tobler's First Law points to the usefulness of spatial autocorrelation in trying to discover underlying mechanisms that drive similarities among close things. In this example, the chemical similarity of close soils may be driven by a common parent material from which both soil samples eroded.



	7.01	7.02	8	19	18	9.04	9.05	9.02	9.03	10	21
7.01	0	**1**	0	0	0	**1**	0	0	0	0	0
7.02	**1**	0	**1**	0	0	0	**1**	0	0	0	0
8	0	**1**	0	**1**	0	0	**1**	0	0	**1**	0
19	0	0	**1**	0	**1**	0	**1**	0	0	0	**1**
18	0	0	0	**1**	0	0	0	0	0	0	**1**
9.04	**1**	0	0	0	0	0	0	**1**	0	0	0
9.05	0	**1**	**1**	0	0	**1**	0	0	**1**	0	0
9.02	0	0	0	0	0	**1**	0	0	**1**	0	0
9.03	0	0	0	0	0	0	**1**	**1**	0	**1**	0
10	0	0	**1**	0	0	0	0	0	**1**	0	**1**
21	0	0	0	**1**	**1**	0	0	0	0	**1**	0

Fig. 1. Vector versus raster approaches to analyzing psychological-aggression data. Vector-based approaches are demonstrated with (a) census tract polygons and (b) the binary contiguity matrix used to remove data unless adjacent. The same data are shown in (c) a grid-based raster analysis in which X highlights a theoretical self-organizing cluster of low reports of psychological aggression that are arbitrarily divided into two separate polygons in the vector-based approach. The raster-based approach allows all data to be included, as shown in (d) the variogram plot, in which the weight given to any data point is based on distance.

In contrast to soils, it would be surprising to find frequent spatial autocorrelations (reflecting local mechanisms) among complex human behaviors. Instead, spatial autocorrelation is likely inflated in vector-based analyses of human behaviors. When polygons are defined using arbitrary boundaries, data are binned into classes and smoothed (or aggregated) into singular values that are later compared with nearby (usually contiguous) polygons. These polygons often are of unequal size and shape (see Figure 1a). With unequal polygon shapes and sizes, researchers have problems defining polygons' proximity to other polygons, which results in a range of work-arounds/problems (e.g., reliance on off-center centroids for irregular polygons, arbitrary Queens vs. Rook criteria, edge

problems). Polygon data are then usually reduced to binary contiguity matrices for analysis (see Figure 1b), which results in treating nonadjacent polygons as zeros. The use of the matrix removes huge amounts of data from consideration simply because other data points are not considered adjacent in some manner.

In contrast to vectors, remote sensing and related fields have relied on gridded-data (i.e., Landsat) approaches that set data on a raster of equal-sized pixels (see Figure 1c). Raster approaches incorporate distance or geographic location for every data point relative to every other data point in analyses, which allows the data to effectively self-organize (rather than researchers' arbitrary organization in vector-based analyses). Raster methods explore contextual spatial relationships by using variograms (see Figure 1d) that characterize data using weights based on the distance between each point and all other points (Berry, 2007). Unlike in vector approaches, in raster approaches data are not excluded or binned, which allows potentially meaningful spatial relationships to emerge (Berry, 2007). Illustrating this point, Figure 1c shows a circled area of low psychological-aggression values (labeled X), which may reflect a cluster of participant experiences. The same data illustrated in Figure 1a are parsed into census tracks. In typical vector-based analyses, those values would be aggregated with other values in the tracts and tied to a centroid, making the meaning of spatial relations, including autocorrelation, unclear.

Taking into account methodological challenges to studying geographic context and psychological phenomena, we sought to address new and important questions about the links between geographic context and IPA characteristics as well as clinical responses using an innovative approach that differs from many published GIS studies in the social sciences. First, we interviewed and measured individual women's experiences of and responses to IPA, which allowed us to examine characteristics (in this case severity) of IPA rather than rely on aggregate population or event data. On the basis of women's geocoded residential addresses, we examined entire data sets of event severity and clinical responses (such as PTSD) to assess spatial autocorrelation across the full data set, independent of arbitrarily proscribed neighborhoods. Finally, we used a raster analysis to explore overlapping data sets to compute variables within 1,000 ft of a participant's home (i.e., crime, land value, etc.). We also transformed spatial census data from vectors of blocks into rasters. By not forcing data into polygons based on arbitrary boundaries, we avoided problems of aggregating and smoothing data.

The current study, in which we examine proximal environments in relation to IPA characteristics and clinical responses using gridded (rather than vector) data, focuses on two questions. First, do proximal environments matter in terms of women's reports of IPA severity and clinical responses? To address this question, we examined spatial autocorrelation patterns using geocoded points in women's reports of IPA severity and symptoms following police-reported IPA. If local environments influence (or are influenced by) IPA, spatial autocorrelation patterns should reflect clustering or dispersion.

Second, do spatial data representing women's proximal environments predict women's clinical responses to IPA in the forms of PTSD and depression symptom severity when victim and incident characteristics are controlled for? To address this question, we created several spatial variables on the basis of census and county data to test the relative contributions of three levels of predictors of women's responses to IPA: participant characteristics, incident characteristics, and proximal-environment characteristics. In terms of proximal-environment characteristics, we selected variables that would characterize the ethnic composition, including percentage of Hispanic/Latino (Latino) and percentage of Black/African American (African American) relative to a Caucasian reference group; economic strain and community stability, including percentage of single mothers, percentage of single fathers, percentage of homeowners, and land values; and other crime in neighborhoods, which have been shown to be linked to crime victims' responses in nonspatial studies (Elo et al., 2009). We included terms to examine the interaction between women's membership in Latina and African American groups and the ethnic composition of neighborhoods. In follow-up analyses, we examined women's perceptions of social support.

Method

Prior to data collection, study procedures were approved by a university institutional review board.

Participants

Participants were 192 adult English-speaking female victims in police-reported IPA cases involving a male offender (see DePrince, Belknap, Labus, Buckingham, & Gover, 2012; DePrince, Labus et al., 2012). As described elsewhere, participants' residences appeared representative of the spatial locations at which calls for law enforcement service occurred during the recruitment period (DePrince, Belknap, et al., 2012). Participants were compensated $50 for their time.

Measures

Demographic characteristics. Women were asked their age and racial-ethnic group. Three related indicators of socioeconomic status (education, occupation, and income) were transformed to z scores and averaged.

Incident characteristics. Severity of the target IPA incident that resulted in a report to law enforcement was assessed using the Revised Conflict Tactics Scale (Straus, Hamby, Boney-McCoy, & Sugarman, 1996). We tallied the total number of psychologically (range = 0–15) and physically (range = 0–13) aggressive tactics used by a man against a female partner during the target incident as well as the number of injuries sustained by the female partner (range = 0–17). Women's fear at the target incident was measured with the Fear Scale of the Trauma Appraisal Questionnaire, a 54-item self-report measure of posttraumatic appraisals with demonstrated reliability and validity (α = .97; DePrince, Zurbriggen, Chu, & Smart, 2010). Finally, to control for time-related effects on PTSD and depression symptom severity, we calculated the number of days from the original IPA incident to the interview.

PTSD and depression symptoms. PTSD symptom severity was assessed using a total score from the Posttraumatic Stress Diagnostic Scale (α = .82; Foa, Cashman, Jaycox, & Perry, 1997). At Time 1, many women did not meet the time requirement for PTSD; thus, we comment only on symptom severity and not PTSD diagnostic status. Depression symptoms were assessed with the Beck Depression Inventory–II (α = .91; Beck, Steer, Ball, & Ranieri, 1996).

Spatial data. Women's self-reported addresses (where they lived the majority of the time during which their IPA criminal cases were open) were geocoded. All spatial data were mapped using a coordinate system of North American Datum 1983, State Plane Colorado Central, Feet. Three sources provided proximal-environment data: the census of 2000, the Denver Police Department, and Denver County. We used data from the census of 2000 because the census of 2010 provided information about absolute population and race/ethnicity only and lacked other variables that could help capture advantage/disadvantage and that had been used in previous research (e.g., Pinchevsky & Wright, 2012), such as single-mother homes and homeowners. To address potential changes in neighborhoods driven by changes in overall population density from 2000 to 2010, we transformed all census of 2000 variables to percentages.

We examined all variables for potential autocorrelation by creating point data sets of ordinal values from the participant data. Using the Global Moran's I, we calculated an index value (i) such that values near 1.0 indicated clustering and values near −1.0 indicated dispersion (Moran, 1950). All data sets were tested on multiple spatial scales (2, 5, 7, and 10 miles), which is necessary to ensure the consistency of autocorrelation patterns.

Proximal spatial variables were developed using rasters with 1,000-ft pixels. To represent violent crime in neighborhoods, we used crime data from the Denver Police Department (2007–2009). Geocoded crime point data were aggregated to the number of violent crime incidences per pixel within a raster covering Denver County. We transformed all census block-level data from absolute values to percentages to account for changes in overall population from 2000 to when data collection occurred in 2007–2008. Following the same approach in the coding of participant race/ethnicity, we treated non-Latina Caucasian as the reference group and included percentage of Latino and percentage of African American in multiple regressions. As a result of very low representation and nonnormal distributions, we chose not to include other percentages of ethnic groups in the multiple regressions. These data were then converted into rasters. To represent economic strain in neighborhoods, we used four variables: 2009 land values for single-family homes (interpolated across Denver County using the same raster used for crime and census data) and percentage of single mothers, percentage of single fathers, and percentage of homeowners (transformed from census of 2000 data into raster data).

Measure for follow-up analyses. In follow-up analyses, we used the 16-item version of the Interpersonal Support Evaluation List (α = .88; Cohen, Mermelstein, Kamarck, & Hoberman, 1985). These items measure the concepts of belonging, tangible support, and perceived support. Items tap general social support (example item: "There is at least one person I know whose advice I really trust") rather than support specific to IPA. Instructions asked participants to think about the degree to which the 16 statements were true of them, although the instructions do not include a specific timeframe. Average scores were computed such that higher scores indicate greater levels of social support.

Results

Participants were 33% African American, 38% Latina, 16% Asian American, Pacific Islander, Native American or Alaskan Native (referred to as Other), and 46% non-Latina Caucasian (participants could select more than one group; thus, the total is greater than 100%). Figure S1 in the Supplemental Material available online represents the spatial distribution of participants as a function of ethnic-group membership. Means and standard deviations for continuous variables are reported in Table 1. Table 2 provides bivariate correlations among predictor variables.

Do proximal environments matter in terms of IPA severity and clinical responses?

To test whether proximal environments play a role in IPA severity, we geocoded participants' address data and

Table 1. Descriptive Statistics for Study Variables

Variable	*n*	*M*	*SD*
Blocks 1, 2, and 3: Participant characteristic			
Age	192	34.30	11.00
Socioeconomic status	192	–0.04	0.76
Blocks 2 and 3: Incident characteristic			
Physical aggression	186	2.94	2.72
Psychological aggression	186	4.44	2.70
Injuries	186	3.25	3.21
Fear	177	2.24	1.13
Time since incident	192	36.49	30.08
Block 3: Neighborhood characteristic			
% Latino	192	0.38	0.26
% African American	192	0.14	0.18
% Single mother	192	0.10	0.08
% Single father	192	0.02	0.01
% Homeowner	192	0.48	0.27
Land value (dollar/square foot)	192	18.89	16.53
Violent crime	192	75.45	60.68
Outcome			
PTSD symptom severity	186	16.27	12.08
Depression symptom severity	179	14.29	10.14
Social support	180	2.03	0.61

Note: Neighborhood variables reflect values of the 1,000-ft pixel in which women's residences fell.

created point data sets to characterize the IPA incident in terms of the total number of psychologically and physically aggressive tactics used against women, number of injuries women sustained, and fear. We also created point data sets for IPA reactions, including depression and PTSD symptom severity and social support.

We tested these seven IPA data sets for data set–wide spatial trends. Only the psychological-aggression data set was significantly spatially autocorrelated. Applying a distance threshold of 5 miles, the Moran's I for the number of psychologically aggressive tactics used against women was 1.2 ($z = 3.46$, $p < .001$); different spatial scales produced nearly identical results. The Moran's I values for the nonsignificant data sets at 5-mile thresholds were number of physically aggressive tactics (–0.52), number of injuries (–0.60), fear (0.02), depression (–0.03), PTSD symptom severity (–0.03), and social support (0.16). The significant spatial autocorrelation pattern for psychological aggression indicated that among women abused by their intimate male partners, those who lived nearer to one another, compared with women who lived farther apart, reported more similar levels of psychological aggression by their abusive partners.

Do proximal environments predict common clinical responses to IPA?

We created a neighborhood spatial database on the basis of geocoded participant addresses and spatial data sets. For every participant, we captured the spatial information (e.g., crime, land value) for each pixel in which the address coincided. The various values around the participants' addresses were then exported to SPSS for use in hierarchical regression analyses (for an illustration, see Figure S2 in the Supplemental Material).

Next, we examined the relative contributions of participant characteristics (age and race/ethnicity; Block 1), incident characteristics (psychological and physical aggression, injuries, fear, time since the event; Block 2), and proximal-environment characteristics (Block 3) to PTSD and depression symptom severity in two hierarchical regressions. In terms of proximal-environment characteristics, we selected variables that would characterize the racial-ethnic composition (percentage of Latino and percentage of African American relative to a Caucasian reference group), economic strain (percentage of single mothers, percentage of single fathers, percentage of homeowners, and land values), and other violent crimes in neighborhoods. Regression analyses were screened for multicollinearity problems, although none were detected.

PTSD. In Block 1, we entered participant characteristics alone; however, the model was not significant, $F(5, 165) = 0.23$, $p = .95$, adjusted $R^2 = –.02$. In Block 2, we added incident characteristics, $F(10, 160) = 18.48$, $p < .001$, adjusted $R^2 = .51$. Two variables significantly contributed to predicting PTSD symptoms on the second block: fear and participants' own Latina identity. Women who reported

Table 2. Bivariate Correlations Among Continuous Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Age		.03	−.20**	−.20**	−.05	.08	−.12	−.06	.10	−.06	−.02	.07	−.04	−.01	.04	.11	−.01
2. SES			−.12	−.07	−.19*	−.06	.07	.01	−.13	−.08	−.07	.08	−.02	−.14	.00	−.13	.15*
3. Physical aggression				.37***	.71***	.07	−.07	.08	−.04	.08	.05	−.02	−.05	−.01	.18*	.08	.00
4. Psychological aggression					.29***	.21**	−.08	−.02	−.08	.06	.10	−.03	.00	.02	.19**	.15	−.10
5. Injuries						.20**	−.07	.12	−.01	.17*	.09	−.11	.00	.02	.27***	.14	−.10
6. Fear							−.14	−.04	−.03	.11	.04	−.11	.05	−.02	.70***	.44***	−.24**
7. Time since incident								.05	−.09	−.10	−.06	−.02	−.08	−.03	−.05	−.10	.12
8. % Latino									−.24**	.40***	.61***	.02	−.32**	.02	−.13	−.15*	.14
9. % African American										.38***	.05	−.01	−.16*	−.01	.05	−.01	−.08
10. % Single mother											.47***	−.21**	−.28***	.02	.04	−.06	−.02
11. % Single father												.05	−.45***	−.06	.03	−.04	.00
12. % Homeowner													−.28	−.49***	−.07	.02	.00
13. Land value														.32***	.04	.07	−.02
14. Violent crime															.00	.02	.01
15. PTSD																.65	−.42
16. Depression																	−.52
17. Social support																	

Note: SES = socioeconomic status; PTSD = posttraumatic stress disorder.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3. Regression Coefficients in Hierarchical Models Predicting PTSD and Depression Symptom Severity

	PTSD				Depression			
Variable	*b*	*SE*	β	*t*	*b*	*SE*	β	*t*
Block 2: Participant characteristic + Incident characteristic								
Age	–0.01	0.06	–0.01	–0.18	0.04	0.07	0.04	0.55
African American	–0.68	0.79	–0.05	–0.86	–1.49	0.85	–0.14	–1.76^
Latina	–1.53	0.76	–0.12	–2.00*	–1.58	0.82	–0.15	–1.92^
Other minority	–0.94	0.91	–0.06	–1.03	–0.60	0.96	–0.04	–0.63
SES	0.78	0.88	0.05	0.88	–1.13	0.94	–0.09	–1.21
Physical aggression	–0.25	0.28	–0.05	–0.87	–0.21	0.31	–0.06	–0.68
Psychological aggression	0.52	0.37	0.12	1.41	0.22	0.44	0.06	0.50
Injuries	0.36	0.31	0.10	1.16	0.12	0.35	0.04	0.34
Fear	7.51	0.61	0.71	12.32***	3.97	0.66	0.45	6.02***
Time since incident	0.01	0.02	0.04	0.65	–0.03	0.02	–0.08	–1.13
Block 3: Participant characteristic + Incident characteristic + Spatial characteristic								
Age	–0.02	0.06	–0.02	–0.35	0.04	0.07	0.04	0.53
African American	–0.85	1.10	–.07	–0.77	–1.54	1.18	–0.14	–1.31
Latina	1.58	1.51	0.13	1.05	0.77	1.65	0.08	0.47
Other minority	–0.69	0.94	–0.04	–0.74	–0.24	1.00	–0.02	–0.23
SES	0.88	0.92	0.06	0.96	–1.35	0.97	–0.10	–1.39
Physical aggression	–0.33	0.29	–0.07	–1.16	–0.33	0.31	–0.09	–1.06
Psychological aggression	0.60	0.37	0.13	1.62	0.23	0.44	0.06	0.53
Injuries	0.50	0.31	0.13	1.62	0.33	0.35	0.11	0.95
Fear	7.54	0.62	0.71	12.14***	4.09	0.68	0.47	6.04***
Time since incident	0.02	0.02	0.05	0.96	–0.03	0.02	–0.08	–1.06
% Latino	–9.35	4.11	–0.20	–2.28*	–9.22	4.42	–0.24	–2.08*
% African American	1.94	4.96	0.03	0.39	–4.31	5.36	–0.08	–0.80
% Single mother	–15.63	12.07	–0.10	–1.30	–13.99	12.92	–0.11	–1.08
% Single father	148.57	61.41	0.18	2.42*	61.07	65.85	0.09	0.93
% Homeowner	0.42	3.07	0.01	0.14	3.52	3.35	0.09	1.05
Land value	0.02	0.05	0.02	0.33	0.01	0.06	0.01	0.16
Reported violent crime	0.01	0.01	0.04	0.63	0.01	0.01	0.04	0.49
Latina × % Latino	–5.95	3.15	–0.23	–1.89^	–4.08	3.38	–0.19	–1.21
African American × % African American	–0.42	4.21	–0.01	–0.10	1.47	4.58	0.03	0.32

Note: PTSD = posttraumatic stress disorder; SES = socioeconomic status.
^$p < .10$. *$p < .05$. ***$p < .001$.

higher levels of fear related to the IPA incident also reported greater PTSD symptom severity. Women who identified as Latina reported lower levels of PTSD relative to other women. Given links between identifying as Latina and symptoms in Block 2, we added two interaction terms to Block 3 to examine the interaction of participant's identity as Latina or African American and the census racial-ethnic composition variables for those groups: Latina Identity × Percentage of Latino and African American Identity × Percentage of African American. In Block 3, we entered spatial characteristics of the participants' local environments, $F(19, 151) = 10.91$, $p < .001$, adjusted $R^2 = .53$. When spatial-characteristic variables were entered, fear remained a significant predictor; however, women's Latina identity was no longer significantly related to PTSD symptom severity. Instead, the percentage of Latinos living near women was negatively associated with PTSD symptoms (i.e., as the percentage of Latinos in a neighborhood increased, women's reports of PTSD symptom severity decreased). In terms of neighborhood economic indicators, the percentage of single-father households also emerged as a significant predictor of PTSD symptom severity such that as the number of single-father households increased, so did women's reports of PTSD symptom severity. A trend for the Latina Identity × Percentage of Latino interaction suggested that Latina women living in neighborhoods with greater concentrations of Latino families reported fewer PTSD symptoms than did their peers. Regression coefficients for Blocks 2 and 3 are reported in Table 3.

Depression. In Block 1, we entered participant characteristics alone; however, the model was not significant, $F(5, 158) = 1.07$, $p = .38$, adjusted $R^2 = .002$. In Block 2, we added incident characteristics, $F(10, 153) = 5.10$, $p < .001$, adjusted $R^2 = .20$. As indicated by the regression coefficients reported in Table 3, a similar pattern to the PTSD findings emerged such that Latinas reported lower levels of depression. A trend suggested that African American women also reported lower levels of depression. In addition, fear was significantly positively associated with depression. Given links between identifying as Latina (as well as a trend for identifying as African American) and symptoms in Block 2, we added two interaction terms to Block 3 to examine the interaction of participant's identity as Latina or African American and the census racial-ethnic composition variables for those groups: Latina Identity × Percentage of Latino and African American Identity × Percentage of African American. When we entered spatial characteristics in Block 3, $F(19, 144) = 3.45$, $p < .001$, adjusted $R^2 = .22$, fear remained a significant predictor, whereas participants' Latina and African American racial-ethnic group membership did not. Furthermore, as the percentage of Latinos increased in a neighborhood, women's reports of depression symptoms decreased.

Exploratory analyses

We conducted exploratory analyses to test whether similar spatial patterns were present when predicting women's perceived social support. In particular, we entered the significant variables from the final step of the PTSD and depression regressions (fear, percentage of Latinos, and percentage of single fathers) as well as the Latina Identity × Percentage of Latino interaction term to predict social-support scores. The full model was significant, $F(4, 162) = 3.85$, $p < .01$, adjusted $R^2 = .06$. Consistent with the previous analyses, results showed that fear, $b = -0.12$, $SE = 0.04$, $\beta = -0.23$, $p < .01$, and percentage of Latinos, $b = 0.51$, $SE = 0.23$, $\beta = 0.22$, $p < .05$, contributed significantly to the model. However, percentage of single-father homes, $b = -3.32$, $SE = 3.87$, $\beta = -0.08$, and Latina Identity × Percentage of Latino interaction, $b = -0.08$, $SE = 0.11$, $\beta = -0.07$, were not significantly related to social support.

Discussion

Using a raster-based analysis, we identified several links between IPA characteristics, clinical responses, and proximal environments, which suggests that local environments may be important to both IPA severity and survivors' clinical responses. First, we documented significant spatial autocorrelation of women's reports of psychological aggression, which indicates that such experiences are, in some way, linked to proximal communities. Second, we controlled for IPA severity and other spatial factors and found that greater Latino ethnic composition in the proximal environments in which women lived was associated with lower PTSD and depression symptom severity. Third, follow-up analyses revealed that women's reports of greater overall social support (not specific to IPA) were also linked with greater Latino ethnic composition in the proximal environments in which women lived.

Women's reports of the number of psychologically aggressive tactics used against them were strongly clustered using multiple spatial scales, which showed that women who lived closer to one another reported more similar levels of psychological abuse by their partners than did women living further apart. This pattern cannot be explained by reporting biases or participant demographics because other variables tested were not autocorrelated; instead, this finding likely reflects something unique about psychological aggression. Psychological aggression comprises behaviors such as shouting at, insulting, and threatening a person and destroying property—all of which can be witnessed/overheard by others. Local environments may vary in the degree to which such behaviors are tolerated by neighbors/bystanders and, thus, may influence the spatial distribution of psychological aggression. Bystander responses that tolerate or condone psychological aggression (e.g., not calling the police when shouting is heard) may facilitate these behaviors, whereas responses that condemn may prompt changes in offender behaviors (e.g., decreased aggression, relocation of offenders). Similarly, other research has shown that communities can be distinguished by the level to which they are willing to intervene, which is linked to rates of IPA (Browning & Cagney, 2002). Thus, the spatial autocorrelation may point to links between IPA psychological aggression and collective efficacy through social cohesion ("I know my neighbors and share their values") and informal social control (neighbors' preventing behaviors).

Alternatively, the spatial autocorrelation pattern may reflect something about offenders in particular. Offenders may seek out locations/communities in which abusive behaviors are less likely to be challenged (e.g., Salter, 2003). On the basis of the current data, we cannot draw conclusions in either case; however, we can emphasize the potential value in uncovering spatially autocorrelated data when data are allowed to self-organize in grid-based approaches (vs. a researcher-imposed organization in polygons). The current study documents that autocorrelated data are rare; thus, when spatial autocorrelation is detected, it may offer valuable insight into mechanisms. From a policy or intervention standpoint, our data and data of other researchers (Browning & Cagney, 2002)

suggest interventions may be more useful if deployed to neighborhoods as opposed to isolated individuals. Furthermore, this particular finding raises another question in regard to IPA studies in which data were analyzed using a different method. By not aggregating the data into polygons, we were able to use the entire data set rather than compare only partial segments that are considered adjunct, which raises the question whether other IPA data already reported in the literature would show similar autocorrelation patterns if analyzed using a raster-based method.

We also examined the relative contributions of participant, incident, and proximal-environment characteristics to women's PTSD and depression symptoms following experiences of IPA. Participant characteristics alone did not significantly predict symptom severity following IPA exposure. When we added incident characteristics in Block 2, fear was significantly positively related to symptom severity, which replicates other findings linking appraisals, including fear, and psychological distress (DePrince et al., 2010). Furthermore, Latinas reported lower PTSD symptom severity relative to other women; trends suggested that relative to other women, Latina as well as African American participants reported lower levels of depression. If we had stopped at this second step, we would have wondered what was different or unique for Latinas that resulted in lower levels of PTSD symptoms (and a trend for lower depression symptoms among Latina and African American women). However, when spatial neighborhood characteristics were added to the model, the effect for women's own Latina ethnicity was no longer significant. Instead, the percentage of Latinos living near women was inversely linked to their self-reported symptoms. An interaction trend suggested that relative to other women, Latinas reported lower PTSD symptoms when living in Latino neighborhoods. Thus, the effect of living in a community more densely populated by Latinos may be more pronounced for Latina women for PTSD reactions (although this was only a trend); however, the buffering effect of living in a Latino neighborhood in terms of depression symptoms was not specific to Latinas in that community. It is important to note that by testing spatial characteristics, we moved beyond a focus on what it is about a particular group of women that leads to patterns of reporting about symptoms and instead asked what it is about women's proximal environments that promote resilience or distress.

To place these findings in the context of the larger literature on IPA, we turned to work on the so-called Latino paradox, which has demonstrated that despite higher poverty levels and less access to education and work, Latino communities are linked with decreases in crime and improvements in a range of health markers (e.g., Alegría et al., 2008; Cagney, Browning, & Wallace, 2007; Martinez, 2002; Rumbaut & Ewing, 2007; Shihadeh & Barranco, 2010). Wright and Benson (2010) found that neighborhood IPA rates and immigration-concentration levels in Chicago were inversely related, although the study did not include individual-level data on clinical responses to IPA. Extending that work, in the current study with English-speaking female participants, we found that social support was positively correlated with Latino community composition. Thus, links between Latino community and women's well-being are not specific to women who have more recently immigrated or who are less acculturated (as indicated by language). Social support may play a role in links between neighborhoods with greater Latino ethnic composition and women's reports of lower symptoms, although more clinical research that considers proximal environments (e.g., neighbors, infrastructure, distance to services) is needed.

Because of the exploratory nature of this work, we tested a large model relative to our sample size. Thus, null tests for individual betas should not be used to rule out the influence of variables on IPA responses; we may simply have lacked power to detect smaller individual effects. The current findings focused on women with police-reported IPA, which leaves open questions about the degree to which findings generalize to women whose experiences of IPA are not reported to law enforcement. Furthermore, this cross-sectional study informs understanding of associations between proximal environments and IPA exposure/clinical responses but does not speak to causal processes. Although a strength of the current study is the use of a range of objective measures of proximal environments, a limitation is the reliance on census of 2000 data. We elected to use census data from 2000 because the census data from 2010 did not include the detailed variables available in the census of 2000 (e.g., percentage of single mothers and fathers). In fact, none of the census variables used, other than race/ethnicity, were available in the 2010 data. To address potential changes in neighborhoods over time that would be driven, for example, by shifts in population density, we transformed all census of 2000 variables to percentages. Although census data do not offer insight into neighborhood-level processes, the data do suggest that there may be value in considering the neighborhood context in future research.

As psychologists consider geographic context in clinical outcomes, two critical questions stand out for future work. First, this work leads to fundamental questions regarding how we think about space in psychological science generally as well as how we use space to understand some of the unique characteristics of clinical responses to violence. Moving away from thinking of space as arbitrarily shaped polygons, this article describes methods that offer a new way to identify psychological

processes that are rooted in local influences. Although spatial autocorrelations are a challenge in vector-based approaches, they offer a potentially powerful lens through which to identify local forces in raster-based approaches. In future work, researchers should examine psychological process variables spatially to identify autocorrelation and thereby potential processes for intervention/prevention.

Furthermore, a raster-based approach encourages questions about the fluidity and navigation of continuous spaces. With regard to IPA (and trauma more generally), this raises interesting and important questions about how victims perceive and navigate space, particularly if space is in and of itself a potential traumatic reminder. One of the hallmark PTSD responses to trauma, including IPA, is avoidance of reminders of the event—including places. When the space in which women live is linked to the IPA experience, a future study could evaluate how women's sense of proximal space shrinks or expands as they seek to avoid reminders of the event. Moreover, studies could evaluate the degree to which the composition of the proximal environment interacts with victims' perceptions of IPA reminders and their movement in space. It may be, for example, that some women perceive that their geographic context actually shrinks in the immediate aftermath of IPA exposure such that their movements become constrained and the relative importance of the compositional characteristics of their immediate environs increases. We heard anecdotal reports from women in the study from which these data were drawn that they began limiting their use of public transportation because nearby businesses were used by the abuser or his friends. In such cases, the characteristics of the immediate environs may play a bigger role in abused women's lives because their use of and exposure to other spaces has literally decreased.

Second, our findings lead to questions about the extent to which general versus IPA-specific processes in proximal environments predict victim responses to IPA. The current study revealed that women's perceptions of overall social support (not specific to IPA and not specific to their proximal environments) were positively associated with Latino ethnic composition of proximal environments. This finding suggests that general processes, not necessarily specific to IPA, may have an influence on victims' coping in the aftermath of IPA; however, we did not measure women's perception of neighborhood social support or IPA-specific social support. The fact that we also found spatial autocorrelation in the severity of psychological aggression reported by women suggests that IPA-specific processes are also at work in neighborhoods, particularly for a form of violence that can be overheard (i.e., yelling and shouting). Although both general and specific neighborhood pathways may be important to understanding characteristics of IPA and clinical responses, a significant next study would systematically assess perceptions of general and IPA-specific social support as well as the degree to which that support is rooted in proximal environments versus in other social networks. In such a study, researchers would gather detailed measurements of women's perceptions of general and IPA-specific social support from persons living near them as well as from social networks outside their proximal environments. These perceptions could then be examined in relation to characteristics of the proximal environments and women's responses to the IPA. Understanding of the general versus IPA-specific processes at play will offer inroads into intervention/prevention. For example, if more general processes predict responses to IPA, policymakers might recruit a host of allied stakeholders, beyond those stakeholders concerned primarily with victim services, to invest in interventions that increase support in neighborhoods.

Author Contributions

A. P. DePrince, S. E. Buckingham, and J. Belknap contributed to the study design. A. P. DePrince oversaw the collection of participant data. S. E. Buckingham acquired the spatial data and created the GIS. A. P. DePrince and S. E. Buckingham analyzed the data. All authors drafted the manuscript and approved the final version of the manuscript for submission.

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Supplemental Material

Additional supporting information may be found at http://cpx.sagepub.com/content/by/supplemental-data

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