

Maternal Parenting Mediates the Association Between Neighborhood Disadvantage and Adolescent Mental Health

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ABSTRACT

Disadvantaged neighborhoods are associated with increased risk for anxiety and depression in children and adolescents; however, the mechanisms accounting for this association are not fully understood. Using a longitudinal design, we investigated whether maternal affective behavior during parent-child interactions mediate the relationship between neighborhood disadvantage and symptoms of anxiety and depression in early- to mid-adolescence. A community sample of 245 adolescents and their parents participated in a baseline assessment (age 12-13; n = 121 male) that included an observational assessment of parent-adolescent interactions, and adolescent-report questionnaires assessing depressive and anxiety symptoms. Neighborhood disadvantage was assessed by combining Postal Area data with a measure of neighborhood disadvantage (Pink, 2006) developed by the Australian Bureau of Statistics. Adolescents were followed-up approximately 4 years later and again completed questionnaires assessing depressive and anxious symptoms. Mothers from disadvantaged neighborhoods were more likely to display aggressive and dysphoric behavior for longer periods, and positive behavior for shorter periods. Mediation analyses demonstrated that the duration of maternal aggression partially mediated the relationship between neighborhood disadvantage and depressive and anxious symptoms at follow-up. The findings of this study suggest that the neighborhood environment is likely to influence adolescents indirectly through its effects on maternal parenting behavior. Prevention and intervention programs targeting parenting in the families of adolescents from disadvantaged neighborhoods may be warranted to prevent the development of internalizing disorders.

The effects of living in disadvantaged neighborhoods have long been linked to a variety of negative outcomes throughout childhood and adolescence, and across different domains, such as physical health, academic achievement, and cognitive development. Though there are many long-term negative outcomes associated with poverty, mental health issues are particularly persistent and prevalent. Children and adolescents from disadvantaged neighborhoods, commonly defined as those with concentrated poverty as well as associated characteristics such as high levels of unemployment or crime (Kim, 2008), are at increased risk for both depression and anxiety (Cutrona, Wallace, & Wesner, 2006). The effects of neighborhoods on adolescent mental health has been demonstrated in several studies. For example, one longitudinal study found that greater neighborhood disadvantage was significantly associated with increased internalizing and externalizing symptoms, even after controlling for parent socioeconomic status (Schneiders et al., 2003). Other quasi-experimental studies have found that adolescents experienced large reductions in symptoms of anxiety and depression after moving to less disadvantaged areas (Katz, Kling, & Liebman, 2001; Leventhal & Brooks-Gunn, 2003), demonstrating that current exposure to neighborhoods could be a contextual factor for internalizing symptoms. However, this research does not provide insight into the mechanisms through which neighborhoods influence risk for depression and anxiety. Researchers have proposed that neighborhood context may be mediated by proximal factors, such as stress or parenting, that ultimately influence individual adjustment (Ingoldsby & Shaw, 2002). Understanding these mediating relationships may give insight into the mechanisms through which neighborhood influences risk for depression and anxiety in adolescence.

One important distinction to make when discussing these studies is the difference between poverty and neighborhood disadvantage. Though families of low SES are more likely to be in disadvantaged neighborhoods, this is not universally true. Individuals who live

in disadvantaged neighborhoods may have a high SES. This would mean that, while family income is incongruent with their overall surroundings, the family is still in the same environment as others, experiencing many of the same hardships as individuals around them (e.g., crime, community involvement). Therefore, it is important to make a distinction between SES and neighborhood disadvantage. To date, there have been very few studies examining neighborhood characteristics and parenting.

Parenting quality represents a potentially important mediating factor as several studies have shown that parenting quality is predictive of later increase in mental health symptoms (Ge, Best, Conger, & Simons, 1996; Schwartz et al., 2014). In particular, considerable evidence suggests that warm, supportive parenting is beneficial to adolescent development (Schwartz, Sheeber, Dudgeon, & Allen, 2012; Baumrind, 1991; Lamborn, Mounts, Steinberg, & Dornbusch, 1991), while hostile and unsupportive parenting increases risk for depression and anxiety (Ge, Conger, Lorenz, & Simons, 1994).

One important aspect of parenting quality that may be relevant as a mediating factor is parental display of positive and negative emotions during interactions with their children (Morris, Silk, Steinberg, Myers, & Robinson, 2007), which has been prospectively associated with risk for adolescent-onset depression (e.g., Schwartz et al., 2018). Display of affective behavior can be operationalized by the duration of episodes of affective behavior. For instance, longer duration of negative affect, such as aggression or dysphoria, is thought to reflect an inability to shift out of undesirable mood states and interactional patterns, while a shorter duration of positive affective behavior is thought to reflect an inability to maintain desirable mood states (Bariola, Gullone, & Hughes, 2011). Two longitudinal analyses based on the cohort in the current study have demonstrated a prospective link between parents' displays of aggressive and positive affective behavior and change in symptoms of depression and anxiety (Schwartz et al., 2011) and the onset of Major Depressive Disorder (Schwartz et

al., 2014).

Neighborhoods, parenting quality, and risk for depression and anxiety

Compared to parents in less disadvantaged neighborhoods, parents in disadvantaged neighborhoods are (1) less likely to interact with their children in a warm, supportive, consistent, and involved manner (Downey & Coyne, 1990; Simons, Johnson, Beaman, Conger, & Whitbeck, 1996); and (2) more likely to use harsh and unpredictable parenting (Pinderhughes, Nix, Foster, & Jones, 2004; Downey & Coyne, 1990).

Parenting style has long been hypothesized as a mediating factor between neighborhood disadvantage and negative mental health outcomes (Bronfenbrenner & Morris, 1998); however, historically, the small number of studies that have examined this have been cross-sectional and used self-report measures. On the whole, this research suggests that aggressive or conflictual interactions are one of the most significant mediating parenting factors between the neighborhood environment and internalizing disorders. For example, Deng and colleagues (2006) examined parent-child conflict in 189 low-income, European and Mexican American children and their mothers, and determined that mother-reported (but not child-reported) parent-child conflict significantly mediated the relationship between mother's perceptions of their neighborhood quality, and child internalizing disorders. A much larger study examined 14,500 parents and adolescents and determined that hostile or harsh parenting was more common in neighborhoods with poorer social resources, which was then found to increase risk for depression and anxiety in children (Wickrama & Bryant, 2004). One longitudinal study examined 14,000 adolescents and determined that parental reports of uninvolved parenting and adolescents' reports of parental rejection were directly related to both neighborhood disadvantage and adolescents' risk for depression in adulthood (Wickrama & Noh, 2010).

While there are relatively few studies that have looked at the mediating role of

neighborhood disadvantage on adolescent depression, there are also a few longitudinal studies that have tested whether poverty mediates the relationship between parenting and adolescent internalizing symptoms. The first study to do so found that current poverty was indirectly associated with higher adolescent internalizing symptoms, through high levels of physical punishment and low levels of responsiveness (McLeod & Shanahan, 1993). One longitudinal study that followed families of newborns until the age of three found that parental stress and harsh discipline mediated the effect between economic disadvantage and internalizing and externalizing symptoms (Rijlaarsdam et al., 2013). Another recent study sought to determine if adolescent mental health issues were mediated by duration and severity of poverty in a Canadian sample (Strohschein & Gauthier, 2017). Though this study found that severity of current poverty was associated with anxiety and depression, parenting style did not mediate the relationship between duration and severity of poverty and internalizing outcomes. It should be noted, however, that these studies used self-report measures, which are more subjective and likely to be subject to recall and other forms of biases than are observational measures.

There is mixed evidence regarding the extent to which positive interactional behaviors mediate the association between neighborhood disadvantage and internalizing symptoms, with several studies finding that family cohesion, but not parental warmth, mediates the relationship between neighborhood disadvantage and internalizing disorders in children and adolescents (Deng et al., 2006; White & Roosa, 2012). In particular, several studies have failed to find a mediating role for parental warmth in the relationship between neighborhood quality and internalizing symptoms (White & Roosa, 2012; Gonzales et al., 2011).

The current study

Research suggests that conflictual family behavior as well as an absence of warm and supportive behavior may mediate the relationship between poverty or neighborhood

disadvantage and internalizing symptoms in adolescents. However, much of this research has been limited by the use of cross-sectional designs and questionnaire measures of parenting. The current study aimed to improve on previous research by taking a longitudinal approach in order to investigate whether parenting mediates the association between neighborhood disadvantage and change in internalizing symptoms across adolescence. Second, the current study also aimed to improve on the previous research by measuring parent interaction using direct observation, as observational measures are considered the most objective and valid way to measure parent affective behavior (Zeman, Klimes-Dougan, Cassano, & Adrian, 2007). Observational measures are superior in that they provide a more ‘natural’ assessment than self-report data (Morris, Robinson, & Eisenberg, 2006), allows for behavior to be measured that participants may not be consciously aware of, such as non-verbal behavior (Bakeman & Gnisci, 2006), and is less subject to social desirability than self-report methods (Morris et al., 2006). To date, no previous studies of neighborhood disadvantage and internalizing symptoms has used both a longitudinal design and observational measures of parenting behavior.

It was hypothesized that mothers’ ability expression of aggressive, dysphoric and positive behavior while interacting with their children would significantly mediate the relationship between neighborhood disadvantage and internalizing symptoms in adolescents. Specifically, disadvantaged neighborhoods were predicted to be associated with longer duration of parental aggression and dysphoria and shorter duration of parental positivity, which in turn would be associated with increased symptoms of depression and anxiety in adolescents at a subsequent follow-up assessment.

Method

The data presented here was drawn from the Adolescent Development Study (ADS), a large, longitudinal study conducted in Melbourne, Australia (for further detail, see Yap,

Schwartz, Byrne, Simmons, & Allen, 2010; Yap, Allen, & Ladouceur, 2008). The current analyses drew on two waves of ADS data collection: a *baseline* assessment, which included an observational family-interaction assessment, an assessment of neighborhood disadvantage, and questionnaire measures of depressive and anxious symptoms, and a *follow-up* assessment, which was conducted approximately four years after baseline and included questionnaire measures of depressive and anxious symptoms.

Participants

The screening sample was drawn from the target population of final year primary school students (Grade 6; ages approximately 10–12 years) in metropolitan Melbourne, Australia. The aim of the screening was to identify a sample representing the full spectrum of risk for psychopathology as a function of temperament, as measured by the Early Adolescent Temperament Questionnaire—Revised (EATQ-R; Ellis & Rothbart, 2001). A total of 2453 students (53.5% of the sampling population; 52% female; mean age 11.62 years) participated.

Following the screening, a sample of 415 students ($n = 121$ male) was selected on the basis of their EATQ-R scores on the Negative Affectivity factor, which includes items that measure tendency for frustration, and the Effortful Control factor, which includes items relating to capacity for attention and self-regulation. High and low scores on these scales, respectively, have been associated with depressive and anxiety symptoms in adolescents (Ellis & Rothbart, 2001; Muris, Van Der Pennen, Sigmond, & Mayer, 2008). The selected sample of 415 students had equal numbers of students with EATQ-R scores that were 0–1, 1–2, 2–2.5, and greater than 2.5 standard deviations above and below the mean on the higher order factors of Negative Affectivity and Effortful Control. Thus, adolescents with scores in the tails of the distribution were over-represented in the selected sample. Of the 415 students selected, 245 (mean age 12.47 years, range 11.38 – 13.61) agreed to participate in the baseline data phase and form the sample used in this study.

Procedures

Questionnaire assessment at baseline and follow-up. At the baseline assessment, adolescents completed anxiety and depression questionnaires and provided both demographic data and their postal code. Family socio-economic status (SES) was assessed using data on parental occupation (or education level if occupation was missing) at baseline according to the *ANU_4 scale* (Jones & McMillan, 2001), which is a socioeconomic index developed for the Australian context. This assessment took place an average of 10.14 months (range 3.90–17.30) after the school screening. The follow-up assessment took place approximately four years after the baseline assessment, when the average age of participants was 16.64 years ($SD = 0.60$ years). Of the 245 original participants, 181 (74%) participated in the follow-up assessment. Adolescents were reimbursed for their time.

Family Interaction Assessment. Adolescents ($n=194$) and one of their parents (159 mothers and 35 fathers) completed the lab-based family interaction assessment, which occurred a mean duration of 1.96 months (range 0.03–8.04) following the baseline questionnaire assessment. Families completed two 20-minute interaction tasks that were video-recorded for subsequent coding. The first task was an event-planning interaction (EPI) and the second was a problem-solving interaction (PSI). The tasks were intended to differentially elicit positive and negative behavior, respectively. The ordering of tasks was fixed because of concern that negative affective states, which are harder to shift out of than positive states (Gilboa, Revelle, Van Goozen, Van de Poll, & Sergeant, 1994), had the potential to persist into the EPI if it were conducted second.

For the EPI, parents and adolescents were instructed to plan one or more pleasant events, with up to five topics for discussion chosen based on events that both the parent and adolescent rated as being ‘very pleasant’ on the Pleasant Events Schedule (MacPhillamy & Lewinsohn, 1976). For the PSI, the interviewer selected up to five issues for discussion that

both the parent and adolescent endorsed as occurring the most frequently and generating the highest intensity of anger on the Issues Checklist (Prinz, Foster, Kent, & O'Leary, 1979).

One family completed only the EPI, and not the PSI.

Though both fathers and mothers took part in the family interaction task, the current study used only data from mothers, given they formed the majority of participating parents. While fathers clearly play a significant role in adolescent development (Sheeber et al., 2007), the small sample of fathers in the current study lacked the power to allow for examination of processes involved in parenting by fathers.

Measures

Center for Epidemiological Studies—Depression (CES-D). The CES-D (Radloff, 1977) is a 20-item self-report questionnaire designed to measure symptoms of depression in the general population. A higher score indicates greater frequency and number of depression symptoms. The CES-D has an established validation history of use in adolescent populations (Radloff, 1991).

Beck Anxiety Inventory (BAI). The Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988; Beck et al., 1988) is a self-report questionnaire measuring clinical symptoms of anxiety. It consists of 21 common anxiety symptoms that were chosen to avoid overlap with depressive symptoms (Beck et al., 1988). The BAI has been commonly used with adolescent populations and has been found to have adequate reliability and validity (Osman et al., 2002).

Living in Family Environments (LIFE) Coding System. The LIFE (Hops, Davis, & Longoria, 1995) is an observational coding system that enables a detailed analysis of individual family members' behaviors. The LIFE consists of 10 nonverbal affect codes (e.g., anger, anxious, dysphoric, pleasant, neutral, happy, caring) and 27 verbal content codes (e.g., validation, complaint, provoke). Coding of video-recorded interactions used an event-based

protocol in which new codes were entered each time the affect or content of one of the interactants changed. These codes were used to develop composite behavior constructs. In this study, the constructs were Aggressive, Dysphoric, and Positive behavior. Aggressive behavior included all codes with contemptuous, angry, or belligerent affect, as well as cruel, provocative, or annoying/ disruptive verbal statements made with neutral affect. Dysphoric behavior consisted of all codes with dysphoric, anxious, or whining affect, as well as complaints and self-derogatory verbal comments made with neutral affect. Positive behavior included all codes with happy, pleasant, and caring affect as well as approving, validating, affectionate or humorous comments made with neutral affect. The LIFE data was used to construct duration per episode (DPE) variables, which represent the average length of time that a behavior was maintained each time it was displayed. It was calculated by dividing the overall duration of the behavior by the frequency with which it occurred in the interaction (Sheeber et al., 2009).

Coders were extensively trained and blind to the clinical and demographic characteristics of the participants. Approximately 20% of the interactions were coded by a second observer to provide an estimate of observer agreement. Random pairs of observers were assigned to the interactions to minimize ‘drift’ between any two observers and to ensure that all observers met minimal criteria for acceptable observations. Inter-observer agreement was assessed using Kappa, a conservative index that controls for chance agreement (Hops et al., 1995). Kappa coefficients for the Aggressive, Dysphoric, and Positive behavior constructs were, respectively, 0.70, 0.57, and 0.86 for mothers. The validity of the LIFE system as a measure of family processes associated with adolescent internalizing symptoms has been established in numerous studies (e.g., Bodner, Kuppens, Allen, Sheeber & Ceulemans, 2017; Sheeber, Davis, Leve, Hops, & Tildesley, 2007).

Neighborhood Disadvantage. The level of relative disadvantage of participants’

neighborhoods was assessed by combining Postal Area data collected during the baseline assessment with a measure of disadvantage called the Index of Relative Socio-economic Advantage and Disadvantage from the Socio-Economic Indexes For Areas (SEIFA) developed by the Australian Bureau of Statistics (Pink, 2006). This index aims to encompass the entire socio-economic spectrum of each neighborhood area (postcode). SEIFA indexes are assigned to Postcodes and are derived from a weighted composite of 31 different indicators of socioeconomic disadvantage and advantage (Bailey et al., 2003; Walker & Hiller, 2007), including, for example, income, education, employment, occupation, housing.

Between baseline and follow-up, only 11 (4.5%) participants moved to neighborhoods with a SEIFA score more than one standard deviation lower or higher than their previous neighborhood, indicating that participants generally remained in a neighborhood of similar disadvantage throughout their adolescence.

Statistical analyses

Regression analyses were first performed to test the direct associations between neighborhood disadvantage and symptoms at follow-up, and the indirect path between neighborhood disadvantage and symptoms as mediated by parenting behavior.

Mediation was tested using the INDIRECT macro (Preacher, Rucker, & Hayes, 2007), which generates bootstrap confidence intervals for total and specific indirect effects. Putative mediators were selected if neighborhood disadvantage demonstrated a significant direct effect on them. All mediational analyses examined whether these variables mediated the relationship between neighborhood disadvantage and (1) change in depressive symptoms from baseline to follow up, and (2) change in anxious symptoms from baseline to follow up. Even if a significant relationship was not detected between neighborhood disadvantage and internalizing symptoms, mediational analyses were conducted to determine whether there were any indirect, mediating relationships between these variables. This approach is

recommended (e.g., Collins, Graham, & Flaherty, 1998; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002), because that the most important test in a mediational analysis is of the indirect path, as other unexplored *suppressor* variables can suppress other mediator variables, leading to a non-significant observed relationship between the independent (i.e., neighborhood disadvantage) and dependent (i.e., internalizing symptoms) variables.

Gender and baseline symptoms were included as covariates of no interest in all analyses, and all analyses were also performed and reported both with and without family SES as an additional control variable (as the addition of family SES provides a more stringent, but perhaps overly conservative, test of the effect of neighborhood disadvantage given the expected significant correlation between these two variables).

Missing data imputation

With regard to symptom data, 3.27% and 28.2% of participants did not complete the BAI at baseline and follow up respectively, and 7.35% and 28.6% did not complete the CES-D at baseline and follow up respectively. As mentioned above, 19.6% of the original 245 families did not complete the family assessment, while one family only completed the EPI and not the PSI. For all missing data, data imputation was conducted using the expectation-maximization (EM) algorithm within SPSS.

Results

Descriptive statistics

Descriptive statistics are summarized in Supplemental Table 1. There was an overall decline in self-reported depressive symptoms between baseline and follow up. The correlation between CESD and BAI scores was .69 at baseline and .68 at follow up. This suggests that, while these constructs do share significant overlap, there is not such a high correlation as to make them redundant. With respect to measures of neighborhood

disadvantage and family SES scores, note that a higher score on each scale indicates a lower level of neighborhood disadvantage/higher SES. Both scales showed high negative skewness, with a slight overrepresentation of less disadvantaged neighborhoods/higher SES families, however this is to be expected from a cohort of families who are willing to participate in research (Heinrichs, Bertram, Kuschel, & Hahlweg, 2005).

Maternal affective behavior (DPE) data

Descriptive statistics for the three styles of maternal affective behavior are displayed in Supplemental Table 2. More persistent negative expressions (i.e., aversive and dysphoric) of emotion were displayed during the conflictual task (PSI). In particular, mothers were also more likely to display aggressive behavior for longer periods during the PSI compared to the EPI ($t_{385} = 10.89, p < 0.0001$).

Regression analyses

Neighborhood disadvantage did not predict change in depressive or anxious symptoms at follow up (controlling for baseline symptoms)¹. A gender by neighborhood disadvantage interaction term was also entered into all tested models, however, this term was not significant in any model (i.e., gender did not moderate any of the relationships tested), thus it was removed from final analyses. Neighborhood disadvantage was a significant predictor of longer duration per episode of aggressive behavior on both the PSI and EPI (See Table 1 and 2). It was also found to be a significant predictor of longer duration of dysphoric behavior, and shorter duration of positive behavior on the EPI. Neighborhood disadvantage was not found to be a significant predictor of dysphoric or positive behavior on the PSI.

Maternal affective behavior as a mediator between neighborhood disadvantage and internalizing symptoms.

¹ A gender by neighborhood disadvantage interaction term was also entered into all tested models, however, this term was not significant in any model (i.e., gender did not moderate any of the relationships tested), thus it was removed from final analyses.

A series of mediation models (controlling for adolescent gender) were conducted to examine whether there was an indirect association between neighbourhood disadvantage and subsequent internalizing symptoms, through maternal affective behaviour. DPE of Maternal Aggression during the PSI and the EPI was found to significantly mediate the relationship between neighborhood disadvantage and follow-up depressive symptoms (see Table 3) and follow-up anxious symptoms (see Table 4). Higher levels of neighborhood disadvantage predicted higher symptoms of depression and anxiety via longer duration of maternal aggression during the PSI and EPI. No other maternal affective behaviors (DPE) were found to mediate the relationship between neighbourhood disadvantage and depression or anxiety (see supplementary Table 3 and supplementary Table 4 for summaries).

Analyses of significant effects controlling for family SES

A series of additional analyses were conducted to determine whether the effects remained after controlling for family SES. These analyses found that neighbourhood disadvantage remained a significant predictor in five of six analyses of direct relationships (duration per episode of aggressive behavior on the EPI was no longer significant; see Supplementary Table 5), while aggressive behavior on the PSI (but not EPI) remained a significant mediator of the relationship between neighborhood disadvantage and internalizing symptoms at follow-up (see Supplementary Table 6 and 7). This indicates that there is a significant effect of neighborhood disadvantage on these outcome variables over and above the influence of family SES (which includes the shared influence of neighbourhood disadvantage and family SES).

Discussion

The aim of this study was to determine whether maternal displays of affective behavior mediated the relationship between neighborhood disadvantage and internalizing

symptoms in adolescents. Hypotheses regarding the mediating role of maternal aggression and internalizing symptoms were supported. Mothers from more disadvantaged neighborhoods were found to display longer episodes of aggressive behavior during both tasks, and this, in turn, was found to predict depression and anxiety scores across a 4 year follow up period. These findings held true for the PSI task when the effect of family SES was accounted for, indicating a unique effect of neighborhood environment over and above the effect of family SES. These findings suggest that maternal aggressive behavior may represent a pathway from neighborhood disadvantage to risk for increasing internalizing symptoms in adolescence over time.

Mothers from more disadvantaged neighborhoods were also found to differ in terms of dysphoric and positive interpersonal behavior. In comparison to mothers from less disadvantaged neighborhoods, they displayed longer periods of dysphoric behavior and shorter periods of positive behavior (during the EPI). However, unlike maternal aggression, these behaviors were not associated with risk for depression or anxiety in adolescents at follow up.

The findings of the current study are in line with other research in indicating that parents from disadvantaged neighborhoods are more likely to demonstrate poorer parenting practices, such as less warm, consistent and supportive parenting (Simons et al., 1996; Downey & Coyne, 1990), more harsh, hostile and coercive parenting (Pinderhughes et al., 2004; Simons et al., 1996; Downey & Coyne, 1990), and are more likely to display poorer regulation of emotions and behavior (Klebanov et al., 1994; Leventhal & Brooks-Gunn, 2000; Guterman, Lee, Taylor, & Rathouz, 2009). The results of the current study also support other studies that have directly examined the mediating role of parenting. Similar to our findings, these studies have found aggressive, but not positive parenting, to play a significant mediating role in the relationship between neighborhood and internalizing symptoms (Deng

et al., 2006; White & Roosa, 2012; Lewinsohn, Clarke, Seeley, & Rohde, 1994), while dysphoric behavior has not been examined previously. Importantly, however, the current study extends upon the findings of previous studies by examining associations prospectively, by measuring parenting behavior using direct observation, and by providing a comprehensive independent measure of neighborhood disadvantage.

Aggression may be a more consistent mediator because it is a more salient outcome of the stressors associated with economically disadvantaged environments than are other affective outcomes, at least with respect to the consequent risk for depression in offspring. Although we do not fully understand the mechanisms responsible for this association, prior research suggests that some plausible candidates may include a sense of lack of control (Bugental & Happaney, 2004), neighborhood-related stress (Earls, McGuire, & Shay, 1994), and poorer neighborhood role models (Coleman, 1994). Also, mothers from disadvantaged neighborhoods are more likely to use aggression as a form of punishment when their children misbehave (CITE). This may occur for several reasons. Mothers from disadvantaged neighborhoods are more likely to experience stress and thus may have a lower frustration tolerance (Guterman et al., 2009). They may feel they need to be strict in order to prevent their children from being exposed to dangers in their neighborhood (Furstenberg, 1993; Baumrind, 1972), and their children may be more likely to engage in aggressive and externalizing behaviors, which are likely to initiate aggressive behavior in parents (Leventhal & Brooks-Gunn, 2000). Supporting these theories is previous research indicating that parents from disadvantaged neighborhoods are more likely to report using coercive or punishing parenting (Downey & Coyne, 1990), and are more likely to believe that this form of parenting is an effective response to misbehavior from children (Kohen, Leventhal, Dahinten, & McIntosh, 2008). Nevertheless, the consistency with which studies have found that aggressive behavior mediates the association between socioeconomic disadvantage and child

mental health outcomes across multiple studies does suggest that aggressive parenting should be a prioritized target for interventions that seek to buffer the impact of neighborhood factors on offspring mental health outcomes.

There are also possible alternative hypotheses to explain the differences in duration of affective behavior found in the current study that should be considered. It is possible that differences in rates of anxiety and depression between parents from disadvantaged and less disadvantaged neighborhoods explain the differences in duration of affective behavior, as several studies have indicated that depression and anxiety is associated with increased levels of hostile, coercive, and disengaged parenting practices (Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Another possibility is that the differences in duration of affective behaviors are due to more frequent misbehavior from children from disadvantaged neighborhoods, as externalizing symptoms are more common in these neighborhoods (Leventhal & Brooks-Gunn, 2000), and may induce dysphoric, aggressive or less positive behavior from mothers.

A number of limitations of this study should be noted. The effect sizes observed in regard to neighborhood influences were relatively small; however, this could possibly be due to the relative lack of range in neighborhood quality within our sample. The current analysis also only used data from mothers, as they formed the majority of participating parents. While under-recruitment of fathers is a common problem in developmental research (Cassano, Adrian, Veits, & Zeman, 2006), future research should aim to actively recruit fathers in order to comprehensively assess the dynamics of adolescents' family environments.

This study also had important methodological strengths. Of great advantage was its ability to study neighborhood effects longitudinally, with the majority of the studies conducted so far being cross-sectional (Mair, Roux, & Galea, 2008). The use of independent measures (i.e., neighborhood data from public statistics, parenting data from behavioral observation, symptom data from self-report) was another design strength. Indeed, this study

was the first to use observational measures of parenting behavior, which is likely to provide a more objective assessment (Zeman et al., 2007). The current study is also important in its formal statistical testing of the mediating relationships in regard to neighborhood influences. These analyses allow for an understanding of the pathways through which neighborhoods influence risk for internalizing in adolescents (Ingoldsby & Shaw, 2002). Examination of mediating pathways at both the neighborhood and individual levels allows for the establishment of plausibility of associations and the relative importance and timing of multiple pathways. This is likely to contribute to the development of more effective and targeted prevention and intervention programs.

Specifically, the results from the current study suggest that adolescents from disadvantaged neighborhoods should be preferentially targeted, given their increased risk for internalizing symptoms. There are several ways in which this population could be helped, including improving neighborhood conditions, and, as evidenced by the current study, through encouraging parents to engage in more positive parenting practices. While most prevention and intervention programs focus on adolescents themselves, some programs have been developed to include parent education sessions aimed to increase the effectiveness of these programs (e.g., Roosa et al., 2010). These interventions often aim to minimize severe family conflict and increase responsive and warm parent-adolescent relationships. The current study indicates that interventions of this nature should not only focus on severe family conflict (e.g., characterized by domestic violence or child abuse) but also focus on conflicts that may be less extreme (as observed during the EPI and PSI). Interventions aimed at improving behavioral and emotional regulation, such as mindfulness programs, could also be of benefit for parents (and therefore their children) (Tang & Posner, 2009).

In conclusion, the findings of the current study, that the neighborhood environment is likely to influence adolescents indirectly through its effects on the more proximal risk factor

of maternal aggression. It is hoped that the identification of prospective risk factors and their relationship to neighborhood disadvantage in this study contributes to the development of preventive interventions that are effective in reducing the rates of depression and anxiety in adolescence.

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Tables

Table 1

Summary of Linear Regression (Controlling for Gender), with Neighbourhood disadvantage Predicting Maternal Interaction Style (DPE) for the Event Planning Interaction (EPI)

Dependent variable	Significance and model fit for Final Model	Predictors in model	Standardised beta (B)	t	p (1-tail)
Dysphoric DPE (EPI)	F(2, 242) = 7.74, p = .001, AR ² = .052	Gender			
			.005	.088	.47
		Neighborhood disadvantage			
			-.25	-3.93	.00
Aggressive DPE (EPI)	F(2, 242) = 3.83, p = .023, AR ² = .023	Gender			
			.096	1.52	.065
		Neighborhood disadvantage			
			-.15	-2.35	.0095
Positive DPE (EPI)	F(2, 242) = 5.43, p = .005, AR ² = .035	Gender			
			.093	1.48	.07
		Neighborhood disadvantage			
			-.19	-2.98	.0015

Bolding indicates $p < .05$

Table 2

Summary of Linear Regression (Controlling for Gender), with Neighbourhood disadvantage

Predicting Maternal Interaction Style (DPE) for the Problem Solving Interaction (PSI)

Dysphoric	F(2, 242) = 2.29, p =	Gender			
DPE (PSI)	.104,		.16	2.083	.019
	AR ² = .016				
		Neighborhood disadvantage	-.040	-.51	.31
Aggressive	F(2, 242) = 8.97, p =	Gender			
DPE (PSI)	.000,		.037	.59	.28
	AR ² = .061				
		Neighbourhood disadvantage	-.26	-4.21	.00
Positive	F(2, 242) = 9.97, p =	Gender			
DPE (PSI)	.000,		.27	4.38	.00
	AR ² = .068				
		Neighbourhood disadvantage	-.059	-.96	.16

Bolding indicates $p < .05$

Table 3

Regression Parameter Estimates (B) for Mediation Analyses with Neighbourhood as the Independent Variable, Maternal Affective Behavior as the Mediator, and Depression (follow-up) as the Dependent Variable, Controlling for Depression at Baseline and Gender

Mediator	Significance and model fit	Effect of IV on M (a path)	Effect of M on DV (b path)	Total effect (c)	Direct effect (c')	95% Confidence interval for indirect effect
Maternal Aggression (DPE) during PSI	$F(4, 240) = 13.99$, $p < .05$, $AR^2 = .18$	-.0275*	.14*	-.0097	-.0059	(-.0084 to -.0010)
Maternal Aggression (DPE) during the EPI	$F(4, 240) = 17.5$, $p < .05$, $AR^2 = .213$	-.0043*	.87*	-.0097	-.006	(-.0085 to -.0002)

* = $p < .05$

Table 4

Regression Parameter Estimates (B) for Mediation Analyses with Neighbourhood as the Independent Variable, Maternal Affective Behavior as the Mediator, and Anxiety (follow-up) as the Dependent Variable, Controlling for Anxiety at Baseline and Gender

Mediator	Significance and model fit	Effect of IV on M (a path)	Effect of M on DV (b path)	Total effect (c)	Direct effect (c')	95% Confidence interval for indirect effect
Maternal Aggression (DPE) during PSI	$F(4, 240) = 7.1, p < .05, AR^2 = .09$	-.029*	.137*	-.0028	-.0011	(-.0103 to -.0005)
Maternal Aggression (DPE) during the EPI	$F(4, 238) = 8.64, p < .05, AR^2 = .1121$	-.0041*	.71*	-.0028	-.0001	(-.0089 to -.0004)

* = $p < .05$