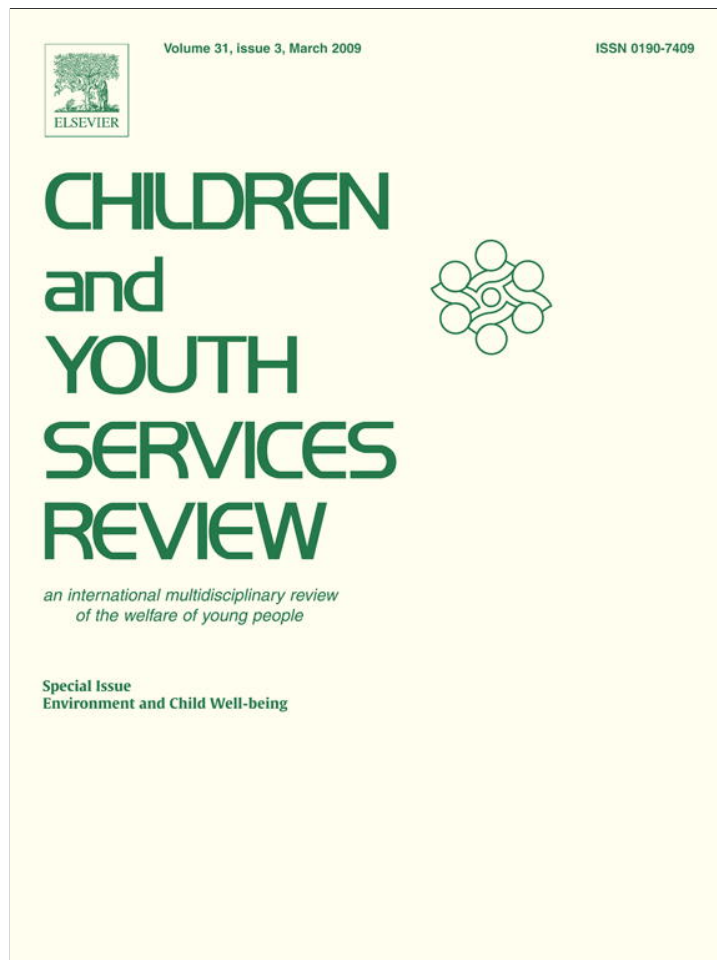


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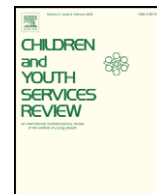
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Neighborhood influences on young children's conduct problems and pro-social behavior: Evidence from an Australian national sample

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ABSTRACT

Mechanisms by which neighborhood socio-economic status influenced children's conduct problems and pro-social behavior were investigated using data from a nationally representative study of 4983 four-to-five-year old children growing up in 257 neighborhoods in Australia. Children's conduct problems were found to be associated with neighborhood socio-economic status, neighborhood safety and neighborhood belonging after accounting for family demographic variables. Further analyses demonstrated that perceptions of neighborhood safety and neighborhood belonging mediated the relationships between neighborhood socio-economic status and children's conduct problems. Furthermore, the associations of neighborhood safety with conduct problems were mediated by neighborhood belonging. A different pattern of results was evident for pro-social behavior. Neighborhood cleanliness and neighborhood belonging had a direct association with pro-social behavior and no mediated associations were evident.

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1. Introduction

Research suggests that children living in neighborhoods with greater levels of socio-economic disadvantage have higher levels of social, emotional and behavioral problems than children living in more affluent neighborhoods (Leventhal & Brooks-Gunn, 2000). However the majority of studies that have investigated neighborhood effects on childhood outcomes have focussed on late childhood and adolescence rather than early childhood (Leventhal & Brooks-Gunn, 2000). There is evidence to suggest that the effect of neighborhoods is greater for adolescents than for children—presumably because adolescents have more contact with their neighborhood than do young children (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993). However, the importance of early childhood experiences in influencing children's long-term outcomes is also well established (Shonkoff & Phillips, 2001) and therefore neighborhood influences on younger children are worthy of study. In this paper we will focus on neighborhood influences on four-to-five-year old children's conduct problems and pro-social behavior.

The small body of research into neighborhood influences on children's outcomes in early and middle childhood has shown that greater levels of neighborhood socio-economic disadvantage have been consistently associated with increased behavior problems for children even when controlling for family factors (e.g., Boyle & Lipman, 2002; Brooks-Gunn et al., 1993; Chase-Lansdale & Gordon, 1996; Edwards, 2005; Greenberg, Lengua, Coie, & Pinderhughes, 1999; Kalff et al., 2001; Romano, Tremblay, Boulerice, & Swisher, 2005; Xue, Leventhal, Brooks-

Gunn, & Earls, 2005). Neighborhood influences on children's outcomes in positive domains such as pro-social behavior have been less frequently investigated, findings have been mixed and further research in this area is needed (Greenberg et al., 1999; Romano et al., 2005).

One of the major limitations of previous research on neighborhood influences has been that the mechanisms through which neighborhood disadvantage may affect children's social and emotional outcomes have not been examined. The only relevant study to date that has addressed this issue showed that the effects of neighborhood socio-economic status on children's internalizing behavior were mediated by resident involvement in local organizations and collective efficacy (a construct that combines social cohesion and informal social control) (Xue et al., 2005). Higher levels of neighborhood socio-economic disadvantage were associated with higher levels of internalizing problems. After including resident involvement in local organisations and collective efficacy in the model, the relationship between neighborhood socio-economic disadvantage and internalizing problems was no longer significant. Higher levels of resident involvement in local organizations and collective efficacy were associated with lower levels of internalizing problems. Further research is required to see if neighborhood social processes mediate the effect of neighborhood socioeconomic status on other types of social and emotional outcomes.

One promising theoretical model for understanding neighborhood influences on children's outcomes was proposed by Roosa, Jones, Tein, and Cree (2003). In their model, neighborhood socio-economic status influences individuals' perceptions of the neighborhood, which in turn are related to neighborhood social processes; and neighborhood social processes are posited to affect children's outcomes (see Fig. 1). Roosa and colleagues argue that the effects of neighborhood social processes on children's outcomes are dependent upon individual perceptions and

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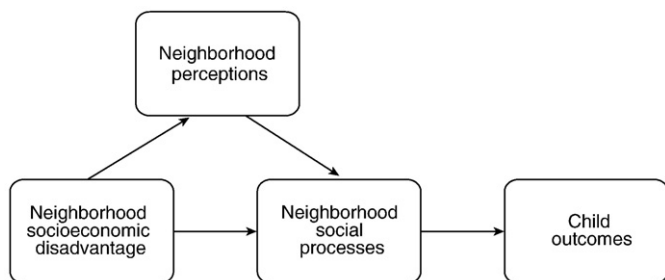


Fig. 1. Roosa and colleague's model of neighborhood influences on children's outcomes.

experiences that are shaped by neighborhood socio-economic disadvantage. Existing research supports the argument that individual perceptions of the neighborhood are important. For example Shumow, Vandell, and Posner (1998) reported that parental perceptions of danger mediated neighborhood quality and influenced children's stress, which in turn contributed to child misconduct.

The majority of research investigating neighborhood effects on childhood outcomes has been undertaken in the US, with a smaller body of research conducted in Canada. In Australia there is some evidence of a growth in income inequality between neighborhoods since the 1970s and this growth has mirrored the trends in other developed countries such as the US and Canada (Gregory & Hunter, 1995; Hunter & Gregory, 2001). Assuming similar mechanisms occur in Australia as a result of neighborhood income inequality as in the US, neighborhood socio-economic disadvantage would also be expected to have deleterious effects on children's outcomes in the Australian context.

In the present study, we investigate the effects of neighborhood socio-economic disadvantage, perceptions of the neighborhood, and neighborhood social processes, on four-to-five-year old children's conduct problems and pro-social behavior using data from a nationally representative sample of Australian children. Specifically we aim to test Roosa, Jones, Tein, and Cree's (2003) model of neighborhood influences in an Australian sample by investigating whether (a) perceptions of the neighborhood mediate the effect of neighborhood socio-economic disadvantage; and (b) whether the effect of these perceptions on children's conduct problems and pro-social behavior are, in turn, mediated by neighborhood social processes. The focus on children's pro-social behavior is particularly important as there is a dearth of research on this issue at present. Several family demographic variables were also included in the analyses to control for factors that may predispose families to live in a particular neighborhood. The influence of an objective measure of remoteness and an observational measure of physical disorder will also be examined.

2. Method

2.1. Definition of neighborhood

Many US studies of neighborhood influences on children have commonly used Census tracts to define neighborhoods (Leventhal & Brooks-Gunn, 2000). The present study used 257 Australian postcodes, which have between 12,000 and 15,000 residents in each (US Census tracts are smaller with 2500 to 8000 residents).¹ In some US studies, Census tracts have been combined making Australian

¹ Although Australian postcodes are larger than have been used by researchers in the US, postcodes have been used in previous Australian neighborhood effects research (e.g. Andrews, Green, & Mangan, 2004), they reflect the boundaries of the suburbs in which people live and are commonly known by Australian residents. Furthermore, they approximate the size of neighborhoods in the Project on Human Development in Chicago Neighborhoods. We would expect however, that our results are likely to be conservative and slightly underestimate neighborhood effects due to the greater heterogeneity within larger units of analysis. Nevertheless, theories of neighborhood effects remain relevant.

postcodes more comparable. For instance, the Project on Human Development in Chicago Neighborhoods (Xue et al., 2005) combined two to three US census tracts to create neighborhood clusters of approximately 8000 residents. Administratively defined units such as Australian postcodes and US Census tracts enable aggregated census information about neighborhood characteristics to be included in the study of neighborhood effects.

2.2. Participants

Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC) is designed to provide a nationally representative sample of Australian children's experiences as they grow and develop. The study employs a cross-sequential design with 10,090 children in two age cohorts of approximately equal size: infancy (children born between March 2003 and February 2004) and early childhood (children born between March 1999 and February 2000). It is planned to follow these cohorts for at least 6 years via biennial data collection waves. For the current study, we have utilized Wave 1 data for the early childhood cohort (four-to-five-year olds, $n=4983$). Data were not collected on children's conduct problems and pro-social behavior for the infant cohort. The study sample was randomly selected from the Health Insurance Commission's Medicare database for 257 postcodes. Medicare is a health service in Australia that enables every Australian resident to have access to free treatment at a public hospital and free or subsidised treatment by health practitioners such as doctors. Stratification was used to ensure the numbers of children in urban and metropolitan areas and from each Australian state and territory were roughly equal to the number of children living in these areas. The response rate for the four-to-five cohort was 50% of families that were sent a letter by the Health Insurance Commission,² however, the LSAC sample is representative of the Australian population and matches Australian Bureau of Statistics (ABS) census data on most characteristics. Survey weights were used to ensure that the sample was representative on a range of demographic characteristics (Soloff, Lawrence, Misson, Johnstone, & Slater, 2006). Respondents for the four-to-five-year old cohort in Wave 1 included parents, child carers, preschool and school teachers, and included interview, observation and survey data (see Australian Institute of Family Studies, 2005; Gray & Sanson, 2005).

2.3. Measures

2.3.1. Child functioning: Conduct problems and pro-social behavior

Two of the five scales from the parent-reported Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997) were used to assess child functioning. The *Pro-social* scale assesses the child's propensity to be considerate and helpful to others. Problem behaviors such as lying, fighting and having temper tantrums are assessed via the *Conduct Problems* scale. Each scale consists of 5 items. The SDQ is a widely used measure of children's social and emotional functioning in European countries (e.g., Goodman, 1997) and in Australia (e.g. Hawes & Dadds, 2004). Many studies have supported the SDQ's reliability and validity (Goodman, 2001). For example, the SDQ has high correlations with the Child Behavior Checklist and is at least as good at detecting externalising and internalising problems (Goodman & Scott, 1999).

2.3.2. Parental perceptions of the neighborhood

Four measures of neighborhood perceptions were employed from parent-report items included in the main interview and self-completion questionnaire phases of the study. *Neighborhood facilities*

² The main sources of sample loss were refusals (35%) and non-contacts—people who had moved or for whom only a post office box address was available (14%). The most common reason given for refusing was "not interested/too busy". Interviewers felt that many parents of young children were very time pressured.

comprised six items that asked parents to rate their neighborhood's parks, playgrounds and play spaces; street lighting; footpaths and roads; access to close, affordable, regular public transport; access to basic shopping facilities; and access to basic services like banks and medical clinics. The internal consistency for this measure was 0.78. *Neighborhood belonging* consisted of four items that assessed parents' trust of neighbors, a sense of identity with the neighborhood, how well informed they were about local affairs, and knowledge about where to find information about local services. The internal consistency for neighborhood belonging was 0.74. *Neighborhood safety* and *cleanliness* were each assessed by one item respectively, "This is a safe neighborhood" and "This is a clean neighborhood".

Multilevel confirmatory factor analysis using Mplus (Muthen & Muthen, 2004) suggested that the two constructs of neighborhood (facilities and belonging) were independent of one another, with items loading on the expected factor only (Edwards, 2006). Neighborhood safety and cleanliness did not load on either factor suggesting that they should be treated as separate constructs.

2.3.3. Neighborhood measures derived from administrative data

Consistent with much previous work on neighborhood influences on children (Leventhal & Brooks-Gunn, 2000), we included neighborhood level (postcode) measures of neighborhood socio-economic status, residential instability and ethnic homogeneity extracted from administrative data. *Neighborhood socio-economic status* was measured by the Socio-Economic Indices for Area's (SEIFA) Index of Advantage/Disadvantage (Trewin, 2001). Lower scores indicate more disadvantage and less advantage and higher scores indicate the reverse. The SEIFA is a composite of 31 variables such as income, unemployment, occupation and education. The validity of the Index of Advantage/Disadvantage has been established by the ABS (Trewin, 2001). To aid interpretability, the SEIFA score was separated into five levels (quintiles), with the first quintile being the most disadvantaged, and the fifth quintile the most advantaged. *Neighborhood residential instability* was measured using ABS census data at the postcode level that recorded the percentage of residents in the neighborhood who had moved in the last 5 years. *Neighborhood ethnic homogeneity* was assessed by the percentage of residents in the postcode who were born in Australia. Although there are particular postcodes that do have a large proportion of a particular ethnic minority living in them, in contrast to the US there are not large proportions of the Australian population across the country who are from a particular ethnic background (e.g., Afro-American or Latino).

A measure of remoteness is particularly relevant to the Australian context as the population density in Australia is two people per square kilometre while the US has a population density of 27 people per square kilometre (Australian Bureau of Statistics, 2004). *Remoteness of the neighborhood* was measured by the Accessibility/Remoteness Index for Australia (ARIA). The ARIA measures remoteness based on road distances to 201 centres where services are located. The index does not include socio-economic and population size indicators and comprises five categories that reflect the remoteness from a range of goods and services and opportunities for social participation (highly accessible; accessible; moderately accessible; remote and very remote). As there were very few postcodes in this study sample that were remote ($n=11$ postcodes, 3.2%) or very remote ($n=5$ postcodes, 1.5%) these two ARIA categories were grouped together for this study.

2.3.4. Interviewer observation of neighborhood physical disorder

The current study includes an observation of physical disorder derived from interviewers' ratings of the general condition of buildings nearby the family residence. Specifically, interviewers were asked to rate buildings within 100 m of the study child's house. Interviewers reported whether the buildings were badly deteriorated, in poor condition and in need of repair, in fair condition, well kept or if there were no other

dwellings nearby.³ As there were only a small minority of ratings in the badly deteriorated ($n=51$, 1.0%) and poor condition categories ($n=100$, 2.0%) these categories were combined with the fair conditions category ($n=1064$, 21.4%). Thus the physical disorder measure comprised three categories 'bad to fair', 'well kept' and 'no other dwellings nearby'.

2.3.5. Family demographic characteristics

Several variables were also included to control for factors that may predispose families to live in particular neighborhoods: parents' combined weekly income (here called family income), child's gender and age, whether the child was of Aboriginal or Torres Strait Islander origin (ATSI), in a single-parent household, in a household where no one worked, in a household where one or both parents were born overseas,⁴ and mother's level of education.

2.4. Statistical analysis

As the data were hierarchical (children nested within neighborhoods), multilevel models were used to obtain accurate estimates of the effect of neighborhood characteristics on children's outcomes (Snijders & Bosker, 1999). As children reside within neighborhoods (postcodes), the multilevel models partition the variation in children's scores into the family level (Level 1) and the neighborhood level (Level 2) variation.

Multilevel models were run in MLwiN (Rasbash et al., 2004), which uses iterative generalized least squares (IGLS), a maximum likelihood procedure to provide model estimates. As a preliminary step, an intraclass correlation coefficient (ICC) for the percentage of variance between neighborhoods was then calculated (Snijders & Bosker, 1999). The higher the level of the ICC the more that residing in that neighborhood explains the outcomes.

As many of the neighborhood variables were categorical (e.g., neighborhood socio-economic status, remoteness and physical disorder), multiparameter tests were employed to test the overall significance by improving the model fit. The deviance statistic is used to assess improvements in model fit (Snijders & Bosker, 1999). The difference in the deviances between the multilevel model without the categorical variable indicates the improvement in model fit resulting from the inclusion of the categorical variable.

The significance of the fixed coefficients in linear random coefficient regression were tested by dividing the fixed coefficient by its standard error, which yielded a t -value (Snijders & Bosker, 1999). Fixed coefficients are the average relationship between a predictor variable (e.g., neighborhood safety) and the outcome (e.g., children's conduct problems). These coefficients are unstandardised. Fixed coefficients that vary between children and their families (e.g., child's gender or family income) are referred to as family level variables, β_{ij} . It should be noted that parental perceptions of the neighborhood are family level variables because they vary across families within the same neighborhood. Predictor variables that only vary across neighborhoods such as neighborhood socio-economic status, are referred to as neighborhood level variables, β_j . There are also two variance components for each linear random coefficient regression. One variance component represents the variation in children's scores (e.g., conduct problems) at the family level, e_{ij} . The other variance component provides information on the variation in children's scores at the neighborhood level, u_j .

³ Inter-rater reliability was not available for the observations of neighborhood physical disorder.

⁴ The specific birth country of both parents was not modelled although this information was available. Parents who were born overseas were from a broad range of countries with the largest frequency of parents born in Great Britain (10.5% of mothers) and thereafter no more than 3% of the total sample comprised any one ethnic group. As the focus of the study was not on this issue and the inclusion of a broad range of dummy variables would have been statistically inefficient, we chose a broad indicator of whether parents were born overseas.

The same model building strategy was employed for all outcomes. In the first model, structural neighborhood characteristics such as neighborhood socio-economic status, neighborhood residential instability, neighborhood ethnic heterogeneity, remoteness and physical disorder were included along with the child and family demographic variables. In the second model, three parental perceptions of their neighborhood were added (neighborhood facilities, neighborhood safety and cleanliness). The final model included social processes via perceptions of neighborhood belonging.

According to Baron and Kenny (1986) the criteria for statistical mediation are when (a) the independent variable (e.g., neighborhood safety) is significantly associated with the mediator (e.g., neighborhood belonging), (b) the independent variable is significantly associated with the dependent variable (e.g., children's conduct problems) when the mediator is not present, (c) the mediator is significantly associated with the dependent variable and (d) the association of the independent variable with the dependent variable is attenuated when the mediator is added to the model. Sobel tests (Sobel, 1982) are a formal method of testing for statistical mediation and will be used in the current study.

Cases with missing data were deleted from the analyses. The deletion of missing data did not affect any substantive conclusions from the analyses as 90% of cases had complete data and the population weights adjusted for factors that influenced non-response (Soloff et al., 2006).

3. Results

3.1. Descriptive statistics

The descriptive statistics for the child outcomes, family and child characteristics, and neighborhood variables are detailed in Table 1. The intraclass correlation coefficients indicated that less than 2% of the variation in children's conduct problems and pro-social behavior was between the neighborhoods. Other continuous variables demonstrated higher levels of variation between neighborhoods. Residing in a particular neighborhood accounted for 8–12% of the variance in perceived neighborhood facilities, safety, cleanliness and belonging. Over one-quarter of the variance in family income were between neighborhoods. The ICC for family income is consistent with Gregory and Hunter's (1995) observations of a trend toward concentration of poverty and affluence in Australia.

3.2. Model 1

The first model tested the influence of several neighborhood level aggregate variables (neighborhood socio-economic status, remoteness of the neighborhood, neighborhood residential instability and neighborhood ethnic heterogeneity) and neighborhood physical disorder on children's conduct problems and pro-social behavior (Tables 2 and 3). Multiparameter tests suggested that neighborhood socio-economic status influenced children's levels of conduct problems ($\chi^2(4)=17.32, p<0.01$) but not pro-social behavior ($\chi^2(4)=7.55, p>0.05$). Children who resided in the three most disadvantaged neighborhood quintiles had significantly higher levels of conduct problems than children living in the quintile with the highest neighborhood socio-economic status (Table 2).

3.3. Model 2

In Model 2, children residing in neighborhoods that were perceived to be less safe were found to have higher levels of conduct problems (Table 2). Children living in cleaner neighborhoods exhibited higher levels of pro-social behavior (Table 3) while neighborhood facilities were not associated with either of the child outcomes.

We tested whether the addition of the variables measuring parental perceptions of neighborhood facilities, neighborhood safety and

Table 1
Descriptive statistics for child outcomes and family and child characteristics

Variable	M	SD	ICC
Conduct problems	2.49	2.01	.02
Pro-social behavior	7.73	2.29	.00
Child's age (months) ^a	56.91	2.64	.41
Weekly family income (\$AUD)	1261	634	.27
Parental perceptions of neighborhood facilities	2.93	0.56	.12
Parental perceptions of neighborhood safety	3.23	0.64	.13
Parental perceptions of neighborhood cleanliness	3.27	0.61	.12
Parental perceptions of neighborhood belonging	3.65	0.63	.08
Percentage in neighborhood that have moved in the last 5 years	77.51	12.06	–
Percentage in neighborhood that are born in Australia	45.44	8.91	–
n		%	
Child is a girl	2446	49.10	
Child is of ATSI origin	187	3.80	
At least one parent employed	4395	88.20	
Single parent family	647	13.00	
At least one parent born overseas	2271	45.60	
Maternal education			
Year 7 or 8	97	1.90	
Year 9	132	2.60	
Year 10	497	10.00	
Year 11	316	6.30	
Year 12	739	14.80	
Certificate	1234	24.80	
Advanced diploma	441	8.90	
Bachelor's degree	802	16.10	
Graduate diploma	312	6.30	
Postgraduate degree	294	5.90	
Other	60	1.20	
Physical disorder			
Well kept	1215	24.40	
Badly deteriorated/poor or fair condition	3526	70.80	
No houses nearby	162	3.30	
Remoteness ^a			
Highly accessible	2702	54.73	
Accessible	1163	23.56	
Moderately accessible	856	17.33	
Remote and very remote	216	4.43	
Neighborhood Socio-economic Status			
Most disadvantaged	53	20.62	
2nd quintile	43	16.73	
3rd quintile	62	24.13	
4th quintile	99	38.52	
Most advantaged	83	32.30	

^aThe large intraclass correlation coefficient for child's age is likely to be a function of the limited variability in children's ages as children ranged from 4 to 5 years of age.

neighborhood cleanliness caused neighborhood socio-economic status to be non-significant for conduct problems which had significant associations in model 1. For conduct problems, the inclusion of the three neighborhood variables partially mediated the effect of neighborhood socio-economic status. The size of the multiparameter test for neighborhood socio-economic status was reduced ($\chi^2(4)=11.12, p<0.05$) and the difference in the level of conduct problems between children residing in the most advantaged neighborhood and children in the 3rd neighborhood quintile (i.e., neither advantaged nor disadvantaged) was no longer significant. There were still significant differences in levels of conduct problems between children in the most advantaged neighborhood quintiles and those living in the two most disadvantaged neighborhood quintiles.

3.4. Model 3

In the final model, higher levels of neighborhood belonging were associated with lower levels of conduct problems and higher levels of pro-social behavior.

We tested whether perceptions of neighborhood belonging mediated some of the effect of neighborhood socio-economic status on conduct problems. The inclusion of neighborhood belonging rendered the influence of neighborhood socio-economic status non-

significant overall for conduct problems ($\chi^2(4)=7.55, p>0.05$). Differences in the level of children's conduct problems were now only evident between children living in the most advantaged and most disadvantaged neighborhood quintiles.

Sobel tests suggested that neighborhood belonging mediated the relationship between neighborhood safety and children's conduct

Table 2
Results from hierarchical multilevel models for effects of neighborhood characteristics on children's conduct problems ($n=4505$)

Fixed coefficients	1		2		3	
	Coefficients	SE	Coefficients	SE	Coefficients	SE
Model Intercept	2.96***	0.76	2.05***	0.78	1.42	0.85
<i>Level 1: Family</i>						
Child's age (months)	0.00	0.01	0.00	0.01	0.01	0.01
Child's is girl	-0.26***	0.06	-0.27***	0.06	-0.30***	0.07
Child is of ATSI origin	0.58***	0.16	0.53***	0.16	0.46*	0.19
Single parent family	0.25*	0.12	0.26*	0.12	0.21	0.13
At least one parent employed	-0.29*	0.13	-0.24	0.13	-0.19	0.15
At least one parent born overseas	-0.05	0.07	-0.05	0.07	-0.07	0.07
Family income × 10	0.00	0.00	0.00	0.00	0.00	0.00
Education (referent, postgraduate)						
Year 7 or 8	0.77**	0.29	0.69*	0.28	0.74*	0.35
Year 9	0.40	0.23	0.39	0.23	0.40	0.26
Year 10	0.31*	0.15	0.28	0.15	0.22	0.16
Year 11	0.26	0.16	0.26	0.16	0.17	0.17
Year 12	0.18	0.13	0.18	0.13	0.16	0.14
Certificate	0.18	0.12	0.14	0.12	0.04	0.13
Advanced diploma	-0.05	0.14	-0.06	0.14	-0.07	0.15
Bachelor's degree	-0.12	0.12	-0.12	0.12	-0.17	0.13
Graduate diploma	-0.06	0.15	-0.06	0.15	-0.11	0.16
Other	0.34	0.30	0.30	0.30	0.43	0.31
Parental perceptions of neighborhood facilities	-	-	0.00	0.01	0.00	0.01
Parental perceptions of neighborhood safety	-	-	-0.22**	0.07	-0.14	0.08
Parental perceptions of neighborhood cleanliness	-	-	-0.13	0.07	-0.09	0.08
Parental perceptions of neighborhood belonging	-	-	-	-	-0.32***	0.06
Physical disorder (referent, well kept)						
Bad/poor/fair	0.08	0.07	0.07	0.07	0.06	0.08
No houses nearby	0.10	0.17	0.06	0.17	0.07	0.19
<i>Level 2: Neighborhood</i>						
% moved in last 5 years	0.01	0.01	0.04	0.04	0.00	0.00
% born in Australia	0.00	0.00	0.00	0.00	0.00	0.00
Remoteness (referent, highly accessible)						
Accessible	0.09	0.07	0.09	0.08	0.10	0.09
Moderately accessible	0.11	0.09	0.11	0.09	0.08	0.10
11	11	11	11	11	11	11
Remote or very remote	0.00	0.16	0.02	0.16	-0.03	0.17
Neighborhood SES (referent, most advantaged)						
Most disadvantaged	0.44***	0.13	0.36**	0.12	0.30*	0.13
2nd quintile	0.34***	0.12	0.30*	0.12	0.15	0.13
3rd quintile	0.23**	0.10	0.18	0.10	0.07	0.10
4th quintile	0.10	0.08	0.07	0.08	0.00	0.09
Variance components						
Level 1 Variance	3.82***	0.09	3.78***	0.09	3.76***	0.09
Level 2 Variance	0.00	0.00	0.00	0.00	0.00	0.00
Deviance	18,890.50		18,755.69		15,951.43	

* $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 3
Results from hierarchical multilevel models for effects of neighborhood characteristics on parent ratings of pro-social behavior ($n=4505$)

Fixed coefficients	1		2		3	
	Coefficients	SE	Coefficients	SE	Coefficients	SE
Model Intercept	7.04***	0.68	7.95***	0.70	8.08***	0.76
<i>Level 1: Family</i>						
Child's age (months)	0.00	0.01	0.00	0.01	0.01	0.01
Child's is girl	0.52***	0.06	0.52***	0.05	0.51***	0.06
Child is of ATSI origin	-0.16	0.14	-0.11	0.14	-0.02	0.16
Single parent family	0.01	0.10	0.01	0.10	0.06	0.11
At least one parent employed	0.16	0.11	0.12	0.11	0.14	0.11
At least one parent born overseas	0.06	0.06	0.07	0.06	0.09	0.07
Family income × 10	0.00	0.00	0.00	0.00	0.00	0.00
Education (referent, postgraduate)						
Year 7 or 8	-0.16	0.24	-0.10	0.24	-0.03	0.28
Year 9	-0.26	0.19	-0.23	0.19	-0.07	0.20
Year 10	-0.28*	0.14	-0.25	0.14	-0.24	0.14
Year 11	-0.36*	0.15	-0.35*	0.15	-0.39*	0.17
Year 12	-0.03	0.12	-0.03	0.12	-0.01	0.13
Certificate	-0.09	0.12	-0.04	0.12	-0.04	0.12
Advanced diploma	0.09	0.14	0.10	0.13	0.07	0.14
Bachelor's degree	0.00	0.12	0.01	0.12	-0.02	0.12
Graduate diploma	0.04	0.15	0.05	0.15	0.00	0.15
Other	0.24	0.25	0.26	0.25	0.19	0.26
Parental perceptions of neighborhood facilities	-	-	-0.01	0.01	-0.01	0.01
Parental perceptions of neighborhood safety	-	-	0.11	0.07	0.00	0.07
Parental perceptions of neighborhood cleanliness	-	-	0.24***	0.07	0.25***	0.07
Parental perceptions of neighborhood belonging	-	-	-	-	0.30***	0.05
Physical disorder (referent, well kept)						
Bad/Poor/Fair	0.03	0.06	0.03	0.06	0.06	0.06
No houses nearby	0.08	0.15	0.15	0.16	0.11	0.17
<i>Level 2: Neighborhood</i>						
% moved in last 5 years	0.00	0.00	0.00	0.00	0.00	0.00
% born in Australia	0.00	0.00	0.00	0.00	0.00	0.00
Remoteness (referent, highly accessible)						
Accessible	-0.06	0.07	-0.04	0.07	-0.03	0.07
Moderately accessible	-0.01	0.08	-0.01	0.08	-0.04	0.08
Remote or very remote	0.06	0.13	0.09	0.14	0.15	0.14
Neighborhood SES (referent, most advantaged)						
Most disadvantaged	-0.12	0.12	-0.02	0.12	0.02	0.12
2nd quintile	-0.15	0.11	-0.09	0.11	0.01	0.12
3rd quintile	0.04	0.09	0.09	0.09	0.08	0.09
4th quintile	0.08	0.08	0.12	0.08	0.16*	0.08
Variance components						
Level 1 Variance	3.13***	0.07	3.09***	0.07	3.04***	0.07
Level 2 Variance	0.00	0.00	0.00	0.00	0.00	0.00
Deviance	17,967.18		17,829.46		15,127.89	

* $p<0.05$; ** $p<0.01$; *** $p<0.001$.

problems (Sobel test statistic=4.67, $p<0.001$). When neighborhood belonging was included the coefficient for neighborhood safety was reduced by 41%. Also, once neighborhood belonging was added, neighborhood safety was no longer significantly associated with conduct problems. In contrast to the results for conduct problems, the association between neighborhood cleanliness and pro-social behavior was not mediated by neighborhood belonging.

4. Discussion

The present study investigated the effects of neighborhood socio-economic disadvantage, perceptions of the neighborhood, and neighborhood social processes, on children's conduct problems and pro-social behavior using data from a nationally representative sample of Australian children. For conduct problems, findings were consistent with the predictions of Roosa et al.'s (2003) model of neighborhood which proposes that (a) perceptions of the neighborhood mediate the effect of neighborhood socio-economic disadvantage and (b) the effect of these perceptions on children's behavioral and emotional outcomes are, in turn, mediated by neighborhood belonging.

Perceived levels of neighborhood safety and belonging were also consistently associated with lower levels of conduct problems. Moreover, neighborhood facilities, cleanliness, safety and belonging mediated the relationship between neighborhood socio-economic status and conduct problems. The relationship between neighborhood safety and conduct problems was in turn, mediated by neighborhood belonging. Interestingly, a different pattern of results were evident for pro-social behavior. Neighborhood socio-economic status was not associated with pro-social behavior. Neighborhood cleanliness and neighborhood belonging were the only neighborhood variables that were significantly associated with pro-social behavior.

4.1. Support for the predictions of Roosa et al.'s (2003) model

The predictions of the model posited by Roosa et al. (2003) was supported for conduct problems.⁵ The relationship between objective neighborhood characteristics (such as neighborhood socio-economic status) and children's conduct problems were mediated by perceptions of the neighborhood (i.e., neighborhood safety). This finding is consistent with Shumow et al. (1998) who reported that the relationships between neighborhood socioeconomic status and fifth grade children's distress and conduct problems was mediated by perceptions of neighborhood safety. Furthermore, the current study also showed that neighborhood belonging mediated the relationship between parental perceptions of neighborhood safety and conduct problems. This is consistent with the predictions of Roosa et al.'s (2003) model, which proposed that the effect of parental perceptions on children's outcomes is mediated by neighborhood social processes.

4.2. Neighborhood effects on pro-social behavior

The pattern of results in relation to pro-social behavior was not consistent with Roosa et al.'s (2003) model. Neighborhood socio-economic status was not associated with children's pro-social behavior and was therefore not mediated by more proximal neighborhood characteristics such as perceptions of neighborhood cleanliness. Moreover, the relationship between neighborhood cleanliness and pro-social behavior was not mediated by neighborhood belonging. It may not be surprising that Roosa and colleagues' model does not hold with pro-social behavior, as much of the research that informed its development focused on negative outcomes. The present study is one of the few to focus on neighborhood influences on positive development and suggests that neighborhood effects may operate differently for positive child outcomes.

Overall, the current findings were generally consistent with the scarce previous research. Romano et al. (2005) also found that neighborhood socio-economic status, neighborhood problems and collective efficacy were not related to pro-social behavior among two-

to-eleven-year old Canadian children. While Greenberg et al. (1999) did not include a measure of neighborhood socio-economic status in their study of neighborhood influences on children's behavioral and educational outcomes and pro-social behavior, they did include a measure of neighborhood risk that incorporated questions regarding neighborhood social involvement. A similar measure to the measure of neighborhood belonging used in the current study. They found that neighborhood risk was associated with children's pro-social and emotion regulation. Thus the current study and that of Greenberg et al. (1999) both suggest that neighborhood social involvement may be a key contributor to children's pro-social behavior. The findings from the current study also indicate a positive association between neighborhood cleanliness and children's pro-social behavior; however, it is not clear what underlies this association. Further research is needed to clarify the relationship between neighborhood variables and outcomes such as pro-social behavior.

4.3. The impact of particular neighborhood characteristics

A particularly striking aspect of the current study was that neighborhood belonging was such an influential factor. This aspect was directly associated with both outcomes and mediated the effects of neighborhood socio-economic status (when significant) and neighborhood safety (when significant) on conduct problems. The current findings reflect other empirical data (e.g., Xue et al., 2005) that suggest that neighborhood social processes such as collective efficacy, are important determinants of children's outcomes. If a measure of collective efficacy were available we believe this variable would have exhibited similar associations as neighborhood belonging because neighborhood belonging incorporates mutual trust, an element of collective efficacy. Moreover, both variables have similar but not identical correlates with high residential stability positively associated with both variables, but ethnic heterogeneity was only associated with collective efficacy (Kim & Ball-Rokeach, 2006).

To the best of our knowledge, this is the first study of neighborhood influences on children to include a measure of geographic remoteness from access to services, particularly relevant in Australia, as it has one of the lowest population densities of countries in the OECD (Australian Bureau of Statistics, 2004). Neither children's conduct problems nor pro-social behavior were associated with geographic remoteness.

Contrary to expectations, the interviewer-observed measure of neighborhood physical disorder was not related to children's conduct problems and pro-social behavior. The lack of significant results may have been due to the fact that this measure only consisted of one interviewer observation.

Although parental perceptions of neighborhood safety were associated with children's conduct problems and neighborhood cleanliness with children's pro-social behavior, parents' perceptions of the quality of neighborhood facilities did not appear important for either outcome. The availability of institutional resources in neighborhoods have been suggested as one mechanism by which neighborhoods influence children's outcomes (Leventhal & Brooks-Gunn, 2000) but there has been limited empirical data to support this supposition (e.g., Coulton, Korbin, & Su, 1999). The findings from the current study suggest that perceptions of the availability of various neighborhood facilities are not as crucial as other aspects of the neighborhood such as perceived safety and cleanliness, and a sense of neighborhood belonging.

4.4. Prevention and intervention implications

The influential nature of neighborhood belonging on children's outcomes also suggests that community development initiatives could be an effective means to foster social processes such as neighborhood belonging. In light of the findings from this study, initiatives that encourage social gatherings of families in their neighborhood may be

⁵ We ran the same models for children's hyperactivity, emotional symptoms and peer problems and had remarkably consistent results to those reported for conduct problems. These findings provide further support for the model proposed by Roosa et al. (2003). These results are available from the first author on request.

particularly effective as a mechanism to build social relationships and develop mutual trust as well as providing information about local services.

4.5. Strengths and limitations

The current study has several significant strengths. The sample of children is large and representative of the population of Australian four-to-five-year old children from both urban and rural areas. Analyses have been weighted so that generalizations can be made to the population of Australian four-to-five-year old children. The large number of neighborhoods (257 postcodes) meant that very affluent and very disadvantaged neighborhoods were included in the study. The influence of many different neighborhood variables on children's conduct problems and pro-social behavior were investigated, including, perceptions of the neighborhood, objective neighborhood characteristics (e.g., neighborhood socio-economic status and geographic remoteness from access to services), and a direct observation of the neighborhood. The use of multilevel analysis provided information about the extent of variation in children's conduct problems and pro-social behavior that could be attributed to neighborhood differences and ensured that analyses were not biased by resident clustering.

The present study has some limitations. Neighborhood effects may be due to decisions parents make about the neighborhoods in which they choose to live (Leventhal & Brooks-Gunn, 2000). As parents reported on their children's emotional and social outcomes as well as some neighborhood characteristics, the influence of parental perceptions of the neighborhood (i.e., safety and cleanliness) and neighborhood belonging may have been overstated due to shared method variance.

The selection of postcodes enabled administrative data from the census to be linked with children's outcomes. However, critics of the Census tract approach have argued that residents' definitions of their neighborhood may not concur with administrative boundaries (Tienda, 1991). Given that residents' definitions of the size of their neighborhood may vary, a methodology such as spatial models, that encompasses variation in the geographic size of neighborhoods may overcome the definitional issue (Coulton, 2005; Freisthler, 2004).

5. Conclusions

In conclusion, the present study found that children's conduct problems were influenced by neighborhood socio-economic status, neighborhood safety, and a sense of neighborhood belonging. The mechanisms by which neighborhood socio-economic status influenced children's outcomes were investigated and support was found for Roosa et al.'s (2003) model of neighborhood influences for negative conduct problems. Neighborhood safety and neighborhood belonging mediated the effects of neighborhood socio-economic status on conduct problems. The effects of neighborhood safety on conduct problems were, in turn, mediated by neighborhood belonging. A different pattern of results was evident for pro-social behavior with neighborhood cleanliness and neighborhood belonging the only neighborhood variables that were significantly associated with this outcome. Future waves of the Longitudinal Study of Australian Children will enable further investigation of the nature and strength of neighborhood influences on children's development to be documented. It is hoped that findings such those presented in this study will act as a catalyst for policies and programs that promote more effective tailoring of services for children and families.

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