



Review article

Neighbourhood deprivation effects on young people's mental health and well-being: A systematic review of the literature

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ARTICLE INFO

Keywords:

Young people
Mental health and well-being
Neighbourhood deprivation effects
Systematic review

ABSTRACT

Since the growth of research into neighbourhood effects on young people's health in the 1980s, there have been major societal changes and scientific methodological advancements. In this systematic review we will, therefore, discuss the recent (>2009) literature on the association between neighbourhood deprivation and young people's (0–19 years old) mental health and well-being. We focus on whether neighbourhood deprivation effects exist, and how and for whom the neighbourhood matters. Together, the thirty studies included in the review indicate that overall there are neighbourhood effects on young people's mental health and well-being. The comparison of results from these studies suggests that such associations were more commonly found for well-being and externalising problem behaviour rather than internalising problem behaviour. Also, mental health and well-being seemed to be more often associated with the neighbourhood social environment than neighbourhood socio-economic status and neighbourhood disorder. Studies investigating mediating processes between the linkage between neighbourhood deprivation and mental health and well-being were rare although there was some evidence that processes within the family and peer context are important mechanisms in this linkage. Inconsistent evidence was found regarding the moderating role of age, gender, and ethnicity. There are ongoing challenges of researching the how and for whom neighbourhoods are important. We should work towards rigorous theory and evidence on how different features of residential contexts matter and on differential exposure and vulnerability to these contexts.

Since Wilson's book *The Truly Disadvantaged* (1987), studies on the consequences of living in deprived neighbourhoods have received increasing attention in the academic world. Studies that focus on neighbourhood effects primarily ask to what extent and in which way the physical and social characteristics of a neighbourhood influence individual outcomes. Around the same time, in the field of developmental psychology, the influential work of Bronfenbrenner (1979) led to increasing attention for the role of context in child and adolescent development. Bronfenbrenner emphasised the importance of neighbourhood characteristics, in addition to individual and family characteristics, for development. Young people spend much of their time in their neighbourhood and maintain a large proportion of their social contacts there, even more so than adults (James and Prout, 1990; Matthews and Limb, 1999).

Several classic works have summarised the literature on neighbourhood deprivation effects on young people (Ellen and Turner, 1997; Leventhal and Brooks-Gunn, 2000; Mayer and Jencks, 1989). In the last decade, however, significant changes in the field of neighbourhood studies have made it important to review the more recent literature on this topic. Several methodological advancements, such as more sophisticated multilevel analyses, have allowed researchers to measure neighbourhood effects more adequately. Moreover, in recent decades, western societies have changed politically, demographically, ecologically, and technologically (OECD, 2019), which may have impacted upon the effects of neighbourhoods on young people. For example, Putnam (2016) has shown that the percentage of families in both high- and low-income neighbourhoods has been increasing, while middle income neighbourhoods have been disappearing. These greater contrasts

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between neighbourhoods might result into more sizeable mental health and wellbeing differences between young people living in different neighbourhoods.

In this systematic review, we will bring together studies on the association between neighbourhood deprivation and young people's mental health and well-being that have been published between 2009 and 2019. Living in a deprived neighbourhood, as measured by various indicators such as socio-economic, social and physical indicators, is assumed to be associated with several problematic developmental outcomes for young people, including poor mental health and well-being. We focus on mental health and wellbeing, because studies have shown that these are important for lifelong individual social outcomes, such as healthy development, human capital and longevity (Hoyt et al., 2012; Lyubomirsky et al., 2005). Seventy-four percent of the mental illnesses in adult life start before age 24 (Kessler et al., 2007) and mental illnesses account for 7% of the total loss in disability-adjusted life years in high income countries (Institute for Health Metrics and Evaluation, 2017). Therefore, providing insight into the (neighbourhood) factors that influence young people's mental health is of crucial importance. In addition, we focus on young people because this group spends more time in the neighbourhood and maintains a larger proportion of their social contacts there compared to adults, potentially increasing the effect of neighbourhood deprivation on mental health and wellbeing (James and Prout, 1990; Matthews and Limb 1999).

1. Methods

PRISMA guidelines for systematic reviews were followed for this review (Liberati et al., 2009). We identified relevant studies through a systematic search in Scopus and Web of Science conducted in June 2017 and in January 2019. We used three groups of keywords, indicative of childhood/adolescence, neighbourhood/area deprivation, and mental health/wellbeing. We chose to limit the definition of mental health and well-being to the following three categories: well-being; internalising problem behaviour and externalising problem behaviour (Greenspoon and Saklofske, 2001; Proctor et al., 2009). Well-being is defined as "a person's cognitive and affective evaluations of his or her life" (Diener et al., 2002, p. 63). The cognitive element refers to a person's life satisfaction in general terms (life as a whole) and in domain terms (e.g. relationships, work). The affective element refers to emotions, moods and feelings (e.g., joy, affection, anger, guilt, fear or nervousness). In line with this definition, this review included studies using measures of happiness, positive affect and life satisfaction. Internalising problem behaviour is defined as behaviour in which negative feelings and emotions are turned inwards (Achenbach and Edelbrock, 1991). Concepts that were included were depressive symptoms, anxiety, emotional distress and measures that combined different aspects of internalising problems. Finally, externalising problem behaviour (Achenbach and Edelbrock, 1991) is defined as negative behaviours that are directed toward the external environment. The included studies assessed delinquency, aggressive behaviour and measures that included different elements of externalising problem behaviour. The mental health search therefore consisted of the following terms: 'mental health' or 'psychological health' or 'well-being' or 'life satisfaction' or happiness or 'externalising problems' or 'internalising problems'. The 'neighbourhood' theme included the following: 'Neighbourhood deprivation' or 'area deprivation' or 'spatial inequality' or segregation.

The search query was limited to articles in English and published in peer-reviewed journals in the last ten years (between 2009 and 2019) to acquire an overview of the most recent literature. To increase comparability between studies, we included studies based on the following criteria:

1) the dependent variable was 'well-being' or 'mental health' or related internalising or externalising problem behaviour;

- 2) the independent variables contained at least one measure of neighbourhood deprivation. Studies that measured deprivation in the form of neighbourhood socio-economic indicators (neighbourhood average/median income, employment rates, educational levels), in the form of social and physical disorder (residential instability, levels of violence and crime, levels of safety, etc.) and in the form of social environment (trust, social cohesion and social capital) were included. Studies that focused on racial/ethnic composition were excluded, as ethnic/racial composition does not necessarily equal disadvantage;
- 3) intervention studies were excluded;
- 4) the research was based on national or city-wide quantitative studies with more than 300 respondents – studies that focused only on rural areas were excluded;
- 5) the study was situated in a high-income country (according to the definition of the World Bank);
- 6) the study dealt with children and young people between 0 and 24;
- 7) the study focused on individuals who belong to the general population. Studies that focused on young people with disabilities or psychiatric disorders, with a low birthweight, experiencing homelessness, with refugee backgrounds, from indigenous populations, and juvenile offenders were excluded. Studies that focused on mental health or wellbeing after specific shocks – such as disasters – were also excluded from the study.

The initial search yielded 1713 unique hits. Of these, 1553 references were excluded based on title and abstract screening. Several studies were excluded on multiple criteria. The remaining 160 candidate studies were scanned for the inclusion criteria and an additional 130 studies were excluded (see Fig. 1). Thirty studies met all of the inclusion criteria. The first round of screening was conducted by the first author; doubtful cases were discussed with the co-authors in order to make a decision. Consequently, the main study characteristics and findings were summarised by the first author. Afterwards, each co-author checked a subset of the included studies by comparing the information in the table with the full-text articles. This round of screening focused on whether the included papers met the inclusion criteria, whether the study descriptions corresponded with the full paper and whether the main conclusions were correctly summarised. Discrepancies were discussed between the first author and the co-authors and led to clarification of some study descriptions and main findings (see Table 1).

1.1. Data extraction

From each study, the following information was extracted: study description (country, sample size, study type and model used), description of the population, main model parameters (outcome variables, neighbourhood variables and measurement of neighbourhood), mediating variables and moderating variables (see Table 2). In addition, the main significant associations and mediating and moderating effects were summarised. The significance of associations was based on the p-values reported in the studies. We used $p < .05$ as a significance threshold. Some studies (Humphrey and Root, 2017; Lima et al., 2010; McDermott et al., 2017; O'Campo et al., 2010) used $p < .10$ as threshold, and reported associations with p-values between .05 and .10 as significant. For most studies such p-values were found for associations that were not relevant for this review. The only exception was the study of Humphrey and Root (2017) who reported an association between neighbourhood disadvantage and internalising problem behaviour with a p-value of .07. In this review we considered this association as non-significant.

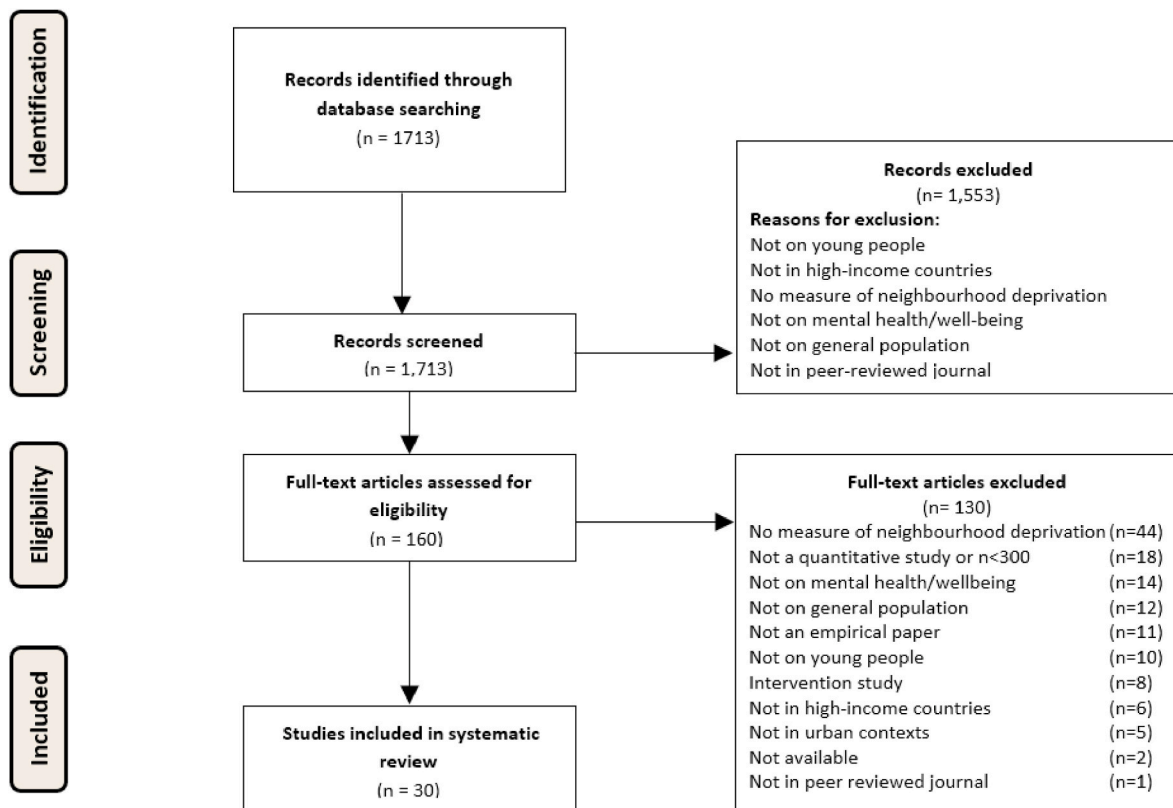


Fig. 1. PRISMA flow diagram of study selection process.

Table 1
Summary of studies.

	Total studies	Studies with significant direct associations	
	n	n	%
Mental health			
Well-being	7	6	86%
Internalising problem behaviour	18	9	50%
Externalising problem behaviour	11	9	82%
Combined measure of int. and ext. problem behaviour	7	6	86%
Measure for neighbourhood deprivation			
Socio-economic disadvantage	14	6	43%
Neighbourhood disorder	11	7	64%
Neighbourhood social environment	9	8	89%
Mediating effects			
Family resources or functioning	4	4	100%
Peer relations	2	1	50%
Residential mobility	2	1	50%
Self-efficacy	1	1	100%
Feelings of unsafety	1	1	100%
Social participation	1	1	100%
Hours of sleep	1	1	100%
Hours of television watching	1	1	100%
Moderating effects			
Individual characteristics			
Age	4	2	50%
Gender	7	4	57%
Race/ethnicity	5	4	80%
Cognitive ability	1	1	100%
Fearfulness	1	1	100%
Family resources or functioning	3	3	100%

2. Results

2.1. Study descriptions

Study designs differed widely (see Table 2). Nine studies used longitudinal designs while the other 21 studies used a cross-sectional design. All studies controlled for individual variables, such as age, gender and race/ethnic background, and family-level variables such as family socio-economic status in their models, in order to reduce the confounding of neighbourhood effects by individual or family effects. Seventeen studies used a multi-level design which included a level for the neighbourhood. One further study (Oberle, 2011) used a multi-level design in which young people were nested in schools. The other twelve studies used a single-level design, of which some (Elgar et al., 2010; Humphrey and Root, 2017; Lima et al., 2010) adjusted for school- and/or classroom clustering. Single-level studies have methodological limitations, but are included in this review because they are illustrative of the type of studies conducted during the period under review. There are no clear differences between single-level and multi-level studies with regards to the associations found. We note, however, that studies that investigated associations with neighbourhood SES typically tended to adopt multi-level models (86% of these studies), whereas multi-level modelling was less common in studies that dealt with neighbourhood disorder (55%) or neighbourhood social environment (44%).

The studies were conducted in a wide range of national contexts. Most studies were conducted in the USA (17); other studies were conducted in the UK (4), Canada (3), Croatia (1), Sweden (1), Australia (1) and New Zealand (1). One study included 11 different countries (Algeria, Brazil, Canada, Chile, Israel, Nepal, Romania, Rwanda, South Korea, Uganda and the USA) and one study included both British and Canadian data.

In terms of age, three studies focused on pre-school children (<5 years old), while the other studies focused on different age ranges between 5 and 19 years old. Even though the age range for the literature

Table 2
Overview of reviewed studies.

Authors (country population size, study type, model type)	Population (age, race/ethnicity)	Main model parameters a) Outcome variable b) Neighbourhood-level covariates (indicators) c) Neighbourhood definition	Mediators	Moderators	Results
Aminzadeh et al. (2013) (New Zealand, n = 9, 107, cross-sectional, multi-level)	High school students (age c.12-18)	a) General mood, life satisfaction and well-being (single item, self-reported) b) Neighbourhood social capital (self-reported) c) Individual experiences aggregated to census area	N/A	N/A	General perception of mutual trust, reciprocity, sense of community and safety in the neighbourhood (cognitive social capital), or youth membership in community organisations (structural social capital) were positively associated with well-being.
Astell-Burt et al. (2012) (UK, n = 4,782, longitudinal, multi-level)	11-16	a) Internalising and externalising behaviour (SDQ, self-reported) b) Neighbourhood socio-economic disadvantage (Carstairs index) c) Census output areas (objective data)	N/A	Ethnic background	Neighbourhood deprivation was negatively associated with psychological well-being for White and Black Caribbean young people.
Barr (2018) (USA, n = 18,740, longitudinal, multi-level)	T1: grades 7-12 (age c. 11-18)	a) Depressive symptoms (CES-D, self-reported) b) Neighbourhood socio-economic disadvantage; neighbourhood socio-economic advantage; perceptions of neighbourhood safety and physical neglect (parent and self-reported) c) Census tracts (objective data)	N/A	Sex	Neither neighbourhood disadvantage nor neighbourhood advantage were associated with depressive symptoms. Neighbourhood disorder was positively associated with initial levels of depressive symptoms. Associations did not differ between boys and girls.
Brazil & Clark (2017) (USA, n = 9,613, longitudinal, single-level)	T1: grades 7-12 (age c. 11-18)	a) Depressive symptoms (CES-D, self-reported) b) Change in neighbourhood poverty c) Census tracts (objective data)	Life course transitions related to family, income and employment	Sex	Associations between changes in neighbourhood poverty and mental health disappeared after controlling for contemporaneous life course events. Females, but not males, moving into neighbourhoods with significantly lower poverty rates experienced improved mental health.
Bush et al. (2010) (USA, n = 316, cross-sectional, single-level)	8-12	a) Internalising and externalising behaviour (CBCL, self-reported); depression (Child Depression Inventory, parent-reported) b) Neighbourhood environment (neighbourhood noise, safety, and quality) (researcher-reported); Neighbourhood safety and social involvement (parent-reported) c) Administrative neighbourhood (researcher-reported); Subjective neighbourhood (parent-reported)	N/A	Temperament	Neighbourhood problems were positively, and social organization was negatively associated with internalising problems. Neighbourhood problems were positively associated with externalising problems. Effects were moderated by temperament: neighbourhood problems were more strongly associated with higher internalising problems for low-fear children.
Dunn et al. (2015) (USA, n = 90,118, cross-sectional, multi-level)	7-12	a) Depressive symptoms (CES-D, self-reported) b) Neighbourhood SES c) Census tracts (objective data)	N/A	N/A	No association between neighbourhood SES and depressive symptoms.
Dupéré et al. (2012) (USA, n = 2,345, longitudinal, multi-level)	9-12	a) Internalising problems (CBCL, self-reported) b) Concentrated poverty, perceived violence, neighbourhood activities and services, collective efficacy c) Census tracts (objective data); community survey aggregated to census tract level	Self-efficacy	N/A	No direct association between neighbourhood factors and internalising problems. The neighbourhood had an indirect association with internalising problems through self-efficacy.
Elgar et al. (2010) (Canada, n = 9,717, cross-sectional, single-level)	Grades 6-10 (age c. 10-16)	a) Psychosomatic symptoms (HBSC symptom checklist, self-reported); life satisfaction (Cantril ladder, self-reported), fighting (single item, self-reported) b) Neighbourhood social capital	N/A	Individual SES	Lower neighbourhood social capital was associated with more internalising and externalising problems and lower subjective well-being, but only in low-SES families

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Table 2 (continued)

Authors (country population size, study type, model type)	Population (age, race/ethnicity)	Main model parameters a) Outcome variable b) Neighbourhood-level covariates (indicators) c) Neighbourhood definition	Mediators	Moderators	Results
Eriksson et al. (2012) (Sweden, n = 3,926, cross-sectional, single-level)	11-15	(self-reported) c) Subjective neighbourhood a) Psychosomatic symptoms (HBSC symptom checklist, self-reported); life satisfaction (Cantril ladder, self-reported) b) Neighbourhood social capital (self-reported) c) Subjective neighbourhood	N/A	N/A	Neighbourhood social capital was positively associated with subjective well-being and negatively associated with internalising problems
Fagg et al. (2013) (Canada, n = 3,421, and Britain, n = 1,927 cross-sectional, multi-level)	11-15	a) Self-esteem (Rosenberg self-esteem scale, self-reported) b) Neighbourhood deprivation (UK: Townsend Index, Canada: Pampalon Index) c) UK: wards and postcode sectors; Canada: Dissemination Areas (census areas) (objective data)	N/A	Age, sex, maternal education, urban/rural status, household income, and family structure	No direct association between neighbourhood deprivation and young people's self-esteem. The prevalence of low self-esteem was higher (in Canada) for boys in the least deprived neighbourhoods compared to other neighbourhoods.
Flouri et al. (2012) (UK, n = 9,736, longitudinal, multi-level)	T1: 9 months, T2: 3 years	a) Internalising and externalising problems (SDQ, parent-reported) b) Index of multiple deprivation (neighbourhood SES + crime rates) c) Lower-layer Super Output Areas (objective data)	N/A	Child verbal and non-verbal cognitive ability and developmental delay	Neighbourhood deprivation was positively associated with peer problems.
Huang et al. (2015) (USA, n = 1,021, cross-sectional, single-level)	Grades 7-12, (age c. 11-18) Asian students	a) Subjective well-being (single item, self-reported) b) Neighbourhood safety and cohesion (self-reported) c) Subjective neighbourhood	N/A	N/A	No association between neighbourhood safety and cohesion and subjective well-being.
Humphrey & Root (2017) (USA, n = 14,960, longitudinal, single-level)	T1: 7; T2:11	a) Internalising and externalising problems (Teacher Social Rating Scale, teacher-reported) b) Neighbourhood disadvantage c) School census tract (objective data)	N/A	Sex, race/ethnicity, family structure, and family SES	Living in disadvantaged neighbourhoods was not associated with internalising or externalising behaviours at age 7. At age 11, externalising behaviour is negatively associated with low median educational attainment in the neighbourhood. Externalising behaviour is positively associated with high levels of female headed households. There is no impact of neighbourhood poverty. For externalizing behaviors at age 11, being black amplified neighborhood effects in environments high in female headed households. For internalizing behaviors, being black amplified effects in social contexts characterized by high levels of poverty and low educational attainment. Being a girl amplified the effect of living in neighborhoods with low educational attainment on externalising behaviour, while family SES neutralizes this effect. Greater family SES amplifies the effect of high levels of poverty on externalising behaviour, while family structure (living in a married household) negated this effect.
Jonsson et al (2018) (UK, n = 5,513, longitudinal, multi-level)	10-15	a) Internalising and externalising problems (SDQ, self-reported) b) Socio-economic deprivation (Townsend index); crime; neighbourhood living environment; ethnic density c) Middle-layer Super Output Area (objective data)	N/A	Ethnic group	Neighbourhood socio-economic deprivation was negatively associated with mental health. There were no associations between crime and living conditions and mental health. Deprivation was associated more negatively with mental health in

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Table 2 (continued)

Authors (country population size, study type, model type)	Population (age, race/ethnicity)	Main model parameters a) Outcome variable b) Neighbourhood-level covariates (indicators) c) Neighbourhood definition	Mediators	Moderators	Results
Kohen et al. (2009) (Canada, n = 2,743, cross-sectional, multi-level)	Kinder-garten (mean age 5.8)	a) Internalising and externalising problems (CBCL, parent-reported) b) Low income, youth unemployment rate, less than high school graduation, proportion of Aboriginal Peoples, recent immigrants, residential mobility c) Census tracts (objective data)	N/A	N/A	White British young people compared to other ethnic groups. Neighbourhood levels of income and education were negatively associated with externalising problems, percentage immigrants were positively associated with internalising and externalising problems.
Lawler et al. (2017) (11 different countries, n = 502, cross-sectional, single-level)	10	a) Life satisfaction, internalizing and externalizing problems (measure developed from the Children's Worlds survey, self-reported) b) Quality of the child's neighbourhood and community and child's satisfaction with aspects of his/her neighbourhood (self-reported) c) Subjective neighbourhood	N/A	N/A	Neighbourhood quality was positively associated with mental health and self-image. There was also a significant effect of neighbourhood quality on life satisfaction for the international sample, but not for the US sample
Li et al. (2017) (USA, n = 3,563, cross-sectional, single-level)	3-12	a) Externalising problems (Behavioural Problem Index, parent-reported) b) Perceived neighbourhood quality (parent-reported) c) Subjective neighbourhood	Family resources, deviant peer affiliation	Age	Neighbourhood quality was negatively associated with externalising problem behaviours, among seven-to twelve-year-olds, but not among children six years and younger. The association between neighbourhood quality and externalising behaviours was mediated by parental distress and family conflict.
Lima et al. (2010) (USA, n = 405, cross-sectional, single-level)	5-7	a) Internalising and externalising problems (CBCL, parent-reported) b) Community involvement with children, social climate (Physical/social disorder, fear of retaliation, fear of victimization) c) Subjective neighbourhood, Census block groups (objective data)	N/A	Family risk	Positive neighbourhood social climate was negatively associated with externalising problem behaviour. No association between social climate and internalising problem behaviour and community involvement and externalising and internalising problem behaviour. Family risk was associated with a larger increment in both externalising and internalising problems for children living in high versus low risk neighbourhoods.
Ma & Klein (2018) (USA, n = 2,388 longitudinal, multi-level)	3-5	a) Internalising and externalising problems (CBCL, parent-reported) b) Neighbourhood collective efficacy (parent-reported); median neighbourhood income (census) c) Subjective neighbourhood; census tract (objective data)	N/A	Race/ethnicity	Neighbourhood income was not associated with internalising and externalising problems. Neighbourhood collective efficacy was negatively associated with internalising and externalising problems. The protective influence of neighbourhood collective efficacy on internalising behaviour was stronger for Hispanic children than White children. No interaction effect between neighbourhood collective efficacy and race/ethnicity for externalising problem behaviour.
Martinez & Polo (2018) (USA, n = 998, cross-sectional, multi-level)	10-14, Latinx youth	a) Externalising problems (Youth Self Report, self-reported) b) Neighbourhood socio-economic status c) Census tract (objective data)		Affiliative obedience (endorsement of values such as respect and deference towards adults); neighbourhood immigrant and Latinx concentration; sex; age	Young people living in higher SES neighbourhoods reported lower externalising problems. Only for young people residing in higher SES neighbourhoods, higher affiliative obedience was associated with lower externalising problems

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Table 2 (continued)

Authors (country population size, study type, model type)	Population (age, race/ethnicity)	Main model parameters a) Outcome variable b) Neighbourhood-level covariates (indicators) c) Neighbourhood definition	Mediators	Moderators	Results
McDermott et al. (2017) (USA, n = 1,072, longitudinal, single-level)	12-15	a) Internalising and externalising problems (CBCL, parent-reported) b) Concentrated disadvantage: neighbourhood social control, neighbourhood cohesion, perceived neighbourhood danger, perceived violence, and youth services c) Census tracts (objective data), community survey aggregated to census tract level	N/A	Self-control	Young people in 'blue collar crime neighbourhoods' (characterized by the lowest levels of youth services, moderate disadvantage, high levels of crime and violence, and a lack of collective efficacy) reported higher levels of internalising problems than those in the most advantaged neighbourhoods. Self-control was a protective feature in some types of disadvantaged neighbourhoods. No differences in externalising problems across the neighbourhood typologies.
Milam et al. (2012) (USA, n = 425, cross-sectional, single-level)	Grade 5 (mean age 9.6), African American children	a) Internalising problems (Youth Self Report, self-reported) b) Violence score and alcohol and drug score (researcher observation); neighbourhood safety (self-reported) c) Community Statistical Areas (objective data), subjective neighbourhood	Self-reported neighbourhood safety	Sex	For girls, but not for boys, neighbourhood safety was negatively associated, and neighbourhood alcohol and drugs scores were positively associated with internalising problems. Violence scores were not associated with internalising problems for either girls or boys.
Novak & Kawachi (2015) (Croatia, n = 3,427, cross-sectional, single-level)	17-18	a) Psychological distress (Kessler scale, self-reported) b) Neighbourhood trust and informal social control (self-reported) c) Subjective neighbourhood	N/A	N/A	Neighbourhood trust was negatively associated with psychological distress, no association was found between informal social control and psychological distress
Oberle et al. (2011) (Canada, n = 1,402, cross-sectional, multi-level, students nested in schools)	Grade 4-7 (age c. 9-13)	a) Life satisfaction (SWLS-C, self-reported) b) Neighbourhood support scale (self-reported) c) Subjective neighbourhood	N/A	N/A	Neighbourhood support was positively associated with children's life satisfaction
O'Campo et al. (2010) (USA, n = 393, cross-sectional, multi-level)	Grade 1 (age c. 6)	a) Internalising and externalising problems (CBCL, parent-reported) b) Socio-economic disadvantage, community involvement with children, negative social climate (physical/social disorder, fear of retaliation, fear of victimization) c) Census block group (objective data), subjective neighbourhood	Parenting behaviour	Intimate partner violence (IPV) in the family	Neighbourhood community involvement with children was negatively associated with externalising problems, but not with internalising behaviour and only for children in families not reporting IPV. Other neighbourhood factors such as disadvantage and social climate were not associated with internalising or externalising problems.
Patalay & Fitzsimons (2016) (UK, n = 12,347, cross-sectional, multi-level)	11	a) Mental well-being (self-reported); mental illness (SDQ, self-reported) b) Perceived neighbourhood safety (self-reported) c) Subjective neighbourhood	N/A	N/A	Neighbourhood safety was positively associated with wellbeing, no association between neighbourhood safety and internalising and externalising problems.
Renzaho & Karantzas (2010) (Australia, n = 3,370, cross-sectional, multi-level)	4-12	a) Child difficulty behaviour (SDQ, parent-reported) b) Quality of neighbourhood environment (parent-reported) c) Subjective neighbourhood	Parental psychological distress, family functioning	N/A	The three measures of neighbourhood environment (safety and cleanliness, infrastructure and accessibility, and services) were not associated with prosocial behaviour, and only neighbourhood infrastructure and accessibility was associated with conduct problems.
Roosa et al. (2010) (USA, n = 738, cross-sectional, multi-level)	9-12, Mexican American	a) Internalising and externalising problems (Diagnostic Interview Schedule for Children, self-reported) b) Neighbourhood disadvantage c) Census block (objective data)	Stressful life events, association with delinquent peers	Sex, generation informal social control	No association between neighbourhood disadvantage and internalising and externalising behaviour.
Singh & Ghandour (2012) (USA, n = 91,642, cross-sectional, multi-level)	6-17	a) Internalising and externalising problems (Behavioural Problems Index, parent-reported) b) Neighbourhood social conditions (perceived)	Family cohesion; Social participation; Geographic mobility; Sleep behaviour; Television watching	Age, sex, race/ethnicity	Higher levels of neighbourhood social disadvantage was associated with higher levels of behavioural problems. Neighbourhood conditions did not interact with

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Table 2 (continued)

Authors (country population size, study type, model type)	Population (age, race/ethnicity)	Main model parameters a) Outcome variable b) Neighbourhood-level covariates (indicators) c) Neighbourhood definition	Mediators	Moderators	Results
		neighbourhood safety, presence of garbage/litter in the neighbourhood, poor/dilapidated housing, and vandalism, parent-reported c) Subjective neighbourhood			age or sex. The impacts of neighbourhood conditions varied by race/ethnicity, with greater influences of neighbourhood environment on problem behaviours among White children than among Black and Hispanic children.
Snedker & Herting (2016) (USA, n = 2,006, cross-sectional, multi-level)	Mean age: 15.7	a) Depression (CES-D, self-reported) b) socio-economic disadvantage, and racial/ethnic heterogeneity c) Census tracts (objective data)	N/A	N/A	Socio-economic disadvantage and residential instability were positively associated with emotional distress, and indicators of economic advantage were negatively associated with emotional distress.

Blue: subjective well-being

Green: internalising problem behaviour

Orange: externalising problem behaviour

Red: combined measure of internalising and externalising problem behaviour

Single-level or multi-level. Multi-level means that one level is the neighbourhood, unless otherwise mentioned.

'Subjective neighbourhood' refers to studies that measure neighbourhood deprivation through individual level surveys (e.g. Do you feel safe in your neighbourhood?). In these surveys 'neighbourhood' is not defined. When an administrative unit (census tract/block, 'small area') is mentioned this means that objective data has been used on the specified area level (e.g. poverty rates, unemployment rates etc.), unless otherwise indicated.

search was 0–24, no studies on young people aged 20–24 were found. Most studies (26) focused on a general population in terms of race/ethnicity; exceptions were Roosa et al. (2010) and Martinez and Polo (2018) who focused on Latinx young people, Huang et al. (2015) who studied Asian American young people, and Milam et al. (2012), who studied African American young people.

2.2. Neighbourhood effects on what?

Seven studies dealt with measures of well-being, which was measured in a myriad of ways: two studies used a single item measure of general mood (Aminzadeh et al., 2013; Huang et al., 2015). The other six studies used an index of children's satisfaction with their lives such as the WHO-5 Well-being index (Aminzadeh et al., 2013); the Cantril ladder (Elgar et al., 2010; Eriksson et al., 2012), the Satisfaction With Life Scale for Children (SWLS-C, Oberle et al., 2011), or an index developed by the authors themselves (Lawler et al., 2017; Patalay and Fitzsimons, 2016). Six (86%) of the seven studies found an association with neighbourhood factors (Aminzadeh et al., 2013; Elgar et al., 2010; Eriksson et al., 2012; Lawler et al., 2017; Oberle et al., 2011; Patalay and Fitzsimons, 2016). Young people living in a neighbourhood with high levels of disorder or a poor social environment expressed lower levels of well-being. Only the study by Huang et al. (2015) among Asian American young people found no association between perceived neighbourhood disorder and social environment and life satisfaction.

Eighteen studies focused on internalising problem behaviour. To measure internalising problem behaviour a wide range of instruments were used. The most common was the Child Behaviour Check List, which was used in seven studies (Bush et al., 2010; Dupere et al., 2012; Kohen et al., 2009; Lima et al., 2010; Ma and Klein, 2018; McDermott et al., 2017; O'Campo et al., 2010). This parent-reported instrument assesses internalising problem behaviour with questions about symptoms of depression, anxiety and somatic complaints. Another four studies (Barr, 2018; Brazil and Clark, 2017; Dunn et al., 2015; Snedker and Herting, 2016) used the CES-D scale, which is based on child reports of measures of depressive symptoms only. The remaining seven studies used different scales: the HBSC Symptom Checklist (child-reported, Elgar, 2010; Eriksson, 2012); the Rosenberg self-esteem scale (child-reported, Fagg,

2013); the Teacher Social Rating Scale (teacher-reported, Humphrey and Root, 2017); the Youth Self Report (child-reported, Milam, 2012); the Kessler scale (child-reported, Novak and Kawachi, 2015) and the Diagnostic Interview Schedule for Children (child-reported, Roosa, 2010). The associations between neighbourhood deprivation and internalising problem behaviour were less consistent than those for well-being. Nine of eighteen studies (50%) found that more neighbourhood deprivation was associated with more internalising problem behaviour (Barr, 2018; Bush et al., 2010; Elgar et al., 2010; Eriksson et al., 2012; Ma and Klein, 2018; McDermott et al., 2017; Milam et al., 2012; Novak and Kawachi, 2015; Snedker and Herting, 2016). This included the study by Barr (2018) who found positive associations of internalising problem behaviour with neighbourhood disorder, but no associations with neighbourhood disadvantage and advantage, and the study of Ma and Klein (2018), who found an association with neighbourhood collective efficacy but not with neighbourhood income. The other nine studies did not find an association (Brazil and Clark, 2017; Dunn et al., 2015; Dupéré et al., 2012; Fagg et al., 2013; Humphrey and Root, 2017; Kohen et al., 2009; Lima et al., 2010; O'Campo et al., 2010; Roosa et al., 2010).

Externalising problem behaviour was investigated in eleven studies. In six studies, externalising problem behaviour was measured with the subscales of the Child Behaviour Check List assessing delinquent behaviour and aggressive behaviour (Bush et al., 2010; Kohen et al., 2009; Lima et al., 2010; Ma and Klein, 2018; McDermott et al., 2017; O'Campo et al., 2010). The remaining five studies use a variety of different scales or sole items: the Behavioural Problem Index (parent-reported, Li et al., 2017); the Teacher Social Rating Scale (teacher-reported, Humphrey and Root, 2017); the Youth Self Report (child-reported, Martinez and Polo, 2018); the Diagnostic Interview Schedule for Children (child-reported, Roosa, 2010) and involvement in physical fights (Elgar et al., 2010). Of the eleven studies that dealt with externalising problem behaviour, nine (82%) found a positive association between levels of neighbourhood deprivation and externalising problem behaviour (Bush et al., 2010; Elgar et al., 2010; Humphrey and Root, 2017; Lima et al., 2010; Kohen et al., 2009; Li et al., 2017; Ma and Klein, 2018; Martinez and Polo, 2018; O'Campo et al., 2010). This includes the study of Ma and Klein (2018) in which they found an association with neighbourhood collective efficacy but not with

neighbourhood income. The other two studies found no association (McDermott et al., 2017; Roosa et al., 2010).

Finally, seven studies used a combined measure for behavioural problems, which included both internalising and externalising problem behaviour. Five of these studies used the Strengths and Difficulties Questionnaire (SDQ). These questionnaires were child-reported, except for the studies of Flouri et al. (2012) and Renzaho and Karantzas (2010) who used parent reports. The remaining two studies used the Behaviour Problem Index (Singh and Ghandour, 2012) and a measure developed from the Children's Worlds survey (Lawler, 2010). Six studies (86%) found a positive association between levels of neighbourhood deprivation and behavioural problems (Astell-Burt et al., 2012; Flouri et al., 2012; Jonsson et al., 2018; Lawler et al., 2017; Renzaho and Karantzas, 2010; Singh and Ghandour, 2012), while one study did not reveal an association (Patalay and Fitzsimons, 2016).

The above suggests that neighbourhood deprivation factors are more robustly associated with well-being and externalising problem behaviour than with internalising problem behaviour. However, as shown in the next section, we cannot rule out that these findings are partly due to the fact that studies that assessed different outcomes also focused on different aspects of the neighbourhood.

2.3. Which aspects of the neighbourhood matter?

One of the underlying ideas of neighbourhood effects is that living in a neighbourhood with high levels of poverty would lead to worse outcomes for young people, including their mental health and well-being. Galster (2012) distinguishes four different mechanisms that explain the relation between neighbourhood socio-economic status and social outcomes in general: social-interactive mechanisms (collective socialization, lack of positive social networks, lack of social cohesion and control); environmental mechanisms (physical surroundings, exposure to violence); geographical mechanisms (spatial mismatch); and institutional mechanisms (stigmatization and lack of access to public institutions).

Our review shows that measures used to assess neighbourhood deprivation vary widely between studies. Still, the selected articles can be divided into three categories assessing deprivation as either a socio-economic or social phenomenon. The first category is neighbourhood socio-economic status (SES), which is measured by levels of poverty, low-income, unemployment, etc. The second category is neighbourhood (dis)order, which is measured by residential instability, levels of violence and crime, levels of safety, etc. The third category is neighbourhood social environment, which is measured by neighbourhood trust, social cohesion, social capital, etc. When linking the reviewed studies to Galster's four mechanisms, we find that none of the studies referred to geographical or institutional mechanisms; instead, they mainly assume that social-interactive or environmental mechanisms explain neighbourhood effects. These social-interactive and environmental mechanism are often theorized in the studies that investigate the impact of neighbourhood SES as there is limited explicit testing for mediating effects (see section below). They are more explicitly tested in the studies that fall into the neighbourhood disorder and neighbourhood social environment categories, as measures for disorder and social environment are used as the main independent variables.

Neighbourhood socio-economic status. Fourteen studies included a measure of neighbourhood socio-economic status as the main independent variable, which was based on census data or equivalent neighbourhood aggregates in countries outside the USA. Some of these studies used a single measure of neighbourhood poverty (Brazil and Clark, 2017; Ma and Klein 2018) or considered a number of separate measures such as poverty, education levels, unemployment rates, rates of residents receiving public assistance and female-headed households (Dunn, 2015; Humphrey and Root, 2017; Kohen et al., 2009), but most common was the use of a composite score (Astell-Burt et al., 2012; Barr, 2018; Dupéré et al., 2012; Fagg et al., 2013; Jonsson et al., 2018; Martinez and

Polo, 2018; O'Campo et al., 2010; Roosa et al., 2010; Snedker and Herting, 2016). These composite scores often consisted of poverty and unemployment rates, the percentage of households receiving public assistance, and the percentage of female-headed households. One exception to this was the study by Barr (2018), which included the percentage of black people in their combined measure for area deprivation. These studies all focused on internalising and externalising problem behaviour, none dealt with the association with well-being. Of these fourteen studies, six (43%) found significant negative associations between neighbourhood socio-economic status and internalising problem behaviour (Snedker and Herting, 2016), externalising problem behaviour (Humphrey and Root, 2017; Kohen et al., 2009; Martinez and Polo, 2018) or a combined measure of both (Astell-Burt et al., 2012; Jonsson et al., 2018). Eight studies did not find a direct association between neighbourhood socio-economic status and internalising problem behaviour (Barr, 2018; Brazil and Clark, 2017; Dunn et al., 2015; Dupéré et al., 2012; Fagg et al., 2013; Ma and Klein 2018; O'Campo, 2010), externalising problem behaviour (Ma and Klein 2018; O'Campo, 2010) or a combined measure for internalising and externalising problem behaviour (Roosa, 2010).

Neighbourhood disorder. One of the underlying ideas in the neighbourhood effects literature is that neighbourhood disorder results in worse mental health outcomes. As noted by Galster (2012, p. 25): "If people sense that their property or person is in danger they may suffer psychological and physical responses that may impair their functioning or sensed well-being". In our review, eleven studies focused on the role of neighbourhood disorder. These measures were parent- or child-reported using a wide variety of instruments, mostly assessing levels of violence and crime and levels of safety. Seven out of eleven studies (64%) found a direct association between higher levels of neighbourhood disorder and lower well-being (Lawler et al., 2017; Patalay and Fitzsimons, 2016), more internalising problem behaviour (Barr, 2018; Milam et al., 2012), more externalising problem behaviour (Li et al., 2017) and higher scores on a combined measure of internalising and externalising problem behaviour (Bush, 2010; Lawler et al., 2017; Singh and Ghandour, 2012). This included the study of Patalay and Fitzsimons (2016) who found that perceived neighbourhood safety was positively associated with well-being, but not with internalising and externalising problem behaviour. Four studies (36%) did not find an association between neighbourhood disorder and either well-being (Huang et al., 2015), internalising problem behaviour (Dupéré et al., 2012) or a combined measure of internalising and externalising problem behaviour (Jonsson et al., 2018; Renzaho and Karantzas, 2009). Dupéré et al. (2012) did not find a direct effect of neighbourhood disorder on internalising behaviour but did find an indirect association through self-efficacy. Neighbourhood deprivation is thought to first influence young people's self-efficacy and through that their internalising behaviour.

Neighbourhood social environment. Another proposed mechanism to explain the association between neighbourhood deprivation and young people's mental health and well-being is through the social environment. It is assumed that neighbourhood deprivation is reflected in lower levels of social cohesion and social control. Nine studies used a measurement of neighbourhood social environment assessing, for instance, trust, social cohesion and social capital at the neighbourhood level. Eight of these studies (89%) reported that a negative neighbourhood social environment was associated with lower levels of well-being (Aminzadeh et al., 2013; Elgar et al., 2010; Eriksson et al., 2012; Oberle et al., 2011), higher levels of internalising problem behaviour (Elgar et al., 2010; Eriksson et al., 2012; Ma and Klein, 2018; Novak and Kawachi, 2015) and higher levels of externalising behaviour (Elgar et al., 2010; Lima et al., 2010; Ma and Klein, 2018; O'Campo et al., 2010). Both O'Campo et al. (2010) and Lima et al. (2010) found an association between a measurement for neighbourhood social environment and externalising problem behaviour, but not for internalising problem behaviour. The only exception was Huang et al. (2015), who found no association between social cohesion and well-being.

Other neighbourhood variables. Two studies used a combined measure of neighbourhood deprivation that did not fit the categories described above. Flouri and colleagues (2017) used a multiple deprivation index which included a measure for SES, but also an indicator of crime rates, which is typically seen as a measure of neighbourhood disorder. The authors found a significant positive association between this measure of multiple deprivation and a composite score of internalising and externalising problem behaviour. McDermott et al. (2017) used latent profile analysis to create four neighbourhood typologies based on the following variables: concentrated disadvantage, neighbourhood social control, neighbourhood cohesion, perceived neighbourhood danger, perceived violence, and youth services. They found that young people in blue collar crime neighbourhoods – characterized by moderate disadvantage but high levels of crime and violence and a lack of collective efficacy and services – reported significantly higher levels of internalising problems than young people in the most advantaged neighbourhoods.

Measurement and spatial scale of neighbourhood deprivation. When interpreting neighbourhood effects, it is important to take into account the way in which the neighbourhood context was measured. Thirteen studies only used objective data at the level of census blocks or tracts, or other administrative units. Of these studies, four did not find any significant associations between neighbourhood deprivation and young people's mental health. The other nine (69%) found at least one association. A second group of eleven studies let the respondent define 'the neighbourhood' and used subjective experiences of, for example, neighbourhood disorder or social environment, which were measured on the individual level using surveys. Of this group, ten studies (91%) found significant associations between the variables of interest. Moreover, two studies combined researcher observations of neighbourhood disorder with data on neighbourhood experiences from individual level surveys (Bush, 2010; Milam, 2012); five other studies combined census data with data on neighbourhood experiences from individual level surveys (Lima et al., 2010; Ma and Klein, 2018; O'Campo, 2010) or aggregated data from community surveys (Dupéré et al., 2012; McDermott et al., 2017); and one study (Aminzadeh et al., 2013) only used aggregated data from their individual survey. These findings show that young people's mental health and well-being seems to be more robustly associated with subjective experiences of the neighbourhood compared to objective measurements. However, it has to be noted that young people with poor mental health might also be more negative about their neighbourhood, and so the direction of these associations remains under-explored. Moreover, the review shows that subjective experiences are most often used in studies that dealt with neighbourhood disorder or social environment. As these studies generally do not take the interdependence of these measures and the nested structure of the data into account, there might be a chance that the neighbourhood effects that are found in these categories are overestimated.

In short, our review indicates that a wide array of neighbourhood variables has been used to measure neighbourhood effects on young people's mental health and well-being. This either illustrates that consensus has not yet been reached on the best way to measure neighbourhood deprivation (see also Van Vuuren, 2014; Rajaratnam et al., 2006) or that there are a variety of neighbourhood variables that together account for neighbourhood effects. Of the three categories discussed, neighbourhood social environment seemed to be more robustly associated with young people's mental health and well-being than neighbourhood disorder and SES. These differences, however, might also be explained by the outcome variables and design of the studies in each category. The studies that focused on the social environment were more likely to have well-being as an outcome and often used a subjective, individual-level measure for the neighbourhood environment, which are both likely to contribute to more significant associations.

2.4. How does the neighbourhood matter?

Only eight of the reviewed studies explicitly tested for mediating effects in their models. Four studies included a mediating variable related to family resources or functioning. The underlying assumption of these studies was that living in a deprived neighbourhood gives parents less access to financial and social resources, or leads to stress or conflicts within families, which in turn impacts upon the mental health and well-being of their children. Indeed, Li et al. (2017), O'Campo et al. (2010) and Singh and Ghandour (2012) revealed that the effect of neighbourhood deprivation was mediated by parenting behaviour, family functioning or financial resources, and Renzaho and Karantzas (2010) found the quality of parent-child relationships to mediate the association between neighbourhood deprivation and young people's mental health. In addition, two authors also included peer relations as a potentially mediating variable in their study. Roosa et al. (2010) showed that a composite score of stressful life events, which included peer hassles, economic hassles, and family conflict, mediated the association between neighbourhood disadvantage and internalising and externalising problems. Furthermore, they also found that the association between neighbourhood disadvantage and both internalising and externalising problem behaviour was mediated by having relatively many delinquent peers. In contrast, Li et al. (2017) did not find a mediating effect of deviant peer affiliation.

Moreover, three studies found mediating effects for several individual level variables such as self-efficacy (Dupéré et al., 2012), experiences of unsafety (Milam, 2012), social participation, hours of sleep and hours of television watching and residential mobility (Singh and Ghandour, 2012). These studies found that in less deprived neighbourhoods, individuals had higher levels of self-efficacy, fewer experiences of unsafety, more social participation, more hours of sleep and fewer hours of television watching and less residential mobility, all of which were associated with more optimal outcomes. Finally, Brazil and Clark (2017) found that moving into a less deprived neighbourhood resulted in better mental health, but also showed that this association disappeared after controlling for life course events such as moving in with a partner or finding a new job. In this case, it may not be the residential move and subsequent change in neighbourhood socio-economic status that explained changes in mental health, but the life course transitions that preceded the move.

In sum, only a limited number of studies explicitly tested for mediating effects related to the association between neighbourhood deprivation and young people's mental health and well-being. The most common approach was to test for social-interactive mechanisms. Most of these studies found that parents and to a lesser extent peers play a role in this context, as living in a deprived neighbourhood leads to increased stressed and strained family functioning and because peers are assumed to transmit deviant norms and values.

2.5. Where do neighbourhoods matter?

We compared study results across countries. Of the seventeen studies from the USA, thirteen (76%) found at least one significant association between neighbourhood deprivation and mental health or well-being, while this was true for eleven out of the twelve studies conducted outside the USA (92%). It has to be noted that five out of the seven studies on well-being – which appears to be more robustly associated with neighbourhood deprivation – were conducted outside the USA. These results are particularly relevant, since existing literature has suggested that neighbourhood effects have been more prominent in the USA compared to European countries due to higher levels of inequality and spatial segregation in the USA (Nieuwenhuis and Hooimeijer, 2016). In addition, Lawler et al. (2017), who studied children in two samples – one from the USA and one and international sample (from ten countries: Algeria, Brazil, Canada, Chile, Israel, Nepal, Romania, Rwanda, South Korea and Uganda), found that neighbourhood quality

was associated with mental health and self-image in both samples, and with life satisfaction in the international sample but not in the USA sample.

2.6. Neighbourhood effects for whom?

Several studies in our review examined cross-level interactions to determine whether young people's or parents' characteristics shaped the extent to which neighbourhood deprivation is associated with young people's mental health and well-being.

Young people's characteristics. Several studies focused on the extent to which the association between neighbourhood deprivation and mental health and well-being was dependent on demographic characteristics of the child, such as their age, sex and race/ethnicity.

Four studies investigated the moderating role of age in the association between neighbourhood deprivation and mental health (Fagg et al., 2013; Humphrey and Root, 2007; Li et al., 2017; Singh and Ghandour, 2012). Whereas Fagg et al. (2013) and Singh and Ghandour (2017) found that interactions of neighbourhood deprivation variables with age were not significant, the two other studies revealed significant associations between neighbourhood deprivation and internalising and externalising problem behaviour for older children but not for younger children.

Seven studies investigated moderating effects of gender. Three studies (Barr, 2018; Roosa et al., 2010; Singh and Ghandour, 2017) did not find significant differences between boys and girls regarding the association between neighbourhood deprivation and internalising and externalising problem behaviour. Four other studies, however, did indicate that the gender of the young person affected the association between neighbourhood deprivation and mental health. Of these, three studies pointed to stronger neighbourhood effects for girls. Milam and colleagues (2013) found that girls who felt unsafe in their neighbourhood were about twice as likely to have internalising problems, whereas no such effects were found among boys. Humphrey and Root (2017) revealed that living in a neighbourhood with low educational attainment had a larger effect on the externalising problems of girls compared to boys. Brazil and Clark (2017) found that girls moving into neighbourhoods with significantly lower poverty rates experienced improved mental health, while this was not the case for boys. In contrast, Fagg et al. (2013) found a surprising difference between boys and girls in the Canadian sample, namely that living in the *least* deprived 20% of neighbourhoods compared to the other 80% led to higher internalising problems for boys but not for girls.

Five studies (Astell-Burt et al., 2012; Humphrey and Root, 2017; Jonsson, 2018; Ma and Klein, 2018; Singh and Ghandour, 2017) investigated the moderating role of race/ethnicity. Three of these studies (Astell-Burt et al., 2012; Jonsson, 2018; Singh and Ghandour, 2017) revealed that living in a deprived neighbourhood had a larger impact on internalising and externalising problem behaviour for white young people compared to their ethnic minority or black peers. In contrast, Ma and Klein (2018) reported that the effects of neighbourhood collective efficacy on externalising problem behaviour did not differ across racial/ethnic groups. Finally, Humphrey and Root (2017) found that being black (relative to white) amplified neighbourhood deprivation effects on internalising and externalising problem behaviour, whereas being Hispanic attenuated these effects.

In addition, Bush et al. (2010) investigated the moderating role of fear and found that effects of neighbourhood deprivation on internalising and externalising problem behaviour were stronger for young people that showed low compared to high levels of fear. Moreover, Flouri et al. (2012) investigated the moderating role of cognitive ability, and found that both verbal and non-verbal cognitive ability buffered the effect of neighbourhood deprivation on internalising problems.

Family resources or functioning. Alongside child characteristics, several processes in the family have been found to moderate the association between neighbourhood deprivation and mental health and well-

being. Lima et al. (2010) showed that family risk exacerbated the effect of neighbourhood deprivation on internalising and externalising problem behaviour. O'Campo et al. (2010) showed that residing in neighbourhoods with high levels of community involvement had a negative effect on externalising behaviour problems, but only for children that lived in families that were low in conflict. Finally, Elgar et al. (2010) showed that lower neighbourhood social capital was associated with more internalising and externalising problems and lower well-being, but only in families with a low socio-economic status.

This section showed that a limited number of studies included individual-level moderators to provide insight into the groups that are most susceptible to neighbourhood deprivation effects. Those that did mainly focused on age, gender, and ethnic/racial differences, and the impact of family functioning. Family functioning seems to be an important moderator: the linkages between neighbourhood deprivation and mental health problems were exacerbated by family poverty or problems, such as family conflicts or violence. In terms of the impact of young people's individual characteristics, the review generally shows inconsistent evidence about the roles that age, gender and ethnicity play in the association between neighbourhood deprivation and young people's mental health and wellbeing, but tentatively points to neighbourhood effects being more prominent for girls and older children.

3. Conclusion and discussion

Over the last decade, a vast body of literature has been published on neighbourhood effects: the idea that neighbourhood deprivation has a negative effect on residents' life chances over and above the effect(s) of their individual characteristics. Moreover, in recent years, increased attention has been paid to the impact of neighbourhood on young people's mental health and well-being, illustrated by the fact that we were able to include thirty studies on this topic that appeared in peer-reviewed scientific journals during the last decade. In the majority of the included studies, growing up in a deprived neighbourhood was associated with negative mental health and well-being outcomes in young people. These findings occurred irrespective of the country in which the study was conducted. The comparison of results from these studies suggests that such associations were more commonly found in studies measuring well-being, and externalising problem behaviour than in studies with internalising problem behaviour as an outcome. Also, some indication was found for stronger associations for the neighbourhood social environment than neighbourhood socio-economic status and neighbourhood disorder. Although our study indicates that links between neighbourhood deprivation and mental health and well-being may vary with the specific outcome or neighbourhood variable, it cannot be ruled out that these results are due to differences in designs across studies.

Studies investigating mediating processes between neighbourhood deprivation and the outcomes were rare, although there was some evidence that processes within the family and peer context are important mechanisms in this linkage. While there is also some research to suggest that family processes influence the association between neighbourhood deprivation and young people's mental health and wellbeing, inconsistent evidence was found regarding the moderating role of age, gender and ethnicity in this association.

Moreover, surprisingly, only eighteen of the thirty reviewed studies used a multilevel design to test for neighbourhood effects. Not taking into consideration the nested structure of the data could be a serious source of error (Diez-Roux, 1998). For example, low-income families are clustered in certain neighbourhoods, and the observed neighbourhood effect of low socio-economic status could in fact be an effect of the individual family's socioeconomic status. The increased risk is thus not necessarily connected to the neighbourhood but may instead be connected with the family. Our research shows that multi-level models were least often adopted in studies that focused on neighbourhood social environment (44% of the studies) and neighbourhood disorder (55%),

whereas it was more common in studies that dealt with neighbourhood socio-economic status (86%). For future research, it is therefore crucial to use multi-level models to account for the nested structure of the data. In studies that use data about neighbourhood experiences at the individual level, data can be aggregated to the neighbourhood level using the econometrics approach (Mohnen et al., 2015; Mujahid et al., 2007), which adjusts for individual characteristics, differences in number of responses per neighbourhood and interdependence of individual responses.

Notwithstanding the insights that can be derived from the available studies on the association between neighbourhood deprivation and young people's mental health and well-being, the analysis of these studies also points to several directions for future research.

Operationalisation and measurement of neighbourhood deprivation. First, neighbourhood deprivation has been measured in a myriad of different ways, which can be summarised in three categories: neighbourhood SES, neighbourhood (dis)order and neighbourhood social environment. However, studies differed considerably on how neighbourhood disadvantage, disorder and social environment were operationalized. Moreover, some studies used social disorder and the social environment as a mediator between neighbourhood socio-economic status and young people's mental health and well-being (Milam et al., 2012; Singh and Ghandour, 2012); whereas in other studies it was the main independent variable. As suggested by Van Vuuren and colleagues (2014), researchers need to choose variables and scales that are of proven validity for neighbourhood deprivation, disorder and social environment. Doing this can both improve the comparability of neighbourhood effect studies as well as improve our understanding of which neighbourhood characteristics matter most for young people's mental health and well-being.

Related to this, our review showed that some studies used standard administrative units, such as census tracts, administrative neighbourhoods or community areas as proxies for neighbourhood context, while other studies asked the respondents about their individual experiences of their neighbourhood, in which 'the neighbourhood' often remained undefined. Although our results showed that both are significantly associated with the outcomes, conclusions on the relative importance of both are not possible as these two approaches have not been compared in the same study. This is an important shortcoming, as studies into other developmental outcomes show that outcomes of neighbourhood effects can largely depend on the choice of the spatial unit of analysis in combination with the outcome of interest (Kwan, 2012; Petrović et al., 2018). For example, mechanisms that involve interaction, such as studies of peer effects and neighbourhood social support, require spatial scales that are specific to the types of interactions most relevant for the individuals being studied. While studies increasingly show the importance of adopting the appropriate spatial scale of analysis and several methodological advancements have been made to empirically do so (e.g., Andersson and Malmberg 2014; Hipp and Boessen, 2013; Petrović et al., 2018) – such as using bespoke individual neighbourhoods – in the articles on young people's mental health and well-being, such approaches have not yet been adopted. Adopting these approaches would significantly improve our understanding of which aspects of the 'neighbourhood' matter for young people's mental health and well-being.

Moreover, authors in the field of neighbourhood effects studies (see Sharkey and Faber, 2014; Galster, 2012) increasingly point to the importance of including the timing and duration of neighbourhood effects. As noted by Wheaton and Clarke (2003), early exposure to neighbourhood poverty was associated with mental health problems later in a child's life. Although some studies in our review (Fagg et al., 2013; Humphrey and Root, 2007; Li et al., 2017; Singh and Ghandour, 2012) compared different age groups – generally finding stronger effects for older children – no studies investigated the impact of timing of neighbourhood exposure (e.g., in childhood vs. adolescence) or the influence of the duration of living in a deprived neighbourhood

longitudinally. Including a measure for timing or duration of exposure, however, is crucial for understanding neighbourhood effects (Sharkey and Faber, 2014).

A final issue regarding the measurement of neighbourhood deprivation is that almost all studies in the review used continuous variables, assuming that the association between neighbourhood deprivation and mental health and well-being of young people evolves in a linear way. By only using a continuous variable for neighbourhood deprivation, studies did not provide answers to the question whether low rates of mental health problems or high levels of well-being are driven by the *absence* of something negative (e.g., lack of neighbourhood deprivation), the *presence* of something positive (e.g., neighbourhood affluence), or both (see Brumley and Jaffee, 2016). Only Barr (2018) included separate measures for neighbourhood advantage and disadvantage and did not find an association with mental health for either. Another exception was the study of McDermott et al. (2017), who tested the impact of various constellations of neighbourhood factors on internalising and externalising problems, finding that only the neighbourhoods with high levels of disorder but a moderate SES had a larger impact on internalising problem behaviour compared with the most advantaged neighbourhoods. This also illustrates that it is important to take the *combination* of different buffering and exemplifying factors at the neighbourhood level into account when studying neighbourhood effects. Moreover, by using linear models, studies overlooked the fact that there might be certain threshold in levels of neighbourhood deprivation after which the effects on mental health and well-being increase. While there are studies that pay attention to such threshold effects (see Galster, 2018) on other outcomes, such methods were not adopted in the reviewed articles. In order to provide a more complete understanding of neighbourhood effects, moving to more complex models that take the abovementioned suggestions into account is an important step.

Operationalisation and measurement of mental health and well-being. In the reviewed studies a wide range of instruments were used to measure young people's mental health and well-being, sometimes combining internalising and externalising behaviour into one index variable. This makes it challenging to compare different studies; although our study indicates that links between neighbourhood deprivation and mental health and well-being may vary with the specific outcome, it cannot be ruled out that these results are due to differences in the way in which mental health and well-being were measured. Moreover, the fact that some studies combined internalising and externalising problem behaviour overlooks the fact that for each of these problem behaviours different mechanisms might be at work. Externalising behaviour might, for example, primarily be influenced through social-interactive mechanisms, whereas internalising behaviour might be mostly impacted through feelings of unsafety (see also discussion below). Therefore, future research is warranted that systematically distinguishes between different mental health and well-being outcomes.

Mechanisms behind neighbourhood effects and effect heterogeneity. In 2010, Harding and colleagues argued that "the field is ready to move away from estimating the effects of compositional properties of neighborhoods and toward an analysis of specific mechanisms and effect heterogeneity" (p. 29). Our review, however, shows that in the nine years afterwards, only a limited number of studies explicitly tested for these mechanisms, or in other words, for mediating effects. Those that included these effects primarily focused on social-interactive mechanisms on the individual level, such as parenting practices and the role of deviant peers (Li et al., 2017; O'Campo et al., 2010; Renzaho and Karantzas, 2010; Roosa et al., 2010; Singh and Ghandour, 2012). Other possible mechanisms, such as institutional mechanisms (availability and quality of schools, health care, community centres, etc.) or stigmatization have not been explored (Galster, 2012).

Moreover, eighteen of the reviewed studies investigated moderating effects, but these turned out to be limited to mostly demographic variables such as age, gender and race/ethnicity. In terms of the impact of young people's individual characteristics, the review does not provide

conclusive evidence about which combinations of neighbourhood and child-level variables are most impactful for predicting mental health and well-being. This is also complicated again by the fact that limited attention has been paid to the potential mechanisms at work. The characteristics of young people that influence neighbourhood effects may be specific to both the outcome variable and to the neighbourhood mechanism at work. For example, neighbourhood socio-economic status might have more impact on externalising problem behaviour of boys compared to girls through the influence of peers, whereas it might have more impact on the internalising problems of girls due to feelings of unsafety. Moreover, most studies in the review did not pay attention to other non-demographic variables that might be even more important for explaining differences in the neighbourhood-mental health association. Recent studies, for example, have shown that factors such as personality or individual levels of resilience (Nieuwenhuis and Hooimeijer, 2016) play an important role moderating the effect of the neighbourhood on the developmental outcomes of young people.

The fact that only a limited number of studies developed and tested clear hypotheses on causal neighbourhood effect mechanisms and heterogeneity in effects means that studies in the field of young people's mental health and well-being provide little insight into the 'black box' of neighbourhood effects. In order to provide insight into this black box, we should work towards rigorous theory and evidence on how different features of residential contexts matter and on differential exposure and vulnerability to these contexts. This means that the development of constructs and methods of data collection should be guided by relatively detailed insights into the interactions of young people and their parents with different neighbourhood contexts and their experiences of these contexts. Several methods to measure space use, time use, network composition and social interactions have already been used in neighbourhood effect studies, but these have not yet been adopted in studies that deal with young people's mental health and well-being. Finally, qualitative studies can provide further support for hypothesized moderating factors such as young people's experiences of neighbourhood deprivation, parental responses, and young people's coping strategies (Backett-Milburn and Harden, 2004; MacDonald et al., 2005; Visser et al., 2015a, 2015b).

In sum, we can say that there are neighbourhood deprivation effects on young people's mental health and well-being, but the challenge still lies in providing insight in the mechanisms *behind* these neighbourhood effects. This is complicated by the limited testing of mediating and moderating effects, the use of different (composite) measures for neighbourhood deprivation and mental health, and the different spatial scales of analysis. We should work towards rigorous theory and evidence on which aspects of residential contexts matter for whom, how people are exposed to these contexts in different ways, and which groups are most vulnerable to neighbourhood deprivation.

Acknowledgement

This work was supported by a grant from Dynamics of Youth, Utrecht University.

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