




# BMJ Open Role of neighbourhood social characteristics in children's use of mental health services between ages 9 and 13 years: a population-based cohort study in the Netherlands

Diana G.M. Eijgermans <sup>1,2</sup>, Mirte Boelens,<sup>2</sup> Joost Oude Groeniger,<sup>2</sup> Wim H.M. van der Zanden,<sup>3</sup> Pauline W. Jansen,<sup>4,5</sup> Hein Raat <sup>2</sup>, Wilma Jansen <sup>2,6</sup>

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For numbered affiliations see end of article.

## Correspondence to

Dr Wilma Jansen;  
[w.jansen@Rotterdam.nl](mailto:w.jansen@Rotterdam.nl)

## ABSTRACT

**Objectives** This study aims to investigate the association of neighbourhood socioeconomic status (SES) and social cohesion (SC) within the neighbourhood with mental health service use in children, independent of individual-level characteristics and mental health problems.

**Design, setting and participants** A longitudinal analysis was done using data from the Generation R Study, a prospective, population-based cohort of children born in Rotterdam, the Netherlands. These data were linked to the Neighbourhood Profile, containing registry and survey data on residents of Rotterdam. Data of 3403 children (mean age: 13.6 years, SD: 0.4) were used to study the associations between neighbourhood SES, SC (SC belonging and SC relations) and mental health service use, adjusted for mental health problems and sociodemographic characteristics.

**Outcome measures** Mental health service use was reported by the accompanying parent at the research centre using the question: 'Did your child visit a psychologist or psychiatrist between 9 and 13 years old?'

**Results** Mental health services were used by 524 (15.4%) children between ages 9 and 13 years. No significant differences in mental health service use between neighbourhoods were identified (median OR: 1.07 (p=0.50)). The neighbourhood social characteristics were associated with mental health service use, but only when adjusted for each other. Children living in neighbourhoods with a low SES (OR 0.57 (95% CI 0.32 to 1.00)) or high SC belonging (OR 0.79 (95% CI 0.64 to 0.96)) were less likely to use services compared with children in a high SES or low SC belonging neighbourhood. SC relations was not associated with mental health service use.

**Conclusions** Our findings indicate that children living in high SES neighbourhoods or in neighbourhoods where people feel less sense of belonging are more likely to use mental health services. As these associations were only present when studied jointly, more research is warranted on the complex associations of neighbourhood factors with children's mental health service use.

## Strengths and limitations of this study

- Our study focused on contextual determinants of children's mental health service use, which is an understudied topic.
- The study was performed in a multiethnic, population-based cohort, representing a wide variety of children.
- The neighbourhood social characteristics (ie, neighbourhood socioeconomic status, SES and social cohesion) were retrieved from adult residents, whereas the individual-level characteristics were retrieved from children and their parents.
- The analyses were adjusted for individual SES characteristics, but it was not possible to adjust for the individual perception of social cohesion.
- Using the data on street level instead of the larger administrative data on neighbourhood level that was used in our study might lead to different results.

## INTRODUCTION

Up to 20% of children experience one or more mental health-related problems during childhood.<sup>1 2</sup> Less than half of them uses mental health services to reduce these problems.<sup>2 3</sup> Besides the need for mental health services, many other factors—including environmental factors—determine whether or not a child will use mental health services.<sup>4</sup> For example, a Dutch study showed that children's mental health service use could be predicted more accurately by population characteristics than by need for services in the neighbourhood.<sup>5</sup> According to the Behavioural Model of Health Service Use,<sup>4</sup> the differences in service use can partly be explained by social environmental factors such as socioeconomic status (SES) and social cohesion (SC) of a neighbourhood. For example, living in



a neighbourhood with a low SES or low SC might introduce mental health problems which, consequently, leads to increased mental health service use.<sup>6–9</sup> Yet, the social environment itself might also influence mental health service use and access to services, unrelated to mental health problems. A potential mechanism for SES might be that people in high SES neighbourhoods know the pathway to services better.<sup>10</sup> Furthermore, people in low SES neighbourhoods are more likely to be surrounded by others with various problems.<sup>9</sup> And because of this, they might perceive their own problems as less severe and use fewer services.<sup>11</sup> A potential mechanism for SC might be that people living in neighbourhoods with high SC are more likely to take care of each other, while people in low SC neighbourhoods are more likely to be excluded and seek professional help.<sup>12 13</sup>

Literature on neighbourhood SES indicates that people living in low SES neighbourhoods are less likely to use services compared with people living in higher SES neighbourhoods.<sup>14–16</sup> However, these studies are mainly performed among adults and literature on children is scarce. Contradicting, one study shows that children living in lower SES neighbourhoods are more likely to use services compared with children living in higher SES neighbourhoods.<sup>17</sup> The authors describe that their study findings might differ from the other literature because they studied a relatively clinical, homogeneous (mainly Dutch residents) population.<sup>17</sup> Regarding SC, evidence is scarce. We found one study on the association between SC and children's mental health service use. This study showed that 'SC and trust' were not related to psychiatric service use in children.<sup>17</sup> However, this study had a relatively small sample size and studied a clinical sample for which determinants of mental health services can differ.<sup>17–19</sup> One other study focused on social capital as determinant of service use in adults.<sup>20</sup> This study showed that lower social capital was associated with increased mental health service use. This time, the association was mainly explained by individual-level factors. To conclude, scientific evidence on the association of neighbourhood SES and SC with children's mental health service use is scarce.

In this study, we aim to investigate the association of neighbourhood SES as well as SC with mental health service use in children. Additionally, we will adjust for individual sociodemographic characteristics and mental health problems to take into account individual-level differences that might explain the findings. Based on literature and the potential mechanisms discussed earlier, we hypothesise that children living in neighbourhoods with a high SES use more mental health services compared with children living in neighbourhoods with a low SES.<sup>14–16</sup> Because of the limited number of studies on SC, it was not possible to base our hypothesis on literature. Yet, based on the potential mechanisms described earlier, we hypothesise that children living in neighbourhoods with low SC are more likely to use mental health services compared with children in neighbourhoods with

high SC. Better insight into the role of neighbourhood social characteristics in children's mental health service use might inform prevention strategies and policy on the potential benefits of targeting specific neighbourhoods or areas when aiming at improving access to mental health services.

## METHODS

### Study design and population

This study is embedded in the Generation R Study, a prospective, population-based, multiethnic cohort in Rotterdam, the Netherlands, which started as a birth cohort between 2002 and 2005.<sup>21</sup> The data in the current study were collected between 2016 and 2019 at age 13 years. Written informed consent was obtained from all children ( $\geq 12$  years) and their parents, at all waves in the study. The data of the Generation R Study was linked to the aggregated data of the Neighbourhood Profile of the Municipality of Rotterdam, the Netherlands.<sup>22</sup>

All children who visited the research centre at 13 years old were eligible for the current study (N=4929). Children were excluded because of missing data on mental health service use (N=64) or because they lived outside of Rotterdam when the neighbourhood characteristics were measured (N=1462). This resulted in a sample of 3403 children.

### Patient and public involvement

No patients were involved. The Generation R Study has a panel with participants of the study that discuss twice a year how the study can be improved. It was not appropriate or possible to involve the public in the design, or conduct, or reporting or dissemination plans of the current study.

### Procedure and measures

Mental health service use was reported by the accompanying parent at the research centre using the question: 'Did your child visit a psychologist or psychiatrist since the last visit at our research centre four years ago?'. Answer options were 'yes' and 'no'.

Neighbourhood SES and SC were obtained via municipal registry and survey data, gathered in the so-called Neighbourhood Profile.<sup>22</sup> The survey data in the Neighbourhood Profile are collected biannually among residents ( $\geq 15$  years) of the 71 neighbourhoods of the municipality of Rotterdam. The neighbourhoods included on average 8678 residents (range: 907–24 789), and 53% of the residents had a Dutch background (range: 11%–90%). For this study, the Neighbourhood Profile 2014 was used, for which data were gathered in 2013. The overall response rate was 22.5%, corresponding to 175–300 residents per neighbourhood. The data collection procedure for the Neighbourhood Profile was designed to obtain a representative sample by facilitating online surveys, paper surveys and surveys via telephone. Furthermore, the surveys were available in multiple languages. After collecting the data,

the responses were weighted by age and migrant origin for each neighbourhood to increase the representativeness of the data. The applied weights ranged from 0.3 to 3.0 (see online supplemental file 1). In the unweighted sample, people of 55 years and older were overrepresented as well as people with a Dutch or ‘other’ ethnic background (ie, not Dutch, Surinamese, Dutch Antillean, Aruban, Cape Verdean, Turkish or Moroccan).

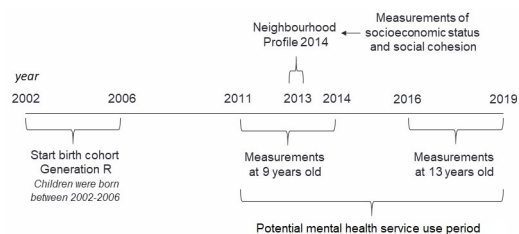
The municipal data were linked to data of our study participants based on their postal code on the 1 July 2013. We constructed a variable ‘neighbourhood SES’ out of the Neighbourhood Profile registry data, based on the included SES-related factors relevant to municipalities like Rotterdam. The included items represent percentages of residents ... (Cronbach’s alpha: 0.95):

- ▶ With a disability benefit (15–75 years old).
- ▶ With a low household income.
- ▶ With debt services (<18 years).
- ▶ Without work (15–75 years old).
- ▶ On social security benefits.
- ▶ Without a basic qualification of education (23–75 years old).
- ▶ Who use social facilities.

SC was defined as the interplay between people within a neighbourhood, the degree of acceptance and connection between neighbours, and their shared norms and values, based on definitions by Forrest and Kearns<sup>23</sup> and Hartig *et al.*<sup>24</sup> Survey data of the Neighbourhood Profile closely related to this definition were used to construct the SC score. The following items were used (Cronbach’s alpha: 0.97), representing the percentage of respondents answering ‘I agree’ or ‘I agree a lot’ on a five-point Likert scale to the following statements:

- ▶ Local residents know each other.
- ▶ Local residents spend much time with each other.
- ▶ Local residents share each other’s views.
- ▶ Local residents help each other.
- ▶ Respondents feel at home with local residents.
- ▶ Young and old get along well in the neighbourhood.
- ▶ Respondents are lucky with the neighbourhood.
- ▶ Respondents are proud of the neighbourhood.
- ▶ Respondents like the neighbourhood.
- ▶ Respondents do not experience any problems in the neighbourhood.
- ▶ Respondents feel connected to the neighbourhood.
- ▶ Respondents feel responsible for the neighbourhood.

The items on neighbourhood SES were reverse coded to align the score with the SC score. Thus, high scores represent a high SC as well as a high neighbourhood SES. We used exploratory factor analyses and Bartlett’s method to calculate factor scores using the Varimax rotation for each neighbourhood social characteristic separately.<sup>25 26</sup> Based on the inflection point of the scree plots, one component for neighbourhood SES and two components for SC were found (see online supplemental file 2). The first component of SC seems to reflect the sense of belonging to the neighbourhood (SC belonging) and the second component of SC seems to



**Figure 1** Timeline of the measurements.

reflect the relations between neighbours (SC relations). Both of these domains of SC are described in research on SC.<sup>27 28</sup> The SES items together explained 81% of the variance, and the SC items together explained 89% of the variance (ie, 49.1% by SC belonging and 39.4% by SC relations). Neighbourhood SES was split into four equal groups because a linear association could not be assumed; a previous study showed that neighbourhoods with a medium SES score had the highest level of mental health service use.<sup>15</sup>

For a timeline of the measurements of the determinants and outcome, see [figure 1](#).

### Covariates

Based on the current literature, eight covariates were added. The age of the children when visiting the research centre was added to control for the participants that responded later to the invitation. The child’s sex was gathered via medical records at birth and categorised as boy or girl. The highest educational level obtained in the household at the child’s age of 5 years, either by mother or father, was categorised as high (higher professional education and university degree), middle (senior general secondary education and secondary vocational education) and low level of education (no education up to pre-vocational secondary education).<sup>29</sup> Net household income at 9 years old was dichotomised in <€2400 and ≥€2400, based on the average monthly income in the Netherlands in 2010.<sup>30</sup> The family situation at 13 years was classified as a one-parent or two-parent family. Children’s migrant origin was added as a covariate to adjust for ethnic background. Migrant origin was based on the origin of parents as all children in our cohort were born in Rotterdam, the Netherlands. In case one or both parents were born outside of the Netherlands, the child was labelled with the corresponding migrant origin. Based on the definition by the Statistics Netherlands,<sup>31</sup> a distinction was made between: no migrant origin, Turkish/Moroccan, Surinamese/Antillean, other Western and other non-Western. Mother-reported emotional and behavioural problems were obtained via the Child Behaviour Checklist/4–18 (CBCL) at 9 years old.<sup>32</sup> The crude problem scores on the externalising and internalising scales were dichotomised based on the 83rd percentile of our sample,<sup>32</sup> which represents a cut-off typically used to describe borderline and clinical problems.



## Statistical analyses

IBM SPSS statistics for Windows, V.25.0, was used for the analyses. Missing data on the covariates were imputed ten times via multiple imputation using a fully conditional specified model. For more information on the imputation process, see online supplemental file 3. No clear pattern was found in the missing values. The correlations between the independent variables were analysed using Spearman's  $r$ . The correlation for neighbourhood SES with SC belonging was relatively high (Spearman's  $r$ : 0.847). This is similar to other studies.<sup>17 20</sup> To test for multicollinearity between the neighbourhood SES and SC belonging, the variance inflation factor (VIF) was calculated. The VIF was below 5, suggesting no multicollinearity. The significance level was set to 0.05 in all analyses. Univariate and multivariable multilevel logistic regression analyses were used to investigate the study's aims. Three models were formulated, next to the empty model, to test the association between the neighbourhood social characteristics and mental health service use:

1. The empty model does not include any independent variables and covariates. This model enables obtaining the Median OR (MOR), used to determine the variance explained by the neighbourhood.
2. Model 1 with independent variables: neighbourhood SES and the SC measures were tested separately and together.
3. Model 2 with part of the covariates: Model 1+sociodemographic individual-level covariates.
4. Model 3 with all covariates: Model 2+ parent-reported internalising and externalising problems.

For each model, we calculated a separate MOR. The  $p$  values for the MOR were calculated in R V.4.1.2 (R Core Team, Vienna, Austria) (packages: *lme4*, *mice*, *broom.mixed* and *foreign*) as this was not possible within SPSS. In Model 3, we tested an interaction of neighbourhood SES with SC belonging and of neighbourhood SES with SC relations as a similar interaction was found in previous literature.<sup>17</sup>

## Sensitivity analyses and complete case analysis

Online supplemental table S1 is an extended version of table 1 which additionally displays the parameter estimates on the covariates. The sensitivity analysis included only children who did not move between July 2011 and the visit at the research centre (between 2016 and 2019) to allow for a prolonged lag time between exposure to the neighbourhood and children's mental health service use. Finally, a complete case analysis was performed, only including children with complete data.

## RESULTS

Mental health services were used by 524 (15.4%) children in the 4-year time period between 9 and 13 years old. Children who used mental health services were significantly more likely to have internalising and externalising problems, be a boy and live in a one-parent family compared with children who did not use

services ( $p < 0.05$ , table 1). Parental educational level, household income, migrant origin, neighbourhood SES, SC belonging and SC relations did not significantly differ between the children that did and did not use mental health services.

The results from the multilevel logistic regression analyses are presented in table 2. The MOR was not significant in any of the models, indicating no differences in mental health service use between neighbourhoods (MOR in joint model 3: 1.08 ( $p = 0.50$ )). In the separate models of neighbourhood SES and SC, no association was found between neighbourhood social characteristics and mental health service use (table 2). The model with neighbourhood SES and both SC measures together showed that children living in a low SES neighbourhood were less likely to use services compared with children in a high SES neighbourhood. This association remained significant after adjusting for individual-level characteristics and mental health problems (OR 0.57 (95% CI 0.32 to 1.00)). In this joint model, SC belonging was also significantly associated with mental health service use. Children in neighbourhoods with a higher SC belonging were less likely to use services (OR 0.79 (95% CI 0.064 to 0.96)). SC relations were not associated with mental health service use in any of the models. No interaction was found between neighbourhood SES and SC belonging or SC relations in model 3 ( $p$  values ranging from 0.16 to 0.82).

## Sensitivity analyses

Online supplemental file 4 and table S1 details the parameter estimates for the covariates. In the sensitivity analyses that only included children who did not move after 2011 ( $N = 2631$ ), findings were similar to the findings in table 2 (see online supplemental file 4 and table S2). Neighbourhood SES (OR 0.45 (95% CI 0.23 to 0.88)) and SC belonging (OR 0.78 (95% CI 0.62 to 1.00)) were only significantly associated with mental health service use when adjusted for each other. SC relations were not associated with service use. In the complete case analyses ( $N = 2162$ ), no significant associations were found (online supplemental file 4 and table S3) but the ORs were comparable to those in table 2.

## DISCUSSION

Multilevel analyses on a large multiethnic cohort showed some minor, non-significant variability between neighbourhoods in mental health service use for 9–13 years old children with a migrant origin. Yet, neighbourhood SES and SC belonging were associated with mental health service use, only when adjusted for each other. These associations were independent of individual-level characteristics and mental health problems. These findings imply that children living in low SES neighbourhoods and children in areas where

**Table 1** Individual and neighbourhood characteristics of the study population (N=3403)

	Total study sample (N=3403)		Service users (N=524)		No service users (N=2879)		P value*
	N(%)/ Mean (SD)	Miss.%	N(%)/ Mean (SD)	Miss.%	N(%)/ Mean (SD)	Miss.%	
Mental health service use	524 (15.4)	0.0	524 (100.0)	0.0	0 (0.0)	0.0	NA
Age at visit research centre (in years)	13.6 (0.4)	0.0	13.6 (0.3)	0.0	13.6 (0.4)	0.0	0.064
Emotional and behavioural problems†							
Internalising (present)	430 (16.1)	21.5	116 (22.1)	22.3	314 (13.9)	21.4	<b>0.000</b>
Externalising (present)	416 (15.6)	21.6	125 (30.7)	22.3	291 (12.9)	21.4	<b>0.000</b>
Sex							
Boy	1692 (49.7)	0.0	303 (57.8)	0.0	1389 (48.2)	0.0	<b>0.000</b>
Girl	1711 (50.3)		221 (42.2)		1490 (51.8)		
Educational level of parents‡							
Low	228 (7.9)	15.3	31 (7.0)	15.6	197 (8.1)	15.2	0.658
Middle	712 (24.7)		106 (24.0)		606 (24.8)		
High	1943 (67.4)		305 (69.0)		1638 (67.1)		
Net household income							
<€2400	731 (28.3)	24.0	120 (30.0)	24.0	611 (27.9)	24.0	0.400
≥€2400	1856 (71.7)		280 (70.0)		1576 (72.1)		
Migrant origin							
No	1908 (57.6)	2.6	318 (62.6)	3.1	1590 (56.7)	2.6	0.058
Turkish/Moroccan	418 (12.6)		47 (9.3)		371 (13.2)		
Surinamese/Antillean	339 (10.2)		51 (10.0)		288 (10.3)		
Other Western	309 (9.3)		47 (9.3)		262 (9.3)		
Other non-Western	339 (10.2)		45 (8.9)		294 (10.5)		
Family situation							
One-parent family§	588 (20.3)	14.8	130 (29.1)	14.9	458 (18.7)	14.8	<b>0.000</b>
Two-parent family	2310 (79.7)		316 (70.9)		1994 (81.3)		
Neighbourhood SES							
High	1009 (29.7)	0.0	159 (30.3)	0.0	850 (29.5)	0.0	0.408
Midhigh	969 (28.5)		149 (28.4)		820 (28.5)		
Midlow	844 (24.8)		139 (26.5)		705 (24.5)		
Low	581 (17.1)		77 (14.7)		504 (17.5)		
SC belonging	0.3 (1.0)	0.0	0.3 (1.0)	0.0	0.3 (1.0)	0.0	0.768
SC relations	0.2 (0.8)	0.0	0.2 (0.8)	0.0	0.2 (0.8)	0.0	0.443

Percentages are the valid percentages and, therefore, add up to 100% without the missing values

Bold represents a significant difference ( $p < 0.05$ ) between the children that use services and children that do not use services, using the  $\chi^2$  test statistic.

\*P value of the Pearson  $\chi^2$  test for the categorical variables and p value of the t-test for the continuous variables.

†Mother-reported problems in the borderline/clinical range.

‡Highest educational level obtained by the mother or father.

§Includes single parents and widowers.

Miss., missingness within the variable; NA, not available; SC, social cohesion.

people feel a sense of belonging to their neighbourhood were less likely to use services compared with their peers in high SES neighbourhoods or in areas where people have a sense of not belonging to their neighbourhood. SC relations were not associated with service use.

This study shows that neighbourhood SES and SC belonging were only associated with mental health service use when adjusted for each other. A possible explanation is the combination of a high correlation

between neighbourhood SES and SC belonging, and their associations with mental health service use in opposite directions. Therefore, in the unadjusted associations of neighbourhood SES and SC belonging with mental health service use, the true associations might be masked by the association in the opposite direction of the other neighbourhood social characteristic. For example, a child might live in a neighbourhood with a high SES and where people feel a sense of belonging to their neighbourhood. When solely focussing on the

**Table 2** The association between SC belonging, SC relations, neighbourhood SES and mental health service use in 13-year-old children (N=3403)

Separate models	Empty model	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
<b>Neighbourhood SES</b>				
High	–	1.00	1.00	1.00
Midhigh	–	0.98 (0.75 to 1.28)	1.00 (0.77 to 1.31)	0.97 (0.75 to 1.27)
Midlow	–	1.03 (0.78 to 1.36)	1.07 (0.81 to 1.42)	1.04 (0.79 to 1.38)
Low	–	0.82 (0.60 to 1.13)	0.95 (0.68 to 1.33)	0.91 (0.65 to 1.28)
MOR	1.14 (p=0.22)	1.13 (p=0.43)	1.11 (p=0.50)	1.09 (p=0.50)
<b>Separate models</b>				
<b>Social cohesion</b>				
SC belonging	–	0.97 (0.87 to 1.08)	0.91 (0.81 to 1.03)	0.92 (0.82 to 1.03)
SC relations	–	1.06 (0.93 to 1.21)	1.06 (0.93 to 1.21)	1.09 (0.95 to 1.24)
MOR	1.14 (p=0.22)	1.15 (p=0.22)	1.09 (p=0.50)	1.06 (p=0.50)
<b>Joint model</b>				
<b>Neighbourhood SES</b>				
High	–	1.00	1.00	1.00
Midhigh	–	0.84 (0.59 to 1.20)	0.83 (0.59 to 1.18)	0.82 (0.58 to 1.17)
Midlow	–	0.77 (0.48 to 1.21)	0.76 (0.48 to 1.18)	0.75 (0.48 to 1.16)
Low	–	<b>0.54 (0.30 to 0.86)</b>	0.59 (0.33 to 1.02)	<b>0.57 (0.32 to 1.00)</b>
SC belonging	–	0.82 (0.67 to 1.00)	<b>0.79 (0.64 to 0.96)</b>	<b>0.79 (0.64 to 0.96)</b>
SC relations	–	1.05 (0.92 to 1.21)	1.05 (0.91 to 1.21)	1.07 (0.93 to 1.23)
MOR	1.14 (p=0.22)	1.14 (p=0.39)	1.11 (p=0.50)	1.08 (p=0.50)

Bold: represents  $p < 0.05$ . OR for mental health service use at 13 years.

Model 1: random intercept model including neighbourhood characteristics. Model 2: model 1 + age of the children at the outcome, sex of the child, educational level of the parents, net income of the household and family situation (one-parent or two-parent family). Model 3: model 2 + parent-reported internalising and externalising problems (83rd percentile cut-off).

MOR, median OR; SC, social cohesion; SES, socioeconomic status.

effect of the high SES neighbourhood, which is likely to be a positive association based on our findings, this will be nullified by the reverse association of SC belonging, which is not taken into account. This will lead to the incorrect assumption that neighbourhood SES is not associated with service use. van der Linden *et al*<sup>17</sup> also concluded that ‘SC and trust’ can alter the effect between neighbourhood SES and mental health service use. Please note that we tested for, but found no evidence of, any interaction effects between neighbourhood SES and both SC measures.

The high correlation in combination with the reversed associations might also explain why we did not find any variability in mental health service use between neighbourhoods. Another explanation could be that in the Netherlands the number of mental health providers is relatively high compared with other European countries.<sup>33</sup> Also, the Netherlands has excellent preventive health service systems for children, including several well-developed pathways of referral to mental health

services.<sup>34</sup> This all might decrease the variability in service use between neighbourhoods.

Our finding that children living in low SES neighbourhoods are less likely to use mental health services aligns with previous studies and our hypothesis.<sup>14–16</sup> Our findings also align with studies on this topic focussing on children and adolescents with mental health problems.<sup>35–36</sup> The findings might be explained by the potential mechanisms described earlier, such as lower health literacy and a lower perceived severity due to the comparison with problems of others among people in low SES neighbourhoods.<sup>9–11</sup> Nevertheless, literature shows that people in low SES neighbourhoods have on average more mental health problems, which would suggest more mental health service use by this group.<sup>6–9</sup> Our analyses showed that the association between neighbourhood SES and mental health service use barely changed after the additional adjustment for mental health problems in model 3. This could imply that people in low SES neighbourhoods do have more problems but do not seek help for

these problems. It could also mean that people seek help for problems other than the emotional and behavioural problems measured via the CBCL. We found one study with a different conclusion. van der Linden *et al*<sup>17</sup> found that children in socioeconomically deprived areas used more services. In this study, a more intensive type of service was studied and a linear association with neighbourhood SES was assumed.

The finding that children use more services in areas where people feel less sense of belonging to their neighbourhood was in line with our hypothesis. We found one other study on a related topic, namely SC and trust, by van der Linden *et al*.<sup>17</sup> In this study, no association was found, which according to the authors might be explained by the specific study population (ie, clinical and homogeneous). It is important to understand the potential mechanisms behind SC and mental health service use. Especially since our study indicates that different aspects of SC may not be similarly related to mental health service use. The potential mechanism discussed in the introduction is not likely to explain the association found in this study. This mechanism implied that people in high SC neighbourhoods are less likely to use services because they can obtain informal care via neighbours, function as each other's safety net and can help to identify each other's problems.<sup>12 13</sup> Yet, this mechanism is more related to SC relations, for which we did not find an association, than to SC belonging. Therefore, more research is needed to elucidate the possible working mechanism behind the association between SC belonging and mental health service use. The association between sense of belonging to a neighbourhood and mental health has previously been established,<sup>37 38</sup> but its relationship to children's mental health service use is yet understudied.

This study has several strengths. First of all, the contextual factors were studied in a prospective, population-based, multiethnic cohort. Furthermore, because of this design, this study's findings can probably be generalised to other urban areas in Western countries with free and easily accessible mental health services for children. When parents have to pay for their children's service use, mental health service density and use will likely be higher in richer neighbourhoods as opposed to poorer neighbourhoods.<sup>14 39 40</sup>

Some limitations need to be considered when generalising the findings. First, we may have missed subtle differences within neighbourhoods regarding SES and SC, considering that variation might be present even at a lower level, for example, street-level. When studying the area directly surrounding the child, that is, egohood, it is more likely to include the relevant environmental factors that affect service use than studying the administrative neighbourhood. Second, we were able to account for individual SES variables, but not for SC of the neighbourhood as experienced by the children and their parents. In line, the fact that the neighbourhood social characteristics were not reported by the participants themselves can be seen as a strength and a limitation. On the one hand, the neighbourhood social characteristics do represent the contextual level rather than the individual level. On

the other hand, the participants in our study might experience their neighbourhood differently.

Third, the Generation R Study faced selective drop-out over the years. However, in the comparable cohort of ALSPAC, the systematic drop-out did not alter associations found in the study.<sup>41</sup> The power in the ALSPAC study did decrease due to the drop-out, which we tried to overcome by imputing the missing covariates. Fourth, the mental health service use was self-reported, which might result in an underreporting of service use.<sup>42</sup> This can be, among others, the consequence of recall bias and of the tendency to provide socially desirable answers.<sup>43 44</sup> Last, due to our research design, the time between the measurements of the neighbourhood profile and mental health service use differs per participant. However, adding this time to the analyses (OR 0.93 (95% CI 0.84 to 1.03)) and adding interaction terms between this time and the neighbourhood social characteristics (>0.05), showed no significant results.

This study shows that policy-makers should be aware of the influence of neighbourhood social characteristics on children's mental health service use. At first sight, no neighbourhood differences were found. Nevertheless, it seems important to pay extra attention to improving access to services for children in neighbourhoods with a low SES and in areas where people feel a sense of belonging to their neighbourhood. Policy-makers should focus on monitoring these neighbourhood characteristics and intervene early when changes in neighbourhood social characteristics are detected that might introduce a decrease in mental health service use. Additionally, it is important to understand the mechanisms behind the associations, so policymakers can intervene evidence based.

More research is needed to study these mechanisms. Potential mechanisms could be the differences between neighbourhoods in the level of health literacy, availability of services and the social safety net.<sup>10 12 14</sup> We have several recommendations for future studies on this topic. First, when studying neighbourhood social characteristics, it is important to use joint models as the effects can be masked by other neighbourhood social characteristics. Second, we recommend studying neighbourhood characteristics in areas where they are less correlated compared with our study, to disentangle the associations. Third, we recommend taking into account the duration that a child lives in a certain neighbourhood. Fourth, we recommend studying egohoods as this might affect a child more intense than its administrative neighbourhood. Insight in these mechanisms in children can inform prevention strategies and policy on the need to differentiate between specific neighbourhoods or areas to improve access to services for under-represented populations.

In conclusion, our study shows that, after adjusting for individual-level characteristics and mental health problems, children living in high SES neighbourhoods or in areas where people feel less sense of belonging to their neighbourhood are more likely to use mental health services compared with their peers in low SES

neighbourhoods or in areas where people feel a sense of belonging to their neighbourhood.

#### Author affiliations

<sup>1</sup>The Generation R Study Group, Erasmus Medical Center, Rotterdam, The Netherlands

<sup>2</sup>Department of Public Health, Erasmus Medical Center, Rotterdam, The Netherlands

<sup>3</sup>Research Department, City of Rotterdam, Rotterdam, The Netherlands

<sup>4</sup>Department of Child and Adolescent Psychiatry/Psychology, Erasmus Medical Center, Rotterdam, The Netherlands

<sup>5</sup>Department of Psychology, Education and Child Studies, Erasmus Universiteit Rotterdam, Rotterdam, The Netherlands

<sup>6</sup>Department of Social Development, City of Rotterdam, Rotterdam, The Netherlands

**Twitter** Hein Raat @heinraat

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#### ORCID iDs

Diana G.M. Eijgermans <http://orcid.org/0000-0003-1439-3856>

Hein Raat <http://orcid.org/0000-0002-6000-7445>

Wilma Jansen <http://orcid.org/0000-0002-4453-9054>

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