EVIDENCE-BASED PUBLIC HEALTH POLICY AND PRACTICE

The association of neighbourhood psychosocial stressors and self-rated health in Amsterdam, The Netherlands

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Accepted 23 February 2007
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Objective: To investigate associations between neighbourhood-level psychosocial stressors (i.e. experience of crime, nuisance from neighbours, drug misuse, youngsters frequently hanging around, rubbish on the streets, feeling unsafe and dissatisfaction with the quality of green space) and self-rated health in Amsterdam, the Netherlands.

Participants: A random sample of 2914 subjects aged $\geq$ 18 years from 75 neighbourhoods in the city of Amsterdam, the Netherlands.

Design: Individual data from the Social State of Amsterdam Survey 2004 were linked to data on neighbourhood-level attributes from the Amsterdam Living and Security Survey 2003. Multilevel logistic regression was used to estimate odds ratios and neighbourhood-level variance.

Results: Fair to poor self-rated health was significantly associated with neighbourhood-level psychosocial stressors: nuisance from neighbours, drug misuse, youngsters frequently hanging around, rubbish on the streets, feeling unsafe and dissatisfaction with green space. In addition, when all the neighbourhood-level psychosocial stressors were combined, individuals from neighbourhoods with a high score of psychosocial stressors were more likely than those from neighbourhoods with a low score to report fair to poor health. These associations remained after adjustments for individual-level factors (i.e. age, sex, educational level, income and ethnicity). The neighbourhood-level variance showed significant differences in self-rated health between neighbourhoods independent of individual-level demographic and socioeconomic factors.

Conclusion: Our findings show that neighbourhood-level psychosocial stressors are associated with self-rated health. Strategies that target these factors might prove a promising way to improve public health.

In the past few years, interest in neighbourhood effects on health has increased tremendously. Evidence strongly indicates that the neighbourhood in which people live influences their health, either in addition to or in interaction with individual-level characteristics.[1 2] A recent systematic review of multilevel studies,[1] for example, showed fairly consistent and modest neighbourhood effects on health despite differences in study designs, neighbourhood measures and possible measurement errors.

The explanation for the relative bad health of people living in disadvantaged neighbourhoods is the subject of intense debate. There are two main interpretations: a psychosocial perspective and a neomaterial perspective. According to the proponents of the psychosocial theory, stressors in the neighbourhood make residents feel unpleasant, and this affects their behaviour (inappropriate coping strategies) and biology (psycho-neuroendocrine mechanisms), which, in turn, increase their susceptibility to diseases in addition to the direct effects of absolute material living standards.[3–8] A negative neighbourhood climate characterised by heightened fear and exposure to crime has been shown to be associated with poor health outcomes.[7–13] This psychosocial approach suggests that health can be promoted by improving neighbourhood psychosocial environment, for example, by reducing crime or drug misuse.

According to the neomaterial theory, the impaired health of residents of certain neighbourhoods results from the accumulation of exposure and experiences that have their roots in the material world.[14–18] The health effects of being deprived of an array of material goods are the consequence of a combination of exposure to material deprivation and a lack of individual economic resources associated with a systematic low investment in a range of human, physical, health and social infrastructures.[14] The unequal distribution of neighbourhood income is the result of historical, cultural, political and economic processes. These processes influence the availability of private resources to individuals and also determine public infrastructure in areas such as education and health care services, availability of food, transport, control of the environment, quality of housing and rules and regulations in the workplace.[14] According to the neomaterial perspective, health can be promoted through reflection on the structural determinants that condition inequality of income, such as residential segregation and unemployment.

Several studies have examined the influence of neighbourhood-level factors on self-rated health.[19–35] Most of these studies were focused on material conditions underlying the health disadvantage. They indicate that neighbourhood-level deprivation,[19–25] lower socioeconomic status,[20 25 26] poor quality of the physical residential environment and lower transport wealth[26] are associated with fair to poor self-rated health. Although it is suggested that the features of neighbourhoods may also affect health through psychosocial pathways, only a small number of studies have examined the associations of neighbourhood-level psychosocial stressors and self-rated health.[26 31 36] The results of these studies have not been consistent. For example, Cummins and colleagues[26] found no association between neighbourhood crime and self-rated health. Steptoe and Feldman[31], however, found perceived neighbourhood problems to be associated with poor self-rated health.

Also, in the Netherlands, recent studies show clear associations between self-rated health and neighbourhood-level deprivation, indicating the importance of material influences on health.[19 20 37] As in other countries, however, it is unclear whether the psychosocial perspective is relevant at this level as

well. It is possible that residential neighbourhood problems may constitute sources of chronic stress, which may increase the risk of poor perceived health.[31][34] The main objective of this paper was to assess the associations between neighbourhood-level psychosocial stressors and self-rated health in Amsterdam, the Netherlands. We tested the importance of each neighbourhood-level psychosocial stressor (i.e. crime, nuisance from neighbours, drug misuse, noise, rubbish on the street, graffiti, youngsters hanging around or feeling unsafe, dissatisfaction with green space and unemployment/social benefit) on self-rated health controlling for material factors at the individual level. In addition, we also determined whether self-rated health varies across neighbourhoods and the extent to which each psychosocial factor contributed to that variation. The estimation of measures of neighbourhood variance is of great importance and complements the information obtained by classical measures of associations.[38][39]

DATA AND METHODS

The data for this study came from two different sources. The individual (first) level data included information on demographics, socioeconomic status (household income and education level) and self-rated health. The contextual (second) level data included information on aggregated neighbourhood-level psychosocial stressors. These two levels were linked by neighbourhood, creating a multilevel design for data analysis.

Data collection at the individual level

The individual-level data were provided by the Department of Research and Statistics of Amsterdam Municipality (Dienst Onderzoek en Statistiek (O+S)) based on the State of the City of Amsterdam Survey. This cross-sectional study was carried out in 2004 by O+S to monitor the participation and living conditions in the Amsterdam general population aged ≥ 18 years. A proportional random sample was drawn from the Amsterdam municipal registers in 14 city districts in Amsterdam (figure 1). The data were collected by means of three different survey methods: postal questionnaires, telephone interviews and face-to-face interviews. The data obtained from face-to-face interviews (275 individuals) were excluded from the analyses because of possible response bias. A further 268 participants were excluded because of small neighbourhood sample size (< 10 subjects in a neighbourhood (n = 14 neighbourhoods)), and missing data on gender, age, educational level, ethnicity or self-rated health. Data analyses were performed on the remaining 2914 participants from 75 neighbourhoods. Of the 2914 participants included in our analyses, 65% were interviewed by postal survey and 35% by telephone. The average number of participants per neighbourhood was 50, ranging from 11 to 120. Women were slightly better represented than men.

Individual-level variables
Self-rated health

Self-rated health was asked in a single question – ''How is your health in general?'' – and included five answer categories: excellent, very good, good, fair and poor. Responses were dichotomised by assigning 0 to those who answered excellent to good and 1 to those responding fair or poor. Self-rated health is considered a valid and robust measure of general health status. It is a strong and independent predictor of morbidity and mortality.[40]

Ethnic groups were classified according to the self-reported country of birth and/or the country of birth of the respondent's mother or father in accordance with the Netherlands Central Bureau of Statistics.[41]

Education level was divided into three categories (primary school and below (low), lower secondary school or vocational school to intermediate vocational school or intermediate/higher secondary school (middle) and higher vocational school and university (high)).

Income was determined by a self-reported monthly income and was divided into two categories < 1000 euros (low) and ≥ 1000 euros (high).

Neighbourhood-level data

The contextual level variables were also provided by O+S Amsterdam, based on the Amsterdam Living and Security Survey 2003. This was a large cross-sectional study (n = 9955) which was carried out in 2003 by O+S to assess the safety and security situation of the Amsterdam general population aged ≥ 18 years.[42] Information on psychosocial stressors was calculated for each neighbourhood. In the Netherlands, neighbourhoods are areas with a similar type of building, often delineated by natural boundaries. As a result, they are socioculturally quite homogeneous. The population size varies greatly by neighbourhood.[19]

Neighbourhood-level variables
Crime

Experience of crime was based on the proportion of people in each neighbourhood who reported having experienced crime (such as break-ins, theft, aggravated assault, vandalism or a stolen purse) in their own neighbourhood in the past 12 months.

Nuisance from drug misuse

The proportion of people in each neighbourhood who reported being bothered by frequent drug misuse.

Nuisance from youngsters hanging around

The proportion of people in each neighbourhood who reported being bothered by youngsters hanging around regularly.

Rubbish on the street

The proportion of people in each neighbourhood who reported rubbish on the streets.

Graffiti

The proportion of people in each neighbourhood who reported graffiti on the walls.

Feel unsafe

The proportion of people in each neighbourhood who reported feeling unsafe regularly.

Nuisance from noise

The proportion of people in each neighbourhood who reported being bothered by noise.

Nuisance from neighbours

The proportion of people in each neighbourhood who reported being frequently bothered by the neighbours in their neighbourhood.

Dissatisfaction with green space

The proportion of people in each neighbourhood who reported being dissatisfied with the quality of green space in their neighbourhood.

Unemployment/social benefit

The proportion of people in each neighbourhood who reported being unemployed or who were receiving social benefit.
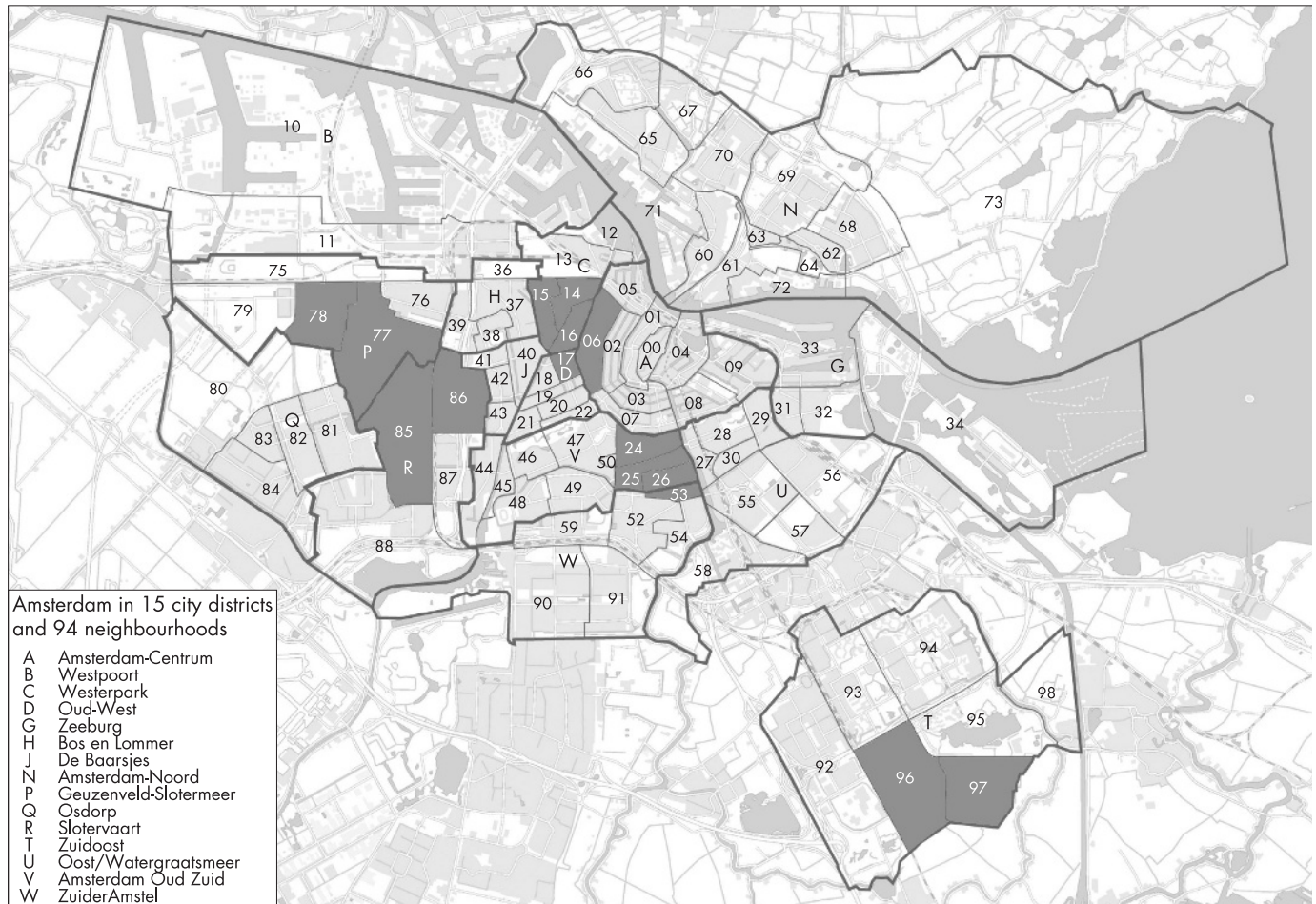
Figure 1 Map of city districts and neighbourhoods of Amsterdam.

Neighbourhoods were divided into three equal-sized groups (tertiles) for each neighbourhood-level factor. Tertile 1 represented neighbourhoods with the lowest proportion of the neighbourhood factor and tertile 3 represented neighbourhoods with the highest proportion of the neighbourhood factor.

Data analysis
We performed a multilevel logistic regression to determine the associations between neighbourhood-level factors and self-rated health with individuals at the first level and neighbourhoods at the second level using the SAS GLIMMIX macro procedure (SAS Institute, Inc., Cary, NC, USA). Each neighbourhood-level stressor was modelled separately because of high correlations between neighbourhood-level stressors (table 1). In addition, we created summary scores for all the neighbourhood psychosocial stressors for each neighbourhood. The results are shown as odds ratios and 95% confidence intervals (CIs). The method of estimation was a restricted maximum likelihood procedure. We performed three models to determine the associations between neighbourhood-level psychosocial stressors and self-rated health adjusting for potential confounding factors. Model 1 included each neighbourhood variable and the individual-level variables age and sex. In model 2 the same variables were included but in addition the individual-level variables education level and income were added to determine whether the differences were independent of individual-level socioeconomic status. In model 3 the same variables were included but in addition the individual-level variable ethnic background was added. Ethnicity was included in the final model because recent evidence in The Netherlands

suggests that different ethnic groups might interpret the perception of self-perceived health differently.[43] We calculated the intraclass correlation (ICC) to estimate the proportion of total variation in self-rated health that occurred at the neighbourhood level, using the latent variable method.[44] In addition, we calculated the median odds ratio (MOR), which has a consistent and intuitive interpretation.[45 46] MOR quantifies cluster variance in terms of odds ratios. It is therefore comparable to the fixed effects odds ratio, which is the most widely used measure of effect for dichotomous outcomes.

RESULTS
Table 2 shows the characteristics of the study population. About 17% of the respondents reported fair to poor health.

Table 3 shows the association between each neighbourhood-level psychosocial stressor and fair to poor self-rated health in three different models. A significantly increased risk of reporting fair to poor self-rated health was observed for people living in neighbourhoods with medium to high proportions of nuisance from neighbours, drug misuse, rubbish on the streets, youngsters regularly hanging around, unemployment/social benefit and feeling unsafe in their own neighbourhoods. These associations were attenuated, but remained, after further adjustments for individual-level socioeconomic status and ethnicity, although neighbourhoods with medium levels of nuisance from neighbours and rubbish on the streets were of borderline significance in the full model. Neighbourhood dissatisfaction with quality of green space was associated with fair to poor self-rated health, although the difference was significant only for the low versus medium levels. There were

Table 1 Correlation matrix for neighbourhood-level psychosocial stressor variables

	1	2	3	4	5	6	7	8	9	10
1 Experience of crime	1.000									
2 Nuisance from neighbours	0.042*	1.000								
3 Nuisance from drugs	0.263***	0.461***	1.000							
4 Nuisance from noise	0.376***	0.413***	0.688***	1.000						
5 Rubbish on the street	0.377***	0.594***	0.484***	0.559***	1.000					
6 Graffiti	0.533***	0.243***	0.548***	0.592***	0.507***	1.000				
7 Youngsters hanging around	0.073***	0.513***	0.381***	0.280***	0.449***	0.070***	1.000			
8 Feeling unsafe	0.400***	0.419***	0.358***	0.448***	0.658***	0.443***	0.594***	1.000		
9 Unemployed/receiving social benefit	0.086**	0.521***	0.266***	0.136***	0.285***	0.110***	0.019	−0.026	1.000	
10 Dissatisfaction with green space	0.391***	0.234***	0.429***	0.571***	0.419***	0.541***	0.006	0.204***	0.241***	1.000

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

no significant associations between neighbourhood experience of crime, graffiti or nuisance from noise and self-rated health. In addition, when all the neighbourhood-level psychosocial stressors were combined, participants from neighbourhoods with a high score of psychosocial stressors were more likely than those from neighbourhoods with a low score to report fair to poor health, the differences still remaining after adjustments for individual-level variables. The trends in the effects of neighbourhood psychosocial stressors on fair to poor health were of similar magnitude.

Table 4 shows the variation in fair to poor self-rated health across neighbourhoods in Amsterdam (i.e. the random intercept). The variation in self-rated health between neighbourhoods was statistically significant. These differences persisted even after adjustment for individual-level differences in age, sex, socioeconomic status and ethnicity. Six per cent of the total variation in self-rated health was between neighbourhoods. Adjustments for individual-level socioeconomic status and ethnicity reduced between neighbourhood variations to 4.6%. Adjustment for each neighbourhood-level stressor further reduced the variation between neighbourhoods, except for crime. Adjustment for nuisance from neighbours had the biggest impact, reducing the between-neighbourhood variation to 2.8%.

The neighbourhood variance corresponds well to the MOR values.

Table 2 Characteristics of the study population

Number of participants	2914
Number of neighbourhoods	75
Mean (min–max) number of participants per neighbourhood	50 (11–120)
Individual-level data	
Mean age (years) (SD)	44.0 (15.6)
Women (%)	57.2
Ethnic groups (%)	
Dutch	69.0
Surinamese	7.8
Antilleans	1.1
Turkish	2.7
Moroccan	2.0
Other	17.4
Education level (%)	
Low	29.7
Middle	24.0
Higher	46.2
Income (%)	
< 1000 euros	16.7
> 1000 euros	83.3
Fair to poor health (%)	16.9

DISCUSSION

The findings of this study indicate that neighbourhoods with high levels of nuisance from neighbours, drug misuse, youngsters frequently hanging around and rubbish on the streets were associated with fair to poor perceived health among their inhabitants. These associations remained after adjustments for individual-level socioeconomic status. The study findings also show clear neighbourhood differences in self-rated health. These differences persisted after adjustment for differences in individual-level demographic and socioeconomic factors. Specific psychosocial stressors at the neighbourhood level contributed to the variation between neighbourhoods in self-rated health.

Some limitations must be acknowledged. Interviews were carried out by postal survey and telephone. It is possible that people might respond differently to questions on paper than to questions asked by an interviewer on the phone. In this study, individuals interviewed by postal surveys were more likely than those interviewed by telephone surveys to report fair to poor health ($p = 0.01$). Nevertheless, applying both postal and telephone interviews was necessary to increase participation and it is an adequate procedure to obtain information of good quality.[47] We controlled for the survey methods in all the analyses. It is therefore unlikely that these differences in survey methods could bias the study conclusions. We were unable to equalise household income because of lack of information on the number of people in each household who had an income. A monthly income of 1500 euros for a household of three people, for example, is not the same as for a household of six people, and this may possibly affect our study conclusions. In addition, our neighbourhood-level psychosocial stressors were not adjusted for neighbourhood-level socioeconomic factors such as the percentage of people with a low education level and income, which may also affect our study conclusions. However, after further adjustment for neighbourhood-level unemployment/social benefit (also an indicator of neighbourhood socioeconomic status), people living in neighbourhoods with high proportions of nuisance from neighbours (OR = 2.14; 95% CI 1.46 to 1.93), drug misuse (OR = 1.52; 95% CI 1.10 to 2.13), rubbish on the streets (OR = 1.57; 95% CI 1.09 to 2.26) and youngsters regularly hanging around (OR = 1.60; 95% CI 1.14 to 2.25) were still associated with fair to poor self-rated health. More studies are needed to confirm these findings. The study sample was limited to the Amsterdam population, which makes it somewhat difficult to generalise the results to the whole of the Netherlands. Also, 14 neighbourhoods were excluded from the analyses because of the low number of respondents in these neighbourhoods. It is possible that these excluded neighbourhoods might differ from the included 75 neighbourhoods, which might affect our study conclusions. A further limitation was the cross-sectional nature of the study design, which is

Table 3 Odds ratios (and 95% confidence interval (CIs)) for self-reporting fair to poor health by neighbourhood-level stressor

Neighbourhood stressor	Model 1: age and sex adjusted	Model 2: adjusted for age, sex education level and income	Model 3: adjusted for age, sex, education level, income and ethnicity
Crime			
Low	1.00	1.00	1.00
Medium	0.70 (0.48 to 1.07)	0.72 (0.49 to 1.04)	0.75 (0.53 to 1.08)
High	0.84 (0.58 to 1.23)	0.86 (0.59 to 1.25)	0.92 (0.64 to 1.31)
Nuisance from neighbours			
Low	1.00	1.00	1.00
Medium	1.38 (1.06 to 1.96)*	1.39 (0.99 to 1.95)	1.36 (0.97 to 1.89)
High	2.55 (1.86 to 3.49)***	2.16 (1.54 to 3.03)***	1.99 (1.43 to 2.78)***
Nuisance from drug misuse			
Low	1.00	1.00	1.00
Medium	1.59 (1.10 to 2.30)**	1.59 (1.10 to 2.28)**	1.49 (1.05 to 2.12)*
High	1.68 (1.17 to 2.40)**	1.66 (1.17 to 2.35)**	1.59 (1.13 to 2.23)**
Nuisance from noise			
Low	1.00	1.00	1.00
Med	1.30 (0.89 to 1.90)	1.30 (0.90 to 1.88)	1.24 (0.87 to 1.76)
High	1.35 (0.92 to 1.99)	1.36 (0.94 to 1.99)	1.30 (0.91 to 1.88)
Rubbish on the street			
Low	1.00	1.00	1.00
Medium	1.42 (1.00 to 2.03)*	1.41 (1.00 to 2.00)*	1.41 (0.99 to 2.00)
High	1.68 (1.17 to 2.42)***	1.68 (1.17 to 2.40)**	1.68 (1.17 to 2.40)**
Graffiti			
Low	1.00	1.00	1.00
Medium	1.37 (0.95 to 1.97)	1.37 (0.96 to 1.95)	1.31 (0.93 to 1.84)
High	1.18 (0.80 to 1.97)	1.19 (0.84 to 1.73)	1.15 (0.81 to 1.64)
Youngsters hanging around			
Low	1.00	1.00	1.00
Medium	1.41 (0.97 to 2.03)	1.40 (0.97 to 2.01)	1.35 (0.95 to 1.91)
High	1.76 (1.23 to 2.52)**	1.73 (1.21 to 2.46)**	1.62 (1.15 to 2.28)**
Feeling unsafe			
Low	1.00	1.00	1.00
Medium	1.23 (0.85 to 1.77)	1.22 (0.85 to 1.76)	1.17 (0.83 to 1.65)
High	1.53 (1.06 to 2.20)*	1.50 (1.05 to 2.16)*	1.47 (1.05 to 2.07)*
Dissatisfaction with green space			
Low	1.00	1.00	1.00
Medium	1.65 (1.07 to 2.53)*	1.66 (1.10 to 2.55)**	1.64 (1.11 to 2.44)**
High	1.20 (0.83 to 1.73)	1.22 (0.85 to 1.74)	1.22 (0.87 to 1.72)
Unemployed/receiving social benefit			
Low	1.00	1.00	1.00
Medium	1.46 (1.00 to 2.12)*	1.45 (1.01 to 2.08)*	1.35 (0.96 to 1.90)
High	1.57 (1.09 to 2.26)*	1.56 (1.10 to 2.22)**	1.51 (1.09 to 2.10)**
All stressors combined			
Low	1.00	1.00	1.00
Medium	1.34 (0.93 to 1.94)	1.33 (0.93 to 1.91)	1.29 (0.91 to 1.83)
High	1.66 (1.88 to 2.34)**	1.65 (1.18 to 2.32)**	1.54 (1.11 to 2.14)**

*p<0.05; **p<0.01; ***p<0.001; all models are adjusted for survey type.

limited in its ability to pin down the direction of causality. More recently, Oakes[48] has raised a series of important questions on the validity of observational approaches in research on neighbourhoods and health and suggested randomised community trials as an alternative. Nevertheless, as emphasised by others,[49–51] and also acknowledged by Oakes,[48] randomised community trials have their own sets of limitations. For many neighbourhood factors of interest, it is impossible to design a randomised community trial and to obtain evidence on the effect of a single factor.[49]

A strength of this study is that it is one of the few studies, and the first in the Netherlands, to assess associations between neighbourhood-level psychosocial stressors and self-perceived health. The neighbourhoods considered in our study are socioculturally rather homogeneous communities. It has been emphasised that contextual or area bound factors may have a greater impact on health if a neighbourhood relates to a socioculturally homogeneous community.[19] The neighbourhood-level variance showed significant differences in self-rated health between neighbourhoods in Amsterdam even after adjusting for individual-level demographic and socioeconomic variables. This study finding is consistent with several

studies,[19 20 27 30 35] including earlier studies on neighbourhood deprivation and self-rated health in the Netherlands.[19 20] The findings of associations between neighbourhood psychosocial stressors and self-rated health in our study add to the existing literature documenting an association between neighbourhood attributes and health.[19–35] A small number of studies have focused on neighbourhood-level psychosocial stressors.[26 30–32] Our study provides further evidence on the associations between these stressors and self-rated health independent of individual-level demographic and socioeconomic factors. Our findings provide support for the psychosocial perspective and are consistent with other studies that have demonstrated associations between neighbourhood-level psychosocial factors and other health outcomes.[3 8 26 30 31]

There are several mechanisms through which neighbourhood psychosocial stressor may be linked to poor health. For example, neighbourhoods that score high on perceived fear of victimisation (such as frequently feeling unsafe as a result of youngsters hanging around) may discourage residents from engaging in healthy lifestyle measures such as physical activity, which, in turn, may lead to poor health. In addition, a poor quality of the neighbourhood built environment, such as

Table 4 Variation in fair to poor self rated health across neighbourhoods in Amsterdam

	Neighbourhood variance (SE)	ICC	MOR
Base model: age and sex adjusted	0.208 (0.072)**	0.060	1.55
Adjusted for age, sex, socioeconomic status†	0.203 (0.071)**	0.058	1.54
Adjusted for age, sex, socioeconomic status and ethnicity	0.160 (0.065)*	0.046	1.47
Adjusted for age, sex, socioeconomic status, ethnicity + crime	0.158 (0.065)*	0.046	1.46
Adjusted for age, sex, socioeconomic status, ethnicity + nuisance from neighbours	0.094 (0.051)	0.028	1.34
Adjusted for age, sex, socioeconomic status, ethnicity + nuisance from drug misuse	0.123 (0.059)*	0.036	1.40
Adjusted for age, sex, socioeconomic status, ethnicity + nuisance from noise	0.149 (0.064)*	0.043	1.45
Adjusted for age, sex, socioeconomic status, ethnicity + more rubbish on the street	0.148 (0.063)*	0.043	1.44
Adjusted for age, sex, socioeconomic status, ethnicity + graffiti	0.145 (0.064)*	0.042	1.43
Adjusted for age, sex, socioeconomic status, ethnicity + youngsters hanging around	0.124 (0.058)*	0.036	1.40
Adjusted for age, sex, socioeconomic status, ethnicity feeling unsafe	0.129 (0.061)*	0.038	1.41
Adjusted for age, sex, socioeconomic status ethnicity + dissatisfaction with green space	0.124 (0.060)*	0.036	1.40
Adjusted for age, sex, socioeconomic status, ethnicity + unemployment/social benefit	0.124 (0.056)*	0.036	1.40
Adjusted for age, sex, socioeconomic status, ethnicity + all stressors combined§	0.114 (0.059)	0.035	1.38

ICC (intraclass correlation coefficient, i.e. the proportion of the total variance in self-rated health that is between neighbourhoods) is estimated as $\sigma u0^2/(\sigma u0^2 + \pi^2/3)$ and ranges from 0 (no differences in self-rated health between neighbourhoods) to 1 (all variation is at the neighbourhood level). MOR (median odd ratio) is estimated as $\exp(\sqrt{(2 \times \sigma^2)} \times \Phi^{-1}(0.75))$; p<0.05, **p<0.01; all models are adjusted for survey type; † (socioeconomic status was determined by education level and income); SE, standard error.

unsatisfactory green space, may also discourage residents from engaging in outdoor recreation, which in turn may lead to unhealthy lifestyles. In our study, dissatisfaction with neighbourhood green space was associated with a higher risk of fair to poor self-rated health. Takano et al[52] also found that living in a neighbourhood with greenery-filled public areas positively influenced the longevity of urban senior citizens. It has been shown that a significant portion of physical health differentials across neighbourhoods is due to stress level differences across neighbourhoods.[36] It is possible that the biological pathway between neighbourhood environment and poor health may be mediated by an abnormal neuroendocrine secretory pattern[53] due to stress. Chronic activation of the stress system is believed to lead to allostasis or allostatic load (i.e. wear and tear on organ systems), which may have harmful effects on health.[54]

Our finding of a lack of association between experience of crime and self-rated health is surprising, but consistent with Cummins and colleagues' study from England.[26] It is in contrast with the strong associations reported between neighbourhood crime and other health outcomes. For example, a recent study from Sweden showed a positive association between neighbourhood crime and coronary heart disease even after controlling for the individual-level factors.[55] Agyemang and colleagues'[56] recent study found a positive association between neighbourhood crime and blood pressure in Amsterdam. In addition, Morenoff[57] found that the neighbourhood violent crime rate was one of the most robust environmental predictors of infant birthweight, after controlling for both individual- and neighbourhood-level characteristics. The reasons for these inconsistent results are unclear. However, it might well be that perception of general health is influenced more by the fear of crime or victimisation rather than experience of crime. A perception of crime and disorder within an individual's community has been associated with numerous outcomes, including anxiety, depression and post-traumatic stress

disorder.[58–60] It is also possible that the discrepancies between our results and those reported elsewhere may be due to a difference in neighbourhood definition and the spatial scale at which exposure was measured. The stronger association between neighbourhood nuisance and self-rated health than other neighbourhood attributes might reflect the importance of social cohesion and trust on health.[9] Stafford and colleagues[30] also found neighbourhoods with low levels of trust or tolerance of neighbours to be strongly associated with fair to poor self-rated health. It is possible that nuisance from neighbours might increase the negative effects of neighbourhood problems more than other neighbourhood factors we considered, with greater consequence on health.[58]

In conclusion, the findings of this study suggest that neighbourhood-level psychosocial stressors are related to fair to poor perceived health independent of individual-level demographics. These findings provide indications to suggest that strategies that target these neighbourhood-level

What is already known on this subject

The neighbourhood in which people live influences their health.

What this paper adds

Neighbourhood-level psychosocial stressors, in particular nuisance from neighbours, drug misuse, youngsters frequently hanging around, rubbish on the streets and unemployment/social benefit, are associated with fair to poor self-rated health in Amsterdam.

Policy implications

Strategies that target these neighbourhood-level psychosocial stressors might prove a promising way to improve public health.

psychosocial stressors might prove a promising way to improve public health. For example, promotion of neighbourhood social relations, clean streets, and discouragement of drug misuse might provide additional benefit in improving the general health of disadvantaged neighbourhoods.

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Competing interests: None declared.

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