Neighbourhood satisfaction, self-rated health, and psychological attributes: A multilevel analysis in Japan

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ABSTRACT

Although earlier studies have demonstrated an association between neighbourhood perceptions and self-rated health, further study is needed regarding how this association is related to an individual's psychological attributes. Hence, we examined how self-rated health is associated with neighbourhood satisfaction after controlling for personality traits as well as other individual- and area-level covariates. We employed multilevel analysis using microdata collected from a nationwide Internet survey in Japan in 2011 ($N = 8139$). When controlling for personality traits, we observed that the odds for reporting poor health in response to neighbourhood dissatisfaction declined but remained highly significant. We obtained similar results when additionally controlling for sense of coherence (SOC) or replacing personality traits with it. We also found virtually no significant effect of personality traits or SOC on the sensitivity of self-rated health with neighbourhood dissatisfaction. Overall, this study indicated that the observed association between neighbourhood satisfaction and self-rated health tends to be overestimated, but cannot be fully explained by personality traits or SOC.

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1. Introduction

Numerous empirical studies have investigated neighbourhood perceptions that may affect individual health (Burdette & Hill, 2008; Echeverria, Diez-Roux, Shea, Borrell, & Jackson, 2008; Evans, 2001; Gary, Stark, & La Veist, 2007; Hill, Burdette, & Hale, 2009; Hill, Ross, & Angel, 2005; Kim, 2008; Latkin & Curry, 2003; Lawrence, 2002; Ross & Mirowsky, 2009). These studies have found that residing in neighbourhoods characterized by social disorder and socioeconomic disadvantages is associated with higher levels of depression, distress, and more broadly, a poorer assessment of overall health.

Many researchers have focused on more specific aspects of neighbourhood perceptions and health; some have stressed the association of heath with interpersonal relations with neighbours or social capital (Kim, Subramanian, & Kawachi, 2006; Subramanian, Kim, & Kawachi, 2002; Tampubolon, Subramanian, & Kawachi, 2011), while others have emphasized the importance of safety problems in the neighbourhood (Rohrer, Arif, Pierce, &

Blackburn, 2004; Tucker-Seeley, Subramanian, Li, & Sorensen, 2009). In addition, researchers have found a link between neighbourhood satisfaction and neighbourhood attachment, which could be considered an indicator of an individual's well-being and adjustment to her/his own urban residential environment (Bonaiuto, Aiello, Perugini, Bonnes, & Ercolani, 1999).

Researchers have also shown that perceived neighbourhood perceptions affect health, even after controlling for objective neighbourhood conditions as well as individual socioeconomic factors (Bowling & Stafford, 2007; Fagg, Curtis, Clark, Congdon, & Stansfeld, 2008; Weden, Richard, Carpiano, & Robert, 2008). Considering that residents' individual differences may affect their views of the same neighbourhood conditions, it is not surprising that objective and subjective neighbourhood conditions have independent associations with health. Indeed, some researchers have stressed that perceived neighbourhood environment is a more reliable predictor of individual health than objective neighbourhood characteristics are (Caughy, O'Campo, & Muntaner, 2003; Christie-Mizell, Steelman, & Jennifer, 2003; Kawachi & Berkman, 2003).

However, we cannot rule out the possibility that the observed association between neighbourhood perceptions and self-rated health is at least partly spurious. Empirical studies have often used self-reported assessments of the neighbourhood on a set of

scales collected from social surveys, which is likely to have caused same-source bias (Diez-Roux, 2007; Echeverria et al., 2008). Moreover, both neighbourhood perceptions and self-rated health are subjective; hence, their observed correlation may reflect their relations with the common factor—that is, psychological attributes of participants—rather than any causal relationship between the two. For example, we can naturally expect that people who are more anxious tend to report lower satisfaction with both their neighbourhood and their own health, regardless of their actual conditions.

In order to acquire precise knowledge of the association between neighbourhood perceptions and health, we must control for any factor closely related to both constructs. To be sure, demographic and socioeconomic factors such as gender, marital status, income, and educational attainment have usually been included as covariates in the regression analysis for predicting self-rated health by neighbourhood perceptions. In this regard, some studies have found that psychosocial factors such as loneliness, depression, hostility, and stress partly account for the effects of perceived neighbourhood environment on health (Wen, Hawkley, & Cacioppo, 2006). In general, however, we need to understand the role of other relevant individual psychological characteristics.

In this study, we focused on neighbourhood satisfaction and examined whether and to what extent it is associated with self-rated health after controlling for an individual's psychological attributes, in addition to other individual- and area-level background variables in a framework of multilevel analysis. If the association between neighbourhood satisfaction and self-rated health remains substantial and significant even after controlling for psychological attributes, we can argue that the observed association between neighbourhood satisfaction and self-rated health is real.

In our empirical analysis, we focused on two aspects of an individual's psychological attributes—personality traits and Antonovsky's concept of sense of coherence (SOC), both of which have been widely used to assess the association between an individual's psychological attributes and health. For example, Goodwin and Engstrom (2002), Löckenhoff, Terracciano, Ferrucci, and Costa (2012), and Turiano et al. (2012) used personality traits, while Eriksson and Lindström (2005) and Richardson and Ratner (2005) used SOC.

For personality traits, we used the Big Five Inventory (BFI), comprising five personality dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness (Benet-Martínez & John, 1998). Among the five dimensions, neuroticism has consistently been found to have a highly negative association with self-rated health. However, results related to the other four dimensions have been largely mixed; for example, Goodwin and Engstrom (2002) found positive associations of self-rated health with all of them, while Löckenhoff et al. (2012) found no association with agreeableness and Turiano et al. (2012) found no association with openness.

Additionally, we used SOC, a key feature of human information processing in resolving conflict and enduring stress (Antonovsky, 1979, 1987). SOC has three components: comprehensibility (the extent of the belief that life makes sense and that information about life is structured and consistent), manageability (the extent of the belief that there are sufficient resources for dealing with events), and meaningfulness (the extent of the belief that a situation is challenging and warrants making commitments to cope with it). A high SOC implies better skills for maintaining and improving health despite stress. In a quantitative analysis, SOC is measured by the SOC-29 scale (Antonovsky, 1993), which comprises 29 statements, each reflecting one of the three SOC components.

The association of neighbourhood satisfaction with personality traits or SOC remains largely unaddressed. However, individuals with lower neuroticism, higher SOC, or both may tend to assess unfavourable neighbourhood conditions less negatively. Hence, we can reasonably hypothesize that the association between neighbourhood satisfaction and self-rated health is at least partly attributable to personality traits, SOC, or both, which appear to be closely associated with subjective assessments of both the neighbourhood and the individuals' own health. Meanwhile, it is well known that personality traits and SOC are closely correlated but not fully interchangeable (Feldt, Metsäpelto, Kinnunen, & Pulkkinen, 2007; Langius, Björvell, & Antonovsky, 1992). Hence, the ways in which estimation results differ across models that separately and jointly controlled for them is worth exploring.

Our empirical analysis was based on microdata collected from a nationwide Internet survey in Japan, which included questions designed to measure personality traits and SOC. In recent years, since the country's widening income inequality has attracted increased attention, researchers have begun investigating the association between regional deprivation or inequality and individual health in Japan (Ichida et al., 2009; Kondo, Kawachi, Subramanian, Takeda, & Yamagata, 2008; Oshio & Kobayashi, 2009). However, these researchers have not explicitly examined neighbourhood satisfaction or its psychological aspects. Moreover, most existing studies about the association between neighbourhood satisfaction and health focus on the United States or European countries, Asian countries being largely ignored, except for a study that used Korean data (Cho, Park, & Echevarria-Cruz, 2005).

2. Material and methods

2.1. Study sample

We used microdata collected from a nationwide Internet survey in Japan. The survey was designed and implemented in 2011 for a research project that investigated the socioeconomic determinants of subjective well-being and was sponsored by the Japan Society for the Promotion of Science. The survey provides ample information about an individual's subjective assessment of his/her own well-being, personal traits, demographic and socioeconomic status, and perceived neighbourhood characteristics, all of which are useful for examining the relationship between perceived neighbourhood characteristics and overall health.

In order to ensure that the sample was representative of the actual population of Japan, we constructed targeted proportions of 15 population groups, which corresponded to a matrix of five age groups (20s, 30s, 40s, 50s, and 60s) and three household income classes (3 million yen or less, 3–6 million yen, and 6 million yen or more). We constructed these population groups on the basis of two official statistical publications: the *Population Census of 2005* and the *Comprehensive Survey of Living Conditions of the People on Health and Welfare of 2009*. Using these targeted sample proportions, we sent questionnaires via the Internet to 16,930 randomly selected monitors who were registered on the members' list of a private Internet survey institute. We administered the survey between February 16 and 22, 2011, and obtained 11,556 responses in total (response rate: 68.3%).

We must note that the microdata collected from this Internet survey had three important biases. First, the gender proportion was somewhat skewed towards men, who comprised 55.4% of the respondents. Second, the respondents were more educated than the actual population; the percentage of those who had graduated from college or had some higher education was approximately 50.2%, well above the 23.8% of the actual population aged 20–69 years (according to the *Employment Status Survey of 2007*). Third, 35.4% of the respondents lived in the Tokyo Metropolitan Area, which is higher than the 26.8% of the population of Japan who

actually live there (according to the *Comprehensive Survey of Living Conditions of the People on Health and Welfare of 2007*). Therefore, we must be cautious when interpreting the estimated results owing to these biases, although the distributions of age and household income do not differ significantly from the actual distributions.

The data was geographically clustered in small areas by seven-digit postal codes. The first three digits of the postal code correspond to the location of each local municipality (city, town, village, and district in large city), the minimal unit of local administration. In the original dataset, the total number of the three-digit areas was 885, and the number of respondents who lived in the same three-digit area ranged from 1 to 100, with a mean of 23.4 and a standard deviation of 17.1.

2.2. Variables

A key dependent variable was self-rated health, which studies have shown to be a reliable indicator of objective health status (Idler & Benyamini, 1997; Wilcox, Kasl, & Idler, 1996). The survey presented the question, 'How do you describe the current state of your health?' and asked respondents to choose an option on a five-point scale ('healthy', 'somewhat healthy', 'average', 'somewhat poor', and 'poor').

For the independent variables, we considered three types of neighbourhood dissatisfaction: overall neighbourhood dissatisfaction, dissatisfaction with neighbourhood safety, and dissatisfaction with trust in neighbours. The first was a comprehensive measure of neighbourhood dissatisfaction, while the latter two were proxies of perceived social disorder and interpersonal relations in one's neighbourhood, respectively. These variables were assessed on a five-point scale ('satisfied', 'somewhat satisfied', 'neither satisfied nor dissatisfied,' 'somewhat dissatisfied', and 'dissatisfied').

We constructed five binary variables for each of the five personality traits. The survey asked respondents to rate their agreement with each of the 44 BFI items on a six-point scale. Then, we summed up the indices for each trait. SOC was measured using the SOC-29 (Antonovsky, 1993).

To analyse the association between neighbourhood satisfaction and self-rated health, we had to control for objective neighbourhood characteristics and individual-level covariates. At the individual level, we controlled for sociodemographic and socioeconomic factors, including sex, age, marital status (married, unmarried, divorced, or widowed), educational attainment (graduated from junior high school or below, high school, and junior college or above), household income, and occupational status [regularly employed (including managers), non-regularly employed, self-employed, student, and not working (including housework)]. Regarding household incomes, the respondents selected their own income levels as well as those of their spouses, if any, from among 14 income bands. We calculated the median for each band and defined the sum of a respondent and his/her spouse's income as the household income. We then calculated the equivalized income by dividing the household income by the root of the number of household members.

At the area level, we aggregated individual survey data of subjective neighbourhood assessments by averaging for measurement errors across individuals by postal code area. Using a five-point scale, respondents assessed the following 18 aspects of their neighbourhood: convenience for commuting, convenience for shopping, safety, access to medical service, convenience for business, income levels of neighbours, job opportunities, neighbours' attitude towards education, cultural atmosphere, natural environment, pollution, residential environment, quality of public service, access to nursing facilities, access to cultural and entertainment facilities, access to good schools, family members or relatives living nearby, and acquaintances living nearby. We averaged respondents' scores for each area. To obtain reliable area-level measures, we focused on the areas with ten respondents or more who had no missing variables. We expected this approach to enable us to construct a valid proxy of objective neighbourhood characteristics, which was not available from the survey (Diez-Roux, 2007; Mujahid, Diez-Roux, Morenoff, & Raghunathan, 2007), even though this proxy would not be entirely free of same-source bias.

After omitting the responses that included missing key variables and those from respondents who lived in an area of less than ten respondents, the number of observations used in the empirical analysis was 8139 (4660 men; 3479 women), representing 70.4% of the original sample. The basic characteristics of the sample are summarized in Table 1. The average number of respondents living in the same area was 27.2 (SD = 16.4).

3. Calculation

In addition to descriptive analysis, we employed four types of multilevel logit models to predict self-rated health by using neighbourhood dissatisfaction. For logistic regression, we constructed a binary variable of poor self-rated health by allocating a value of 1 to the bottom two responses ('somewhat poor' and 'poor'), which comprised 21.4% of the entire sample. We did not employ ordered logit models using the original five-point-scale variable or condensed three-point-scale ones. Valid ordered logit (or probit) models assume that the coefficients describing the relationship between, for example, the lowest versus all higher categories of the response variable are the same as those that describe the relationship between the next lowest category and all higher categories. The results of the approximate likelihood-ratio tests (not reported) confirmed that this proportional odds assumption was violated in all cases when estimating ordered logit models of five- or three-point-scale self-rated health.

We also constructed binary variables of the three types of neighbourhood dissatisfaction—overall neighbourhood dissatisfaction, dissatisfaction with neighbourhood safety, and dissatisfaction with trust in neighbours—because their original categorical variables could not be used directly as explanatory variables. For

Table 1
Basic characteristics of the sample.

		All	Men	Women
Proportion (%)				
Poor self-rated health		21.4	23.2	19.1
Overall neighbourhood dissatisfaction		14.3	13.2	15.7
Dissatisfaction with neighbourhood safety		22.8	19.4	27.4
Dissatisfaction with trust in neighbours		32.9	31.2	35.2
Married		63.6	65.5	61.0
Single		29.8	29.2	30.6
Divorced		5.3	4.3	6.6
Widowed		1.4	1.0	1.9
Graduated from junior high school		2.1	2.2	2.0
Graduated from high school		24.4	22.9	26.4
Graduated from junior college or above		73.5	74.8	71.6
Regularly employed		41.0	55.3	21.9
Non-regularly employed		19.9	13.5	28.5
Self-employed		7.5	10.3	3.6
Student		4.1	3.8	4.3
Other		27.6	17.1	41.7
Household income ('000 yen)	M	3343	3515	3113
	SD	2396	2473	2268
Age	M	45.1	47.9	41.3
	SD	14.2	14.4	13.0
N		8139	4660	3479

overall neighbourhood dissatisfaction and dissatisfaction with neighbourhood safety, we allocated a value of 1 to the bottom two responses ('dissatisfied' and 'somewhat dissatisfied'), which accounted for 14.3% and 22.8% of all responses, respectively. For dissatisfaction with trust in neighbours, we allocated a value of 1 to the bottom response ('dissatisfied'), which accounted for 32.9% of the same.

In all models, we controlled for sociodemographic and socioeconomic factors at the individual level as well as the 18 aspects of the neighbourhood at the collective area-level. We started with Model 1, which predicted self-rated health by overall neighbourhood satisfaction and covariates and did not include personality traits or SOC. In Model 2, we added personality traits to Model 1. In Model 3, we replaced personality traits with SOC. Finally, we included both personality traits and SOC in Model 4. We repeated the same regressions for dissatisfaction with neighbourhood safety and trust in neighbours.

We also examined how personality traits or SOC affected the sensitivity of self-rated health to neighbourhood dissatisfaction. We added six interaction terms with the fourth (highest) quartiles of each component of the five personality traits and SOC to Model 4. We focused on the level and statistical significance of the odds ratio of each interaction term.

4. Results

4.1. Descriptive analysis

Table 2 shows a pairwise correlation matrix across key variables intended to capture a rough picture of their correlations, although we should note that measures of self-rated health and neighbourhood satisfaction were represented on their original five-point scales. From this table, we first observed highly significant, positive correlations between self-rated health and each of the neighbourhood satisfaction measures. Second, we found that self-rated health was negatively associated with neuroticism and positively associated with the other four personality dimensions as well as with SOC. Third, we noticed close correlations across five personality dimensions, suggesting that their observed associations with self-rated health in multivariate regression models tend to be unstable. This can be a possible reason for the mixed results of observed associations with self-rated health and each personality dimension (except neuroticism) in existing studies. Fourth, we also found close correlations with SOC and each personality dimension, suggesting that personality traits and SOC were highly correlated.

Finally and most importantly, we confirmed from this table that both self-rated health and neighbourhood satisfaction measures were closely linked with each of the personality traits and SOC

variables. This result suggests that the observed correlations between poor self-rated health and neighbourhood dissatisfaction are at least partly due to their relationships with the common factors, that is, personality traits and SOC.

To show the correlations among self-rated health, neighbourhood satisfaction, and personality traits graphically, Fig. 1 shows the proportion of respondents reporting poor health and neighbourhood dissatisfaction (which corresponded to the bottom responses) by neuroticism quartiles. We observed that higher levels of neuroticism corresponded to higher proportions of both poor self-rated health and neighbourhood dissatisfaction. This result pointed to a spurious correlation between self-rated health and neighbourhood satisfaction due to their correlations with neuroticism.

Fig. 2 shows the proportion of respondents reporting poor health and neighbourhood dissatisfaction by SOC. We observed that higher levels of SOC were associated with smaller proportions of poor self-rated health and negative neighbourhood perceptions. Like Fig. 1, it points to the possibility of spurious correlations between self-rated health and neighbourhood satisfaction.

4.2. Regression analysis

Table 3 presents the predicted associations between poor self-rated health and overall neighbourhood dissatisfaction, controlling for personality traits and SOC. We did not report the results for individual- and area-level covariates to save space (available upon request from the authors). As seen in the table, Model 1 (which did not control for personality traits or SOC) shows that poor self-rated health was highly associated with overall neighbourhood dissatisfaction (OR 1.64, $p < 0.001$, 95% CI 1.42–1.90). We obtained this result even after controlling for both individual-level background factors and collective area-level features.

When controlling for personality traits (Model 2), the odds ratio for poor self-rated health dropped to 1.40, but the association remained highly significant ($p < 0.001$, 95% CI 1.20–1.62). This result suggests that the observed association between overall neighbourhood satisfaction and self-rated health was real, albeit overestimated by their relationship with personality traits. We also found that higher levels of neuroticism and openness increased the odds for poor self-rated health, while extraversion, agreeableness, and conscientiousness showed no significant association with self-rated health. The negative association of self-rated health with neuroticism was consistent with findings of previous studies (Goodwin & Engstrom, 2002; Löckenhoff et al., 2012; Turiano et al., 2012), while the results of other dimensions were mixed even in the previous studies.

By replacing personality traits with SOC in Model 3, the odds ratio for poor self-rated health decreased to 1.32, a figure lower

Table 2
Pairwise correlation across self-rated health, neighbourhood dissatisfaction, personality traits, and SOC.

	1	2	3	4	5	6	7	8	9	10
1. Self-rated health[a]	1.00									
2. Overall neighbourhood satisfaction[a]	0.19***	1.00								
3. Satisfaction with neighbourhood safety[a]	0.11***	0.15***	1.00							
4. Satisfaction with trust in neighbours[a]	0.07***	0.18***	0.00	1.00						
5. Extraversion	0.15***	0.14***	0.02	0.16***	1.00					
6. Agreeableness	0.11***	0.20***	0.09***	0.10***	0.07***	1.00				
7. Conscientiousness	0.16***	0.18***	0.12***	0.09***	0.29***	0.55***	1.00			
8. Neuroticism	−0.26***	−0.19***	−0.17***	−0.12***	−0.38***	−0.41***	−0.57***	1.00		
9. Openness	0.06***	0.09***	0.02*	0.06***	0.43***	0.30***	0.44***	−0.30***	1.00	
10. SOC	0.34***	0.30***	0.09***	0.22***	0.56***	0.45***	0.53***	−0.56***	0.50***	1.00

*$p < 0.05$; ***$p < 0.001$.
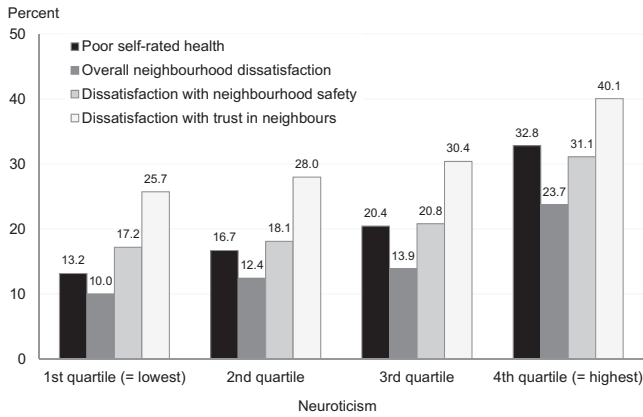[a] Categorical variables (five-point scale).

Fig. 1. Proportions of respondents reporting poor health and neighbourhood dissatisfaction by neuroticism quartiles.
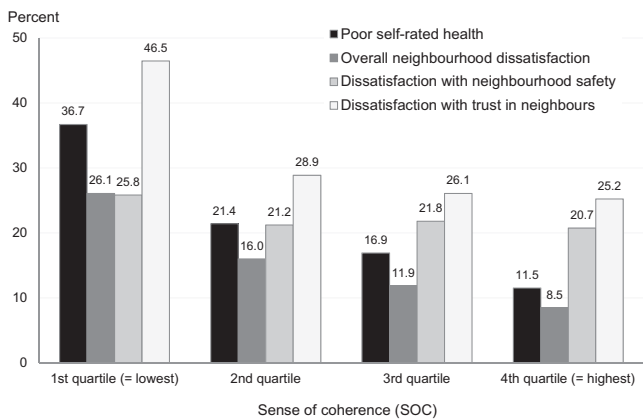

Fig. 2. Proportions of respondents reporting poor health and neighbourhood dissatisfaction by sense of coherence (SOC) quartiles.

than that in Model 2. This decline indicates that neighbourhood satisfaction and self-rated health were more closely related to SOC than personality traits. As in Model 2, however, the association between neighbourhood satisfaction and self-rated health remained highly significant ($p < 0.001$, 95% CI 1.13–1.54). We also

found a strong negative correlation between SOC and poor self-rated health.

Finally, in Model 4 (which included both personality traits and SOC), the odds ratio decreased further to 1.22. Roughly speaking, personality traits and SOC, when combined, explained about 66% ($= (1.64 - 1.22)/(1.64 - 1)$) of the association between neighbourhood dissatisfaction and poor self-rated health after individual- and area-level covariates. However, we should note again that the association remained significant ($p < 0.05$, 95% CI 1.04–1.42), even after controlling for both personality traits and SOC.

By comparing the results between Models 2 and 4 and those between Models 3 and 4, we also found that neuroticism and SOC have more stable correlations with self-rated health than other dimensions of personality traits do. Higher levels of neuroticism consistently increased the odds for poor self-rated health and lower levels of SOC consistently decreased them. The inclusion of SOC raised the odds for poor self-rated health for other dimensions of personality traits—a finding indicating their interactions with SOC, as already suggested in Table 2.

Table 4 compares the associations between poor self-rated health and three types of neighbourhood dissatisfaction. After controlling for personality traits and/or SOC, the odds for poor self-rated health decreased but remained significant across all measures. We also observed that dissatisfaction with neighbourhood safety had the highest association with poor self-rated health, while dissatisfaction with trust in neighbours had the lowest one. Another noteworthy finding is that controlling for SOC reduced the association of self-rated health with dissatisfaction with trust in others (OR = 1.48 vs. OR = 1.21), more than the association with dissatisfaction with neighbourhood safety (OR = 1.77 vs. OR = 1.72). This result suggests that SOC may be a measure more relevant to the assessment of interpersonal relationships than to that of objective aspects of the neighbourhood.

Finally, Table 5 assesses how the interaction with personality traits and SOC affects the sensitivity of self-rated health to neighbourhood dissatisfaction, by adding six interaction terms of neighbourhood dissatisfaction measures with personality traits and SOC to Model 4 (which controlled for all of them). We observed no significant association between self-rated health and almost all interaction terms, while the main effects of neighbourhood dissatisfaction remained highly significant. We also conducted an analysis that separated each interaction term, but the results remained virtually unchanged (not reported in the table).

Table 3
Estimated association of poor self-rated health with overall neighbourhood dissatisfaction, controlling for personality traits, SOC, and other control variables: a multilevel analysis.[a]

Model	1	2	3	4
Controlling for:	None	Personality traits	SOC	Personality traits + SOC
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Overall neighbourhood dissatisfaction	1.64 (1.42, 1.90)***	1.40 (1.20, 1.62)***	1.32 (1.13, 1.54)***	1.22 (1.04, 1.42)*
Personality traits[b]				
Extraversion		0.95 (0.89, 1.02)		1.22 (1.13, 1.31)***
Agreeableness		1.05 (0.98, 1.13)		1.22 (1.14, 1.31)***
Conscientiousness		0.94 (087, 1.02)		1.00 (0.92, 1.08)
Neuroticism		1.72 (1.59, 1.85)***		1.47 (1.36, 1.59)***
Openness		1.14 (1.07, 1.22)***		1.30 (1.21, 1.40)***
SOC[b]			0.56 (0.52, 0.59)***	0.49 (0.45, 0.54)***

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

[a] 18 types of regional characteristics and 6 types of individual features (sex, age, marital status, educational attainment, household income, and occupational status) were also controlled for.

[b] Odds ratios (ORs) for personality traits and SOC indicate how much the odds for poor self-rated health were raised in response to a one-standard-deviation increase from the mean for each variable.

Table 4
Estimated association of poor self-rated health with three types of neighbourhood dissatisfaction, controlling for personality traits, SOC, and other control variables.[a]

Association of poor self-rated health with:		Overall neighbourhood dissatisfaction		Dissatisfaction with neighbourhood safety		Dissatisfaction with trust in neighbours	
		OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Model	Controlling for:						
1	None	1.64	(1.42, 1.90)***	1.77	(1.57, 2.01)***	1.48	(1.32, 1.66)***
2	Personality traits	1.40	(1.20, 1.62)***	1.55	(1.36, 1.76)***	1.30	(1.20, 1.52)***
3	SOC	1.32	(1.13, 1.54)***	1.72	(1.51, 1.96)***	1.21	(1.07, 1.36)**
4	Personality traits + SOC	1.22	(1.04, 1.42)*	1.57	(1.38, 1.79)***	1.18	(1.04, 1.34)**

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
[a] For control variables, see note on Table 3.

Table 5
Interaction effects of personality traits and SOC on the association of poor self-rated health with three types of neighbourhood dissatisfaction.[a]

Association of poor self-rated health with:	Overall neighbourhood dissatisfaction		Dissatisfaction with neighbourhood safety		Dissatisfaction with trust in neighbours	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Main effect	1.40	(1.07, 1.83)**	1.68	(1.35, 2.09)***	1.46	(1.07, 1.99)**
Interaction effect with[b]						
Personality						
Extraversion	0.80	(0.55, 1.16)	0.90	(0.67, 1.19)	0.86	(0.68, 1.09)
Agreeableness	0.88	(0.60, 1.30)	1.10	(0.82, 1.47)	1.04	(0.82, 1.32)
Conscientiousness	0.91	(0.61, 1.37)	0.91	(0.67, 1.25)	0.99	(0.77, 1.26)
Neuroticism	0.81	(0.60, 1.10)	0.87	(0.67, 1.12)	0.90	(0.70, 1.15)
Openness	1.06	(0.75, 1.49)	1.21	(0.90, 1.61)	0.85	(0.67, 1.08)
SOC	1.44	(0.86, 2.41)	0.82	(0.58, 1.17)	1.00	(0.77, 1.30)

**$p < 0.01$; ***$p < 0.001$.
[a] Personality traits, SOC, 18 types of regional characteristics, and six types of individual features (sex, age, marital status, educational attainment, household income, and occupational status) were also controlled for.
[b] Interaction terms with highest quartiles of each variable were added.

5. Discussion and conclusion

Using data from Japan, we examined how self-rated health was associated with neighbourhood dissatisfaction, after controlling for an individual's psychological attributes and other individual- and area-level variables. Two key findings emerged.

First, our multilevel regression analysis without controlling for an individual's psychological traits revealed that overall neighbourhood dissatisfaction was positively associated with poor self-rated health, independent of area- and individual-level attributes. We also observed a significant association between poor self-rated health and both dissatisfaction with neighbourhood safety and trust in neighbours. These observations are generally consistent with the results of preceding studies on neighbourhood perceptions and health conducted in many countries other than Japan (Echeverria et al., 2008; Gary et al., 2007; Hill et al., 2005; Kim, 2008; Latkin & Curry, 2003; Ross & Mirowsky, 2009).

Second and more importantly, we observed that the strength of the association between neighbourhood dissatisfaction and poor self-rated health decreased but remained highly significant after controlling for personality traits and SOC. Thus, we can reasonably argue that the observed association between neighbourhood satisfaction and self-rated health tends to be exaggerated by their correlations with personality traits and SOC, but that the association cannot be fully explained by these psychological attributes. We also observed that the interaction of neighbourhood dissatisfaction with personality traits and/or SOC did not greatly affect the association. This result accords with those of other studies indicating that perceived neighbourhood quality predicts or correlates with a positive people-neighbourhood relationship, as measured by, for example, neighbourhood attachment (Bonaiuto et al., 1999).

Moreover, a closer look at the estimation results revealed a difference in the association of self-rated health with various aspects of neighbourhood dissatisfaction. Compared to dissatisfaction with trust in neighbours, dissatisfaction with neighbourhood safety had a closer association with self-rated health, and its association was not attenuated much by controlling for personality traits or SOC. These results suggest that a safety problem in a neighbourhood is a relatively imminent stressor for self-rated health, in line with the results of existing studies (Rohrer et al., 2004; Tucker-Seeley et al., 2009). This implies that neighbourhood safety represents a priority.

Another noteworthy finding is that SOC was closely related to the association between dissatisfaction with trust in neighbours and self-rated health. The inclusion of SOC reduced the odds for poor self-rated health in the case of dissatisfaction with trust in neighbours much more than in the case of dissatisfaction with neighbourhood safety. Hence, we can argue that SOC is closely related to the association between stresses caused by interpersonal relations and self-rated health.

This study also suggests that further research should aim to identify the roles of an individual's psychological attributes more precisely. In regression analysis, we assumed that personality traits and SOC are exogenous and confound the association between neighbourhood satisfaction and self-rated health. The results in Table 4 do not support the view that personality traits and SOC moderate or amplify the association between neighbourhood satisfaction and self-rated health. However, the results in Table 3 do not contradict the view that personality traits or SOC mediate their association, where these psychological attributes are affected by neighbourhood satisfaction.

Regarding SOC in particular, we cannot rule out the possibility that it works as a mediator between neighbourhood stressors and health. Indeed, SOC has been found to mediate the impact of socioeconomic status on health (Ing & Reutter, 2003; Kivimäki et al., 2002; Suominen, Blomberc, Helenius, & Koskenvuo, 1999). Neighbourhood stressors may possibly lower the level of SOC, which in turn has a negative impact on health, especially if

individuals reside in the same area for a long time. More broadly, future research should address the pathway or mediating mechanism that links neighbourhood stressors to health.

We recognize that this study has several limitations. First, as mentioned in Subsection 2.2, the microdata used in the empirical analysis have biases inherent to an Internet survey. In addition, the area-level averages of neighbourhood perceptions, which we used as a proxy of objective neighbourhood characteristics, were not entirely free from same-source bias, especially in the areas where the number of surveyed residents was low.

Second, we should expand the analysis to cover wider aspects of neighbourhood characteristics and their subjective assessment. In particular, we must address neighbourhood quality through the development of different sets of scales measuring socio-environmental features (Bonaiuto et al., 1999; Bonaiuto, Fornara, & Bonnes, 2003; Fornara, Bonaiuto, & Bonnes, 2010), which this study did not explicitly discuss. Examining the ways in which more specific physical aspects of the environment, such as noise, air quality, base stations for mobile phones, power lines, cleanliness, and access to green spaces, affect health is also of interest.

More importantly, our analysis draws on a cross-sectional dataset, which makes identifying causality between measures nearly impossible. We need to conduct additional research to examine the relationship among neighbourhood satisfaction, health, and personality traits by considering their simultaneous relationships. In addition, we need a framework of dynamic analysis for making residential location decisions, which were pre-determined in the current study, endogenously determined in analytic strategy (Boone-Heinonen et al., 2011).

Acknowledgements

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