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Exploring the relationship between perceptions of neighbourhood-resources, sense of coherence and health for different groups in a Norwegian neighbourhood

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Significance for public health

The creation of health-promoting settings has been outlined as one of the main strategies ahead by the Ottawa-charter. Findings from this study suggest that health can be promoted through the neighbourhood, both through strengthening Sense of coherence (SOC), and providing resources for health-promotion. It is suggested that the neighbourhood might be of benefit for promoting health in groups which might be otherwise hard to reach, such as people outside the work-force. Moreover, investigating the relationships between various perceptions of neighbourhood-resources and SOC/health across groups allows for developing strategies for positive change, including improving quality of neighbourhood-resources, and facilitating neighbourhood participation.

tribute to better health-outcomes for groups with weaker average SOC. The proposed theoretical framework is only partly supported.

Abstract

Background. Health and conditions for health are unevenly distributed across neighbourhoods. Within a salutogenic perspective, neighbourhood-resources can be internalised, and become generalised resistance resources. This paper aims to examine whether the neighbourhood could be a supportive arena for health-promotion, and for whom.

Design and Methods. A cross-sectional study, based on register data from the population-survey in Malvik, Norway, (N=865) was conducted. Using multiple regression analysis, total sample and sub-group analyses (men/women, low/high earners, employed/unemployed) of 5 independent neighbourhood-measures (overall satisfaction, neighbourhood Social Capital, satisfaction with availability and quality of neighbourhood-resources, and neighbourhood participation) on Sense of Coherence (SOC) and health respectively were obtained.

Results. Overall satisfaction ($\beta=0.153$) and neighbourhood social capital ($\beta=0.134$) emerged as the most consistent partial correlates of SOC across groups. In turn, SOC was the strongest coefficient for health-outcomes ($\beta=0.238$). Neighbourhood participation had more consistent correlations with health than SOC across groups. Group-differences became visible in proportions of explained variance in SOC (varying from 7 to 23.7%) and health (varying from 6.7 to 20.6%), and in the relative importance of neighbourhood-variables. Satisfaction with quality of neighbourhood-resources was significantly related to SOC in non-workers ($\beta=0.451$) and low-earners ($\beta=0.261$), and health-outcomes in women ($\beta=0.143$).

Conclusions. Health might be promoted in the neighbourhood mainly through strengthening SOC, and deprived groups, especially non-workers, may benefit most from health-promotion in the neighbourhood. Findings suggest that high satisfaction with quality can con-

Introduction

Health and conditions for health are distributed unevenly across neighborhoods.¹⁻⁴ Neighbourhoods can either expose inhabitants to health risks, or they can distribute resources for good health.^{2,5} A *neighbourhood* can be defined as a place or community within a place.¹ Throughout this paper, a holistic understanding of neighbourhood is adopted, including the geographical, architectural, political, and social aspects of a certain geographic area and the people who inhabit it. In line with descriptions of a *setting*⁶ is the neighbourhood context experienced on the basis of these aspects and their mutual inter-relations. The international core policy document for Health Promotion, the Ottawa charter, outlines the creation of healthy settings as one of the main strategies ahead.⁷

A large amount of research has focused on health-risks following geographically distributed deprivation. Low socio-economic status and bad social climate within neighbourhoods have been linked to a number of negative health-outcomes such as accumulated stress, lower birth weight, behavioural problems, obesity, affective disorders and cardio-vascular diseases.^{3-5,8,9} Lower involvement and less participation within the neighbourhood-context have been associated with unfavourable health outcomes, especially for young people.^{4,10-12} Environmental stressors such as noise, pollution and traffic may have severe health- consequences; at the same time, they tend to be more prominent in deprived areas.¹³

On the positive side, neighbourhoods can promote health through the provision of social, material and affective resources.⁵ For example, the experience of social capital has been linked to a variety of positive health-outcomes.^{12,14,15} Neighbourhood social capital (NSC) has been described as one aspect of social connectedness.¹⁴ It is possible that experiencing social capital on a community- or neighbourhood-level might be even more beneficial for health than individual social capital,¹⁵ especially for children and adolescents.⁴ The presence or absence of health-care facilities within the neighbourhood affects health-seeking behaviour, as frequency-of-contact with the healthsector.¹⁶ Additionally, neighbourhoods can promote a healthy lifestyle by offering arenas for activity.¹⁷ A lot of attention has been on the walk- and bike-ability of neighbourhoods, which can promote physical activity both for transport and leisure, and increase contact among neighbours simultaneously.^{13,17} Likewise, the availability of nearby green-spaces has been linked to positive health outcomes and more physical activi-

ty.¹⁸ The natural features of a neighbourhood – the landscape – can promote health and well-being through possibilities for stress-reduction, physical activity, and social engagement and integration.¹⁹ However, perceptions of the neighbourhood might affect health and well-being even more than its objective characteristics.²⁰ Thus, how inhabitants experience their neighbourhood, its facilities and resources, might be as important for health as the actual amenities.

It is possible to influence both behaviour and social relations within a neighbourhood.^{21,22} However, the health-promoting influence of resources can be diminished or even reversed through unsuitable design or internal organization.^{13,17} Additionally, neighbourhoods are embedded in a broader societal and geographical context, which might support or hazard the health-promoting aspect of resources and interventions within the setting.²³ Social groups relate to the neighbourhood-context differently. For example, perceptions of safety influence the frequency and mode of use of a nearby park more in women than in men.²⁴ Especially minority women seem to use the neighbourhood actively to promote mental health.²⁵ For older adults, neighbourhood organisation is crucial for involvement and activity in every-day-life.²² However, it has been stated that the use of resources in the neighbourhood might be more dependent on individual than environmental characteristics, suggesting those who are better off might also benefit more from environmental resources.²⁶ As health follows a social gradient, closing gaps in the distribution of environmental health-resources is an important goal in health-promotion.²⁷

Theoretical framework

The applied theoretical framework, salutogenesis, as developed by Aaron Antonovsky. Salutogenesis links environmental resources to (positive) health-outcomes.^{28,29} Antonovsky describes health as a life-long process, experienced along a continuum, ranging from complete *health to un-health*. He stresses the importance of understanding the *positive side* of health, and what conditions move us towards the healthy end of the continuum. A core concept within Salutogenesis is the *Sense of Coherence* (SOC), referring to individuals and groups experiencing the world as structured, comprehensive, manageable and meaningful.³⁰ SOC is developed through processing *significant life events*. Environments, as the neighbourhood, influence the development of SOC by facilitating significant events, and offering more or less adequate resources to handle these significant events. Through this, environmental resources are internalised and become *generalised resistance resources* (GRRs). Antonovsky assumed SOC is mainly developed in adolescence and early adulthood (up to the age of 30), and stay relatively stable thereafter.²⁹ However, growing evidence suggests that the internalisation-process itself might be more important for a strong SOC than the mere presence of resources.

Individual SOC has repeatedly been linked to health-outcomes.³⁰ SOC has also been described as the ability to identify and adequately use resistance resources during stressful situations.³¹ Health-outcomes might partly depend on an interaction between environmental resources and SOC: for example, perceptions of the neighbourhood as resource-full (for example, displaying attractive walking-paths), might influence health-promoting behaviour (walking in the neighbourhood) more in people with a weaker SOC than in people with a strong SOC. Following this, we expect neighbourhood-resources (NRs) to affect health-outcomes in two ways: by facilitating the development of a strong SOC, and by working as a resource for individual health-promotion strategies.

The focus of this paper is to examine how different groups experience the relationship between environmental resources and health-outcomes. The overarching objective is to gather evidence on whether neighbourhoods could be a supportive arena for health-promotion, and for whom. To explore these questions, we will examine the relationships between perceived neighbourhood-resources and SOC/health

across different groups, as well as the relative importance of different neighbourhood-dimensions.

According to the theoretical framework, we expect to find: i) direct (positive) relationships between perceptions of neighbourhood-resources and SOC; ii) relationships between perception of neighbourhood and health-outcomes, both direct and mediated by SOC; iii) group-differences in the relative importance of measured neighbourhood-dimensions for health and SOC.

Design and Methods

This article draws mainly on register data from a population survey, conducted in the municipality of Malvik, in Sør-Trøndelag County.³² Malvik is located near the third biggest city in Norway, has a population of above 13.000 (malvik.kommune.no), and displays a variety of settlements ranging from urban to rural. The population survey is part of the municipalities' public-health-effort. It assesses health and conditions for health and well-being on a local level. Data was gathered between January 2011 and April 2012. A sample of 3300 adult inhabitants (app. 25% of the whole population), spread equally across three neighbourhoods, were invited after being drawn randomly from the municipality's register. The survey was distributed by post, along with an informed consent. The response rate was 26.21% (N=865). Respondents were between 18 and 97 years old.

In order to gain a better picture of the Malvik population, it is compared with a representative general Norwegian population sample from the Nord-Trøndelag Health Study (the HUNT-study). The HUNT-study is one of the largest health studies ever performed, and it is a unique database of personal and family medical histories, collected in three extensive waves. Data used for comparison in the present study is derived from HUNT3 (N=50,821; age 19-101; response rate: 54), the third wave of data-gathering, which took place from 2006 to 2008. There is no overlap between the Malvik-population and HUNT. The HUNT-database is regarded as a Norwegian normal population (see www.ntnu.no/hunt).

Included measures

The present sample was described as a whole, and separately for each sub-group in terms of personal characteristics such as age, gender proportions, income etc. Additionally, measures of subjective health, SOC and neighbourhood-perceptions were included. Variables measuring perceptions of neighbourhood, as described below, are later referred to as Neighbourhood Variables (NVs). This is not to be confused with the term neighbourhood-resource (NR): for example, *Satisfaction with quality of NR* is one of the five NVs included into analysis. Included variables were constructed as follows:

Subjective health was assessed on a four-point Likert-scale ranging from *not good to very good*, with higher numbers indicating better health. This measure has been used and validated in a variety of research, including studies linking subjective health directly to mortality.³³ The variable is included in both the Malvik-survey and HUNT3.

Sense of coherence (SOC) is assessed through the individual's sum-score on the validated and widely used *Sense of Coherence Scale*, in this study the SOC-13.³⁴ It includes 13 questions such as, *How often does your everyday life seem meaningless?* and *Has someone you trust ever disappointed you?* Agreement is expressed on a seven-point Likert scale, resulting in a range from 13 to 161 with higher scores indicating a stronger SOC. Cronbach's alpha of the SOC-13 was 0.842 for the Malvik sample.

Overall satisfaction was measured through one question about how

one thrives where one lives, with five alternatives ranging from *very good* (=1) to *very bad* (=5). Before analysis, it was reversed, resulting in a range from 1 to 5, with higher scores indicating greater satisfaction.

*Neighbourhood Social Capital*¹⁴ (NSC) was assessed through agreement on seven statements such as, *I feel safe in my neighbourhood* and *Generally, people do thrive here*. Answers are given on a five-point Likert-scale and are indicated by the sum-score on all variables. After reversal, NSC was measured on a range from 5 to 35, with higher scores indicating a higher NSC. In HUNT3, NSC is measured through three questions. Cronbach's alpha of NSC was 0.842 for the Malvik sample and 0.528 for HUNT3.

Satisfaction with the availability and quality of neighbourhood-resources (later referred to as NR-availability/NR-quality respectively) was measured using single items describing assessments of 11 environmental areas, including out-door facilities, public transport, bike-paths, service-facilities, and shopping-opportunities. These were evaluated individually on an 11-point scale, ranging from *very satisfied* to *not at all*. In further analysis, sum-scores (range 11-121) of both variables were included. Cronbach's alpha was measured to be 0.822 for availability and 0.829 for quality of resources.

Neighbourhood participation was measured through 23 items altogether, clustered into four sections throughout the population survey. It includes the frequency-of-use measure on a variety of facilities as described above, involvement in organised and un-organised activity, use of cultural arenas and sport-facilities, as well as involvement in organisations and clubs. All included variables were re-coded to obtain comparable measures: no or very low participation =0, moderate to high participation =1, and very high participation =2. This resulted in a range from 0 to 46, with higher numbers indicating more involvement. Cronbach's alpha was 0.723.

Procedure and initial analysis

Groups of interest were defined and matched on the ground of theoretical and empirical evidence for consistent differences in health.^{27,35} This resulted in four pairs as follows: men/women, oldest/youngest, low/high earners and people with/without paid work. The latter two pairs can thereby describe somewhat deprived groups: non-workers are seen as a group with access to fewer important societal arenas, while low-earners are understood as representatives for groups with fewer personal resources at hand. Low earners (n=208; 24.5% of the sample) were defined as persons living in households with less than 500,000 Norwegian Crowns (NoK) income per year, just above the average individual income in Norway (453,000 NoK in 2011). High earners were defined as persons living in households making at least 1 million NoK a year, 23.6% of the sample (n=200).

Differences between matched pairs varied around the population mean, indicating a linear relationship. The only exception was the youngest and the oldest, both displaying worse-than-average health-outcomes. As this indicates a reversed U-shaped relationship, age groups were excluded from further analysis.

Statistical analysis

Analysis was carried out using SPSS version 20.0. All steps-of-analysis were first run on the whole sample, and for each sub-group separately. The procedure was as follows. First, descriptive measures on personal characteristics (such as average scores on age and proportions of high- and low-income households) were obtained. Descriptive data from the Malvik-sample was compared to a Norwegian average population (represented through the HUNT-study). Descriptive data from included sub-groups were constructed as opposites and compared pair-wise. The results are shown in Tables 1 and 2.

Table 1. Descriptive statistics and background-variables.

	N.	Sex (women, %)	Marital status (% married)	Age, mean (SD)	Working (%)	Income (range)	Education (range)
HUNT	50,806	54.6	62.9	53.13 (16.09)			
Malvik	865	55.6	81.6	49.07 (15.16)	76	23.6-24.5	53.2-11.8
Women	480	100**	78.3**	47.06 (15.05)	76.3	23.2-27.3	57.9-10.2**
Men	383	0**	85.9**	51.6 (14.9)	75.5	23.9-21.2	47.1-13.9**
Not working	202	55	69.8**	63.24** (15.91)	0**	6.6-59.9**	30.5-29.9**
Working	640	56	86.7**	44.24** (11.43)	100**	29.1-12.3**	60.6-5.8**
Lowest income <500,000	208	61.5	51**	57.54** (18.43)	39.8**	0-100**	28.9-26.5**
Highest income >1,000,000	200	54.8	94**	44.43** (10.61)	93.5**	100-0**	82.9-3.0**

SD, standard deviation. **Significant at P<0.05.

Table 2. Descriptive statistics: neighbourhood- and health-variables.

	N.	Health, % (good, very good)	SOC, mean (SD)	Overall satisfaction, % (good, very good)	NR-availability, mean (SD)	NR-quality, mean (SD)	NSC, mean (SD)	Participation, mean (SD)
Range			13-161		11-121	11-121	5-35	
HUNT	50,806	73.8					12.25 (2.24)	
Malvik	865	84.6	69.58 (10.34)	91.9	83.89 (17.14)	79.49 (16.78)	27.07 (4.52)	20.01 (5.24)
Women	480	83.2	68.71** (10.76)	90.9	85.05** (17.46)	80.13** (17.72)	26.91** (4.81)	20.67 (5.16)
Men	383	86.3	70.68** (9.64)	93.4	82.44** (16.67)	78.7** (15.55)	27.27** (4.13)	19.27 (5.24)
Not working	202	66**	67.73** (11.42)	90.5	82.99** (21.21)	78.88** (20.49)	27.49 (4.91)	17.23** (6.49)
Working	640	90.8**	70.32** (9.8)	92.3	84.36** (15.74)	79.77** (15.63)	26.96 (4.39)	20.55** (4.69)
Lowest income <500 000	208	72.1**	66.25** (10.75)	91.6	81.34 (21.51)	76.65** (19.4)	26.57 (5.16)	17.4** (6.29)
Highest income >1000000	200	94**	72.02** (9.59)	91.9	82.48 (15.78)	78.88** (20.49)	27.25 (4.43)	21.24** (4.58)

SOC, sense of coherence; NR, neighbourhood-resource; NSC, neighbourhood social capital; SD, standard deviation. **Significant at P<0.05.

The initial correlation analysis between neighbourhood-variables, SOC and health was carried out, to check which NV to include into regression analysis. During further analysis, subjective health and SOC were treated as outcome variables (dependent measures), while general satisfaction, NSC, satisfaction with availability and quality of NRs and neighbourhood participation were treated as independent variables. Independent measures were checked for internal correlations through a Pearson's correlation analysis.

A linear regression analysis of statistically correlated NV on SOC and health was carried out. Missing values were replaced by the group mean in the independent variables. NVs were entered into regression analysis in one step. In relation to health, regression analysis was carried out in two steps: first, significantly correlated NVs were entered in one step. In the second step, SOC was included into the model.

No control for personal variables such as age or level of education was applied. The main objective of the study is to find out, from a town-planning perspective, how potential health-promotion strategies affect different groups in the neighbourhood. Thus, the focus is on describing group-

differences, and not on identifying personal characteristics which influence the relationship among neighbourhood, SOC and health. Differences in group-composition (*i.e.* more elderly people in the non-working group), are therefore understood to be important information for describing groups in a realistic way and increase external validity. Results from regression analysis are summarised in Tables 3 and 4.

Results

In the Malvik study, 55.6% were female, 81.6% were married or living in a partnership (Table 1), and 84.6% reported *good* or *very good* health (Table 2), respectively 30.2% *very good*, 54.3% *good*, 13.9% *not so good*, and 1.6% *not good at all*. The mean age was 49.07 (SD=15.16), and participants scored an average of 27.05 (SD=4.52) on social connectedness, measured on a range of 7-35 with higher scores indicating higher connectedness.

Table 3. Multivariate linear regression analysis: neighbourhood variables in relation to sense of coherence.

Group	Independent variable	Dependent variable: SOC		
		B	β	R ²
All (n=832)	Constant	-	41.822	0.132***
	Overall satisfaction	2.412	0.153***	
	NR-availability	0.025	0.040	
	NR-quality	0.072	0.109*	
	NSC	0.306	0.134***	
	N-participation	0.207	0.097**	
Women (n=462)	Constant	40.639	-	0.144***
	Overall satisfaction	1.636	0.104**	
	NR-availability	0.088	0.130	
	NR-quality	0.065	0.098	
	NSC	0.206	0.093*	
	N-participation	0.256	0.102**	
Men (n=368)	Constant	42.052	-	0.142***
	Overall satisfaction	3.408	0.216***	
	NR-availability	-0.032	-0.051	
	NR-quality	0.086	0.130	
	NSC	0.362	0.154**	
	N-participation	0.183	0.109*	
Non-workers (n=196)	Constant	34.517	-	0.237***
	Overall satisfaction	2.194	0.130*	
	NR-availability	-0.148	-0.243*	
	NR-quality	0.283	0.451***	
	NSC	0.479	0.204**	
	N-participation	0.174	0.085	
Workers (n=619)	Constant	48.247	-	0.099***
	Overall satisfaction	2.440	0.161***	
	NR-availability	0.084	0.123*	
	NR-quality	0.001	0.002	
	NSC	0.259	0.116**	
	N-participation	0.000	0.000	
Low earners (n=195)	Constant	38.540	-	0.173***
	Overall satisfaction	2.996	0.183**	
	NR-availability	-0.058	-0.100	
	NR-quality	0.158	0.260*	
	NSC	0.397	0.188**	
	N-participation	0.000	0.000	
High earners (n=196)	Constant	55.913	-	0.070**
	Overall satisfaction	3.099	0.211**	
	NR-availability	0.012	0.019	
	NR-quality	0.043	0.063	
	NSC	0.050	0.023	
	N-participation	0.000	0.000	

SOC, sense of coherence; NR, neighbourhood-resource; NSC, neighbourhood social capital. ***Significant at P<0.001; **significant at P<0.05; *significant at P<0.1.

Table 4. Multivariate regression analysis: neighbourhood variables and sense of coherence in relation to health.

Group	Step	Independent variable	Dependent variable: health		R ²
			B	β	
All (n=827)	1	Constant	1.893	-	0.059***
		Overall satisfaction	0.132	0.124**	
		NR-availability	-0.003	-0.063	
		NR-quality	0.005	0.104*	
		NSC	0.004	0.027	
	2	N-participation	0.022	0.153***	
		Constant	1.353	0.108***	
		Overall satisfaction 0.093	0.088**		
		NR-availability	-0.003	-0.073	
		NR-quality	0.004	0.079	
Women (n=459)	1	Constant	1.803	-	0.079***
		Overall satisfaction	0.101	0.098*	
		NR-availability	-0.004	-0.086	
		NR-quality	0.007	0.158*	
		NSC	0.010	0.067	
	2	N-participation	0.024	0.166***	
		Constant	1.236	-	
		Overall satisfaction	0.078	0.076	
		NR-availability	-0.005	-0.116	
		NR-quality	0.006	0.143*	
Men (n=366)	1	Constant	2.221	-	0.049***
		Overall satisfaction	0.159	0.141**	
		N-participation	0.023	0.157**	
		Constant	1.309	-	
		Overall satisfaction	0.072	0.064	
	2	N-participation	0.018	0.128**	
		SOC	0.018	0.255***	
		Constant	1.254	-	
		Overall satisfaction	0.044	0.040	
		Satisfaction with availability of NR	-0.006	-0.148	
Non-workers (n=194)	1	Satisfaction with quality of NR	0.013	0.323**	0.129***
		Neighborhood Social Capital	0.020	0.132*	
		Neighborhood participation	0.016	0.113*	
		Constant	0.539	-	
		Overall satisfaction	-0.002	-0.002	
	2	Satisfaction with availability of NR	-0.002	-0.077	
		Satisfaction with quality of NR	0.008	0.186	
		Neighborhood Social Capital	0.010	0.067	
		Neighborhood participation	0.014	0.103	
		SOC	0.021	0.318***	
Workers (n=617)	1	Constant	2.345	-	0.038***
		Overall satisfaction	0.124	0.125**	
		Satisfaction with availability of NR	-0.001	-0.024	
		Satisfaction with quality of NR	0.002	0.053	
		Neighborhood Social Capital	0.004	0.025	
	2	Neighborhood participation	0.015	0.100**	
		Constant	1.800 2	-	
		Overall satisfaction	0.096	0.097**	
		Satisfaction with availability of NR	-0.002	-0.045	
		Satisfaction with quality of NR	0.002	0.053	
Low earners (n=198)	1	Neighborhood Social Capital	0.001	0.006	0.088***
		Neighborhood participation	0.013	0.089**	
		SOC	0.012	0.180***	
		Constant	1.74	-	
		Satisfaction with quality of NR	0.001	0.017	
	2	Neighborhood Social Capital	0.019	0.135*	
		Neighborhood participation	0.033	0.249***	
		Constant	1.081	-	
		Satisfaction with quality of NR	-0.001	-0.035	
		Neighborhood Social Capital	0.010	0.074	
		Neighborhood participation	0.030	0.234***	
		SOC	0.016	0.242***	

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Table 4. Continued from previous page.

Group	Step	Independent variable	Dependent variable: health		
			B	β	R ²
High earners (n=196)	1	Constant	2.715	-	0.026***
		Overall satisfaction	0.101	0.102	
	2	Satisfaction with availability of NR	0.003	0.079	0.073***
		Satisfaction with quality of NR	0.001	0.012	
		Constant	1.859	-	
		Overall satisfaction	0.051	0.052	
		Satisfaction with availability of NR	0.003	0.074	
		Satisfaction with quality of NR	-	-0.002	
		SOC	0.015	0.225**	

SOC, sense of coherence; NR, neighbourhood-resource; NSC, neighbourhood social capital. ***Significant at $P < 0.001$; **significant at $P < 0.05$; *significant at $P < 0.1$.

Data from the HUNT-study show that the average Norwegian population is composed of 54.6% women, 62.9% married or living with a partner (Table 1), and 73.8% with good/very good health (Table 2), distributed as follows: 15.8% with *very good*, 58% *good*, 24.7% *not so good*, and 1.5% *not good at all*. The average age was 53.13 (SD=16.09), and the mean score on social connectedness 12.25 (SD=2.24; range 3-15, higher scores indicating higher connectedness). As NSC is measured on a differently, and according to initial analysis less secure scale than in Malvik, results cannot be compared directly.

Gender-groups in the Malvik population showed significant differences on the following measures: women tended to have higher education, were younger, less often married/living with a partner, reported more satisfaction with NR-quality, and more neighbourhood participation than men. Women scored lower on the SOC-13, whereas no significant gender-differences were found in health-outcomes.

Comparing the working to the non-working population (workers/non-workers) and those with the lowest and the highest income (low-/high-earners) revealed significant differences on virtually all measured variables, except gender-proportions, overall satisfaction and NSC. Workers and high earners reported better health, a stronger SOC and higher satisfaction with neighbourhood-variables than their respective counterparts.

Correlation analysis

Correlation analysis was carried out in order to check for internal correlations, and to exclude un-significant variables from further analysis. Results are summarised below, and not shown in a separate table.

Initial data analysis revealed weak to moderate internal correlations among the independent measures (ranging from 0.096 to 0.442), except for satisfaction with availability and quality, which were strongly related (0.845). Neighbourhood-variables (NVs) showed stronger correlations with SOC-scores than health-outcomes.

All NVs showed significant correlations to SOC in the whole sample and across sub-groups, except for participation, which did not reach significance in non-workers and neither high nor low-earners. In regard to health, SOC ($\beta=0.288$) emerged as the strongest correlate of health-outcomes across groups. All measured NV showed significant correlations with health across groups, with the following exceptions: NR-availability for men, workers and low-/high-earners; NR-quality for men and high-earners; NSC for men and low-/high-earners; overall satisfaction for low-earners and participation for high earners.

Multivariate regression analysis

Regression analysis was carried out by entering all significant NVs into analysis in one single step. For the whole sample, NV together explained 13.2% of SOC-variance, with overall satisfaction ($\beta=0.153$), NSC ($\beta=0.134$) and neighbourhood participation ($\beta=0.097$) making significant contributions. For women, NVs together explained 14.4% of

SOC-variance, for men 14.2%. Overall satisfaction, NSC and neighbourhood participation made significant contributions to explained variance in both gender-groups. For non-workers, NVs explained 23.7% of variance in SOC, with satisfaction with NR-quality ($\beta=0.451$) emerging as the strongest coefficient. In workers, NVs explained 9.9% of SOC-variance, with overall satisfaction ($\beta=0.161$), NSC ($\beta=0.116$) and NR-availability ($\beta=0.123$) being significant. For low earners, NVs explained 17.3% of SOC-variance. NSC ($\beta=0.188$), overall satisfaction ($\beta=0.183$) and NR-quality ($\beta=0.260$) were significantly related to SOC. For high earners, 7% of all variance in SOC was explained by NVs, and overall satisfaction was the only NV with a significant relationship to SOC ($\beta=0.211$).

Regarding health, regression analysis was carried out in two steps: all significant NV were entered into analysis in the first step, in the second step, SOC was entered into analysis. NVs all together explained 5.9% of variance for the whole sample, with neighbourhood participation ($\beta=0.153$), overall satisfaction ($\beta=0.124$) and satisfaction with quality of NR ($\beta=0.104$) emerging as significant predictors. Entering SOC into the model raised proportions of explained variance to 10.8%. In the second step, SOC emerged as the strongest partial correlate of health ($\beta=0.238$), followed by neighbourhood participation ($\beta=0.130$) and overall satisfaction ($\beta=0.088$). NR-quality did not become significant after SOC was entered into the model. For women, NVs explained 7.9% of health-variance before, and 11.8% after entering SOC. For men, NVs explained 4.9% of health-variance. Combined with SOC, the model explained 10.7% of health-variance, with SOC ($\beta=0.255$) and neighbourhood participation ($\beta=0.128$) as significant coefficients. In non-workers, NVs explained 12.9% of health-variance, and combined with SOC, 20.6% of health-variance is explained. SOC emerges as the only significant coefficient ($\beta=0.318$). For workers, NVs explained 3.8% of health variance. All together NVs and SOC explained 6.7% of health-variance, with SOC ($\beta=0.180$), overall satisfaction ($\beta=0.097$) and neighbourhood participation ($\beta=0.097$) making significant contributions. In low-earners, NVs explained 8.8% of health-variance before, and 13.8% after including SOC.

For high earners, NVs explained 2.6% of health-variance, but no singular dimension became significant. Entering SOC raised proportions of explained variance to 7.3%, with SOC ($\beta=0.225$) as the only significant coefficient.

Discussion

The overarching objective was to explore whether neighbourhoods could be a supportive arena for health-promotion, and for whom. Findings are discussed in the light of salutogenic theory, and how they can contribute to the development of health-promotion strategies in the neighbourhood.

The Malvik population appears to be healthier than the Norwegian average. As the focus of this paper is on *the positive side* of health, this is considered an advantage. Instead of focusing on populations at risk, the spotlight here is on what makes people healthy. Health-differences became most pronounced when comparing the whole range (from *bad* to *very good*). This highlights the importance to regard health as a continuum in line with Antonovsky's thinking, rather than a categorical variable.^{28,29} Better health-status could be due to differences in personal characteristics, or in the environment. The first interpretation is supported by descriptions of Malvik's population as above-average educated and wealthy (www.ssb.no). However, our findings simultaneously indicate high satisfaction on all measured NVs. It is therefore reasonable to assume that the environment contributes to the good health-status among Malvik's inhabitants.

Initially, assumptions about the relationships between neighbourhood, SOC and health were made. We expected to find direct relationships between NV and SOC/health respectively. This was supported by our findings: NVs alone explained 13.2% of SOC-variance, and 5.9% of health-variance. Additionally, we expected that the relationships between NVs and health might be mediated by SOC. Across sub-groups, entering SOC into the model would raise proportions of explained variance, change levels-of-significance and strength-of-relationships between NVs and health. For the whole sample, correlations with both overall satisfaction and neighbourhood participation declined, whereas satisfaction of quality of NR lost significance after introducing SOC. Furthermore, we assumed that SOC and health might be associated with different neighbourhood variables. This is only partly supported: while we found stronger correlations between NSC and SOC, and participation and health respectively, pronounced group-differences made it hard to draw general conclusions (Table 4). This is in line with our last assumptions: all these relationships might differ across sub-groups, indicating that social groups relate to their neighbourhood in different ways.

Gender-differences in the relationship between neighbourhood variables, sense of coherence and health

Gender-differences became less pronounced during analysis: while correlation analysis suggests stronger correlations between NVs and SOC in women than in men, similar proportions of explained SOC-variance in women and men were revealed through regression analysis. Three NVs (overall satisfaction, NSC and neighbourhood participation) associated with SOC in both gender-groups. Against expectations, and despite women having a lower average SOC, no significant gender-differences in health-outcomes were discovered. According to the theoretical framework, health is influenced by interactions of environmental resources and SOC.³¹ This finding might thereby point towards an environment which helps to balance the draw-back of a weaker SOC. This would imply that in this sample, the environment would make more and SOC less contributions to health-outcomes in women than in men. This is partly supported by our findings: NVs explained nearly twice as much health-variance in women than in men. After SOC was introduced, similar proportions of health-variance were explained in women and in men. The only pronounced gender-difference was found in respect to satisfaction with NR-quality, which was significantly linked to health-outcomes in women, but not in men (Table 4). Descriptive analysis revealed that women reported the highest satisfaction with NR-quality of all sub-groups. Does this indicate that perceptions of high NR-quality can improve health-outcomes? Or does the higher-than-average education- and employment-status among women in this sample balance the weaker SOC, and enable them to experience equally good health as men? Either way, it is possible that gender-differences are more pronounced in other populations, where men and women differ more in respect to socio-economic status.

Employment status and income in relation to neighbourhood variables, sense of coherence and health

As anticipated, NVs explained more SOC- and health-variance in non-workers and low-earners than in workers and high-earners respectively. In regard to SOC, NVs explained most variance in non-workers, followed low-earners. Of all investigated sub-groups, perceptions of NR and SOC/health seemed to be most intertwined in non-workers. Non-workers and low-earners were less satisfied with NSC, simultaneously as they perceived stronger correlations between NSC and SOC than the other groups. Is it possible that non-workers and low-earners are more sensitive to social aspects of the neighbourhood? Can social connectedness in the neighbourhood protect health by influencing the experience of social stigma following a low socio-economic status or lack of employment?

NR-quality emerged as the strongest, highly significant partial correlate of SOC-scores in non-workers; and a strong, but less significant coefficient in low-earners. Simultaneously, non-workers and low earners reported less satisfaction with NR-quality than their respective counterparts. The picture becomes even more complex when looking at NR-availability. The theoretical framework suggests that more and easily identifiable resources in the environment should make positive contribution to SOC.³¹ However, what we find in non-workers is an association between a strong SOC, and less satisfaction with NR-availability. The same tendency, though not significant, is found in low-earners. This is in line with earlier research, stating that people with a stronger SOC would benefit more from external resources. However, this might explain differences in health-outcomes, but not necessarily in SOC-scores. Earlier, SOC has been described as the ability to identify and adequately use resources³¹- therefore, a stronger SOC should lead to the experience of more, not less available resources. Before jumping into conclusions, it has to be considered that participants were asked to evaluate availability of listed resources, not to identify environmental resources freely. While a strong SOC might help in finding resources, is it possible it also raises awareness of lack of availability when resources are listed? Can it be that that people with a weaker SOC are less likely to actually have used NRs, and are less critical due to lack of experience? Moreover, could people in a deprived position, but with a stronger SOC, identify this survey as a way to influence decision-processes, and therefore report lower satisfaction deliberately? In that case, why did we not find the same in regard to NR-quality? Earlier, it has been stated that a strong SOC might be developed even in resource-poor environments, as long as the process is favourable- is it possible that this process still is facilitated by quality and *adequacy* of resources? On the other hand, is it possible that the importance of quality, and the negative association with availability, only holds true in resource-rich environments, whereas other mechanisms might be found in environments with less available resources?

In regard to health, it was expected that the relationship between SOC and health would be weaker in groups with more resources at hand, as a resourceful environment could balance a weaker SOC. Findings partly support this notion, revealing strong links between SOC and health in non-workers and low-earners. However, strong correlations between SOC and health were also found in men and high earners, both groups with a relatively strong SOC, and presumably good access to resources. Thus, the inter-play between environmental resources and SOC seems more complex than anticipated.

Even if we could find some similarities, differences between non-workers and low-earners became visible during analysis. It seems like NVs had most impact on SOC/health in non-workers. How is it that lack of work seemed to lead to more environmental dependence than low income? One possible explanation could be the Norwegian welfare-system, which provides material resources for those in need. Simultaneously, there is a strong inclination towards values emphasizing the role of work.³⁶ Is it possible that non-workers lack social support

and positive social identities? The importance of NSC and quality of NRs for non-workers might then be explained by the neighbourhood's ability to reduce stigma, offer meaningful social roles and possibilities for participation. However, resources might be found across a variety of contexts, and the more arenas one has access to, the less important are resources in one specific arena.^{3,12} Is it possible that the importance of neighbourhood-resources for non-workers is mainly due to a lack of access to other important arenas? Then, instead of aiming at promoting health through placing more resources into one context, one could make attempts to increase the number of accessible contexts in which to find resources.

Health-promotion in the neighbourhood-how, and for whom?

Apart from major group-differences in the relative importance of NVs for SOC and health, findings suggest that developing a strong SOC and promoting health are different processes, which implies the need to develop separate strategies. Looking at the whole sample, one could state that health might be promoted by raised engagement and more possibilities for participation, strengthen SOC, and increase overall satisfaction within the neighbourhood-context. SOC, on the other hand, might be enhanced through increasing NSC and overall satisfaction. Additionally, taking a closer look at the quality of neighbourhood-resources might prove beneficial, especially for deprived groups.

All in all, the emerging picture suggests that it might be easier to facilitate the development of a strong SOC than to promote health directly through the neighbourhood. However, it is indicated that high satisfaction with quality of environmental resources can balance the draw-backs of a weaker SOC, thus facilitating better health-outcomes: women experienced higher satisfaction with NR-quality than men, and despite a weaker average SOC, they had equally good health-outcomes. Non-workers, on the other hand, were least satisfied with NR-quality. NR-quality made strongly significant contributions to SOC-scores, and to health-outcomes in the first step of analysis. However, SOC emerged as the only significant correlate of health-outcomes when included into the analysis. Can this be taken as an argument that if resources are perceived to be of good quality (as they are for women in this sample) they can balance a weaker SOC, but if they are perceived to be less adequate (as non-workers do), they may even reinforce the impact of SOC on health-outcomes? Taken together, closing the gap in health through the neighbourhood might be achieved through an improvement in the quality of environmental resources, rather than an increase in availability.²⁵

Theoretical considerations

In this study, Salutogenesis was applied as a theoretical framework for research on health-promotion in the neighbourhood. It was assumed that neighbourhood resources can facilitate the development of a strong SOC, or act as resources in individual health-promotion strategies.^{29,31} Findings from this study suggest closer associations between NVs and SOC than between NV and health. This partly supports described relationship among SOC, health and environmental resources: SOC is developed through internalising resources- here, neighbourhood-resources. The experience of health, on the other hand, is a combination of available resources, experienced stressors, somatic health-status and individual SOC.³⁰ It has even been claimed that SOC might be more dependent on pre-disposition than context, almost like a personal trait.³⁶ However, evidence after Antonovsky proves SOC increases over the whole lifespan, and is more context- sensitive and flexible than anticipated.^{34,37} This is supported by our findings, indicating that perceptions of environmental resources, SOC and health are found to be heavily intertwined, especially for deprived groups. Taken together, it seems that SOC is more closely related to perceptions of neighbourhood-resources than to the actual use of these resources, while health might be stronger linked to active par-

ticipation in the neighbourhood. These findings support recent research on SOC, suggesting that the process through which environmental variables are internalised might be more important than the actual resources at hand.³¹

Since the influence of *overall satisfaction* and *quality of resources* on health is reduced when SOC is introduced into the final analysis, one might question whether they measure concepts closely related to SOC, or if it is possible that they offer insights into the internalisation-process through which environmental resources are *made part* of an individual's SOC. Distinctions between environmental resources and personal characteristics seems fluent: for example, *work* might be understood as an environmental resource, or as a personal- or group-characteristic (as we did in this study). In Salutogenic terms, environmental resources- as work- can be internalised, turn into a GRR and strengthen SOC. A closer look at the distinction between environmental resources and internalised GRR might reveal some interesting insights into this process- how does an *environmental resource* become a *personal characteristic*?

Limitations of this study

Data used in this study is obtained through the population survey in Malvik. A response-rate of 26.21% might imply respondent-bias. However, as respondents were equally distributed across neighbourhoods, and showed equal proportions of gender/age etc, the sample is considered to be representative of the Malvik population.

Further, the Malvik-population is described as above-average healthy and resourceful. This might indicate a selection bias, namely that healthier people were more likely to participate in this survey. As Statistics Norway (www.ssb.no) describes Malvik as above-average wealthy and educated, and we find levels of good health-outcomes across neighbourhoods, we propose the Malvik-population as healthier than the average Norwegian population. High socio-economic status and high environmental satisfaction in Malvik might limit the generalisation of our findings: they might primarily describe mechanisms involved in the health-promotion of already-healthy people in a resourceful setting. However, interpretations were based on internal comparison between groups, which reduces the importance of comparable values from other studies. Even though the focus of this study was on a healthy population, strategies for closing the gap in health were discovered.

Some insecurity is linked to the orientation of some of the described relationships: for example, neighbourhood participation might promote health, or good health might be a favourable condition for participation. Moreover, missing values were replaced by the group-mean. Even though initial analysis revealed this did not have influence our findings, it might have diminished subtle group-differences. At this point, generalisations should be made with great care.

The focus of this paper is on how social groups experience the relationships between perceptions of neighbourhood-resources, SOC and health. It is not on objective assessments of neighbourhoods' resources, nor on identifying personal characteristics which influence these relationships. This choice has two major implications: first, no contextual information (*e.g.* type of houses, distance to amenities, neighbourhood-turn-over *etc*) is given, and no differentiations are made between the three neighbourhoods included in this study. Second, no controls for personal characteristics were applied. Differences in group-composition are seen as a characteristic of the group; for example, work status is partly dependent on age. Further, the initial analysis revealed inconsistent levels of significance for a number of variables which ordinarily could have been controlled for (namely age, education, neighbourhood, gender/income/employment-status respectively). Thus, we argue that we already capture these distinctions through the chosen definitions of groups-of-interest.

Regarding group-composition, some insecurity is linked to the definition of low-earners, defined without regarding the number of people

living in the household or contributing to its income. Differences between low- and high-earners might be more pronounced if a more sensitive identification is applied.

Further, some insecurity concerning some of the applied measures has to be taken into consideration: first, Antonovsky described health as a life-long-process. Throughout life, individuals will find themselves on varying positions on the health-continuum. In this study, health is measured through a four-category-scale at one point in time. Even if the four-category-scale did reveal more information than a crude two-category measure, it still gives a more static and categorical picture of health than suggested by Salutogenesis. Moreover, NR-availability, NR-quality and neighbourhood participation were measured through sum-scores of single items. Participation was constructed as the frequency-of-involvement across a variety of topics. Cronbach's alpha was measured to be 0.829 for quality, 0.822 for availability, and 0.742 for participation, which has been labelled acceptable for surveys.³⁸

Practical implications and implications for further research

The insecurity linked to the above-described variables might offer new angles for research. For example, is it possible to further differentiate between different types of involvement and environmental resources, *e.g.* between social, physical and institutional environment? This might become useful in phrasing even more-specific strategies for health-promotion in neighbourhoods.

Further, age groups were excluded from analysis due to descriptive characteristics craving different methods. As age has a strong theoretical link to both SOC and health, investigating its' influence on the described relationships seems beneficial. Moreover, other groups might put a special emphasis on the neighbourhood-context, for example parents with small children, or people from other cultures. Throughout this paper, group-differences in the relationships between NVs, SOC and health have been described in an attempt to start phrasing strategies for health-promotion in the neighbourhood. More knowledge is needed concerning these relationships in different contexts, such as linking the presence/absence and design of specific resources to SOC and health. Notions about how SOC does affect the relationship between NVs and health calls for more knowledge on these interactions. It might prove beneficial to monitor health and SOC over time, in order to gain insights into the involved processes. Moreover, one could explore inter-relations between independent variables, *e.g.* how satisfaction with quality influences participation, or which NVs are linked to high NSC and overall satisfaction. This might become especially beneficial in terms of phrasing strategies and developing interventions for specific neighbourhoods or sub-groups, including strategies to reduce inequality in health.

Conclusions

Results from this study suggest that perceptions of neighbourhoods and neighbourhood-resources are associated with a strong SOC and good health. Theoretical links between neighbourhood-resources and SOC/health-outcomes, as implied in Salutogenesis, are partly supported. Surprisingly, NVs showed tighter links to SOC than to health. The influences of NVs on health were intertwined with SOC, especially in groups with a weaker average SOC. Non-workers emerged as the group which was most sensitive to the influence of NVs.

Findings suggest that health can be promoted in the neighbourhood through raised participation, while SOC can be strengthened through NSC, increased overall satisfaction and good quality of NR. High satisfaction with quality of environmental resources might even contribute to balance health-outcomes for groups with a weaker average SOC.

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