THEORY AND METHODS

Development and validation of an instrument to measure perceived neighbourhood quality in Taiwan

M-J Yang, M-S Yang, C-H Shih, I Kawachi

See end of article for authors' affiliations

Correspondence to:
Dr I Kawachi, Department of Health and Social Behavior, Harvard School of Public Health, 677 Huntington Avenue, Boston MA 02115, USA; Ichiro.Kawachi @channing.harvard.edu

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Study objectives: Social epidemiologists have hypothesised that neighbourhood quality may exert an important contextual influence on mental and physical health. However, validated instruments do not exist for measuring neighbourhood quality in Taiwan. A self reported instrument to measure perceived neighbourhood quality in Taiwan was developed and tested.
Design: Community survey.
Setting: Southern Taiwan, including the metropolitan Kaohsiung area and eight surrounding communities, representing urban, suburban, and rural districts.
Participants: A total of 1084 residents, aged 18 to 75, were surveyed during 1999 to 2000.
Main results: Using factor analysis with varimax rotation, three subscales explained 54.8% of the variance in our 15 item Neighbourhood Quality Index: perceived social capital (Cronbach α=0.84), perceived security (α=0.78), and adequacy of services and facilities (α=0.67). Lower perceived neighbourhood social capital (odds ratio, OR, 1.26; 95% CI: 1.21 to 1.32), lower neighbourhood security (OR 1.37; 95% CI: 1.26 to 1.48), and inadequate neighbourhood services and facilities (OR 1.17; 95% CI: 1.06 to 1.28) were all related to higher residential dissatisfaction.
Conclusions: A Neighbourhood Quality Index was developed for use in Taiwan with good internal consistency and test-retest reliability, as well as convergent validity. Future studies will examine the association between this index and measures of individual mental and physical health.

It has long been hypothesised that residential environment exerts a contextual effect on mental health.[1–3] In other words, mental health is the product not just of individual level attributes, but also the social context in which people lead their daily lives. For instance, in their classic study of Chicago neighbourhoods, Faris and Dunham [4] found increasing rates of admission for schizophrenia the closer residents lived near the inner city. Their interpretation was that social isolation and disorganisation in the inner city housing areas produced higher rates of psychiatric disorder. Similarly, Ross [5] found that the residents of poor, neighbourhoods with higher concentrations of single female headed households exhibited higher levels of depression than residents of more advantaged neighbourhoods. More recent multilevel studies have shown an independent contextual influence of neighbourhood quality on individual psychiatric symptoms and levels of psychological distress.[6 7] Despite burgeoning research in this area, few studies have attempted to describe contextual variation in mental health within Asian societies. The Taiwan Psychiatric Epidemiological Project reported that psychosomatic disorder and generalised anxiety disorder were more prevalent among residents of townships compared with those in the metropolis and village. It was postulated that social changes associated with rapid industrialisation and greater population mobility explained this phenomenon.[8 9] In southern Taiwan, Cheng [9] found that minor mental disorders were more prevalent among rural young women. He attributed this finding to social selection—that is, those who were mentally ill were less likely to move to urban areas. The results of a recent pilot study on neighbourhood environment and mental health by Yang [10] disclosed that community socioeconomic condition and perceived social support from neighbours were significantly associated with individual mental health status. Yet despite these clues about the existence of contextual variation in mental health, research has been hampered by the lack of a validated instrument to assess neighbourhood quality. Investigators have relied on existing measurements, often derived

from the population census, to capture relevant aspects of neighbourhood quality, for example, through variables such as the proportion of households living below the poverty threshold, or the percentage of single female headed households.[2 3] With notable exceptions,[11] few attempts have been made to directly measure residents' perceptions of their neighbourhood quality. Nor is there general agreement about which *aspects* of neighbourhood environment may be relevant to mental health. Neighbourhood quality is likely to be a multidimensional construct.[2 3] Accordingly, we set out in this study to develop and validate an instrument, for use in Taiwanese society, to capture residents' perceptions of neighbourhood quality. The resulting Neighbourhood Quality Index has broad utility in terms of use in future aetiological studies, as well as for the planning of neighbourhood level interventions to promote mental health.

METHODS

Subjects and survey implementation

We used a multilevel sampling strategy to recruit residents from the Metropolitan Kaohsiung area in southern Taiwan. Residents were sampled from the following communities to represent urban, suburban, and rural areas: SanMin District, Kaohsiung City and Feng Shang city Kaohsiung County (urban); JenWu, ALien, ZiGuan, and TianLiao Hsiang, Kaohsiung County (suburban); and SanMin Hsiang, TaoYuan Hsiang, and MaoLin Hsiang, Kaohsiung County (rural). By a random sampling procedure proportional to the population structure, 1500 residents aged 18 to 75 were recruited during 1999–2000 for this interview study. Thirty subjects were selected for test-retest reliability. The questionnaire was self completed. Research assistants distributed the surveys in person and collected them. For respondents who were illiterate, the research assistants administered the questionnaire through face to face interview. The overall response rate to our survey was 73.1%. We excluded surveys with insufficient data, leaving 1084 valid

Table 1 Characteristics of survey respondents and their mean (SD) score* on neighbourhood quality index

	N (%)	Perceived social capital	Perceived security	Perceived adequacy of facilities
Sex				
Male	537 (49.6)	18.18 (5.40)	9.27 (2.80)	6.56 (2.09)
Female	545 (50.4)	17.78 (5.69)	9.15 (3.03)	6.32 (2.26)
Neighbourhood characteristics				
Urban: FengShan City and SanMin District	441 (40.7)	18.67 (5.76)	9.96 (2.95)	5.88 (2.14)
Suburban: JenWu Hsiang, ALien Hsiang, TianLiao Hsiang, and ZiGuan Hsiang	543 (50.1)	18.14 (5.25)	8.92 (2.78)	6.78 (2.14)
Rural: SanMin Hsiang, TaoYuan Hsiang, and MaoLin Hsiang	100 (9.2)	14.07 (4.58)	7.40 (2.49)	6.99 (2.10)
Age means (SD)	40.94 (13.72)			
Educational level				
<7 years or illiterate	337 (31.3)	17.30 (5.25)	8.70 (2.94)	6.34 (2.22)
7–12 years	548 (50.9)	17.96 (5.84)	9.43 (2.94)	6.45 (2.17)
>12 years	192 (17.8)	19.28 (4.98)	9.41 (2.82)	6.55 (2.16)
Religion				
Christian	126 (11.7)	15.25 (5.01)	7.98 (2.63)	7.01 (2.14)
Buddhism, Taoism, and Folk Religion	832 (77.3)	18.17 (5.50)	9.35 (2.90)	6.36 (2.19)
Other or none	118 (11.0)	19.66 (5.56)	9.53 (3.17)	6.32 (2.10)
Occupation				
Home maker	223 (20.7)	16.81 (5.22)	8.68 (2.83)	5.92 (2.16)
Farmer and factory worker	306 (28.4)	18.12 (5.53)	8.99 (2.58)	6.77 (1.96)
Governmental worker	130 (12.1)	18.74 (5.42)	9.45 (3.01)	6.64 (2.32)
Professional and merchant	264 (24.5)	18.75 (5.89)	9.97 (3.08)	6.60 (2.22)
Unemployed	154 (14.3)	17.71 (5.19)	8.92 (3.09)	6.11 (2.25)
Marital status				
Married	762 (71.5)	17.81 (5.67)	9.18 (2.97)	18.85 (5.14)
Single	229 (21.5)	9.48 (2.81)	6.84 (2.11)	17.27 (5.44)
Other	75 (7.0)	17.27 (5.44)	8.56 (2.76)	5.85 (2.09)
Monthly income (US $)				
< $1000	264 (24.5)	17.57 (6.34)	8.84 (3.08)	6.61 (2.30)
$1000 or more	513 (47.7)	18.48 (5.14)	9.58 (2.85)	6.36 (2.07)
Missing	299 (27.8)	17.48 (5.38)	8.88 (2.82)	6.42 (2.24)
Duration of residence in present neighbourhood (y)				
<6	151 (14.0)	19.20 (6.10)	9.41 (3.17)	6.54 (2.22)
6–10	151 (14.0)	19.28 (6.22)	9.87 (2.74)	6.77 (2.56)
11–15	186 (17.3)	18.42 (5.35)	9.25 (2.84)	6.60 (2.20)
>15	588 (54.7)	17.24 (5.14)	8.98 (2.91)	6.27 (2.15)
Whether or not dissatisfied with neighbourhood				
Satisfied	795 (73.3)	16.19 (4.85)	8.32 (2.57)	5.95 (1.99)
Dissatisfied	289 (26.7)	22.91 (4.21)	11.63 (2.43)	7.77 (2.14)

*A higher score denotes lower satisfaction with neighbourhood quality.

forms. Although we do not have information on non-respondents, comparison of the sociodemographic characteristics of our respondents (for example, household income and educational attainment) with data from the Department of Statistics, Ministry of the Interior, Republic of China, showed that our survey sample did not substantially differ from the national sample.

Questionnaire

We selected the items on our Neighbourhood Quality Index based on prior literature[1–3 11 12] as well as the responses from focus groups carried out in a previously reported pilot study.[10 13] The index, comprised initially of 16 items, focused on multiple dimensions of neighbourhood experience, including residents' perceptions of neighbourhood security, community participation, community social control and collective efficacy, satisfaction with the physical environment (quietness, spaciousness, and adequacy of facilities and services), weak ties among neighbours, and social support. A 4 point Likert style response scale was used to gauge how residents perceived their experience within their residential neighbourhoods, from total agreement to total disagreement. The translated English version of our Neighbourhood Quality Index is included in the appendix. Residential satisfaction was assessed with a single item (satisfied/not satisfied).

Statistics

Frequency distributions and percentages were used for variable description. Pearson's correlation was used for test-retest reliability. Factor analysis with varimax rotation was used to examine the construct of Neighbourhood Quality. The internal consistency reliability of each resulting factor was assessed by Cronbach's α. The overall neighbourhood quality score was derived by linear summation of responses to each item (1 for "strongly agree", 4 for "strongly disagree"). Thus, the higher the score, the poorer the respondent's perception of their neighbourhood quality. Logistic regression was used to examine the associations between each subscale of the Neighbourhood Quality Index and residential satisfaction (satisfied versus not satisfied). Each subscale was dichotomised at the median cut off point, for example, "low security" versus "high" security.

RESULTS

Of the 1084 respondents, 50.4% were women and 49.6% were men. Their average age was 40.9 (SD 13.7), ranging from 18 to 75. Most of them were married (71.5%) and from urban or suburban communities (90.8%); 9.2% resided in aboriginal villages. Excluding non-respondents, 47.7% of the surveyed residents reported earning a monthly income of more than US $1000. Though the majority of respondents (50.9%) reported 7 to 12 years of education or more, a substantial proportion (31.3%) had less than six years of formal education (including illiterate respondents). More than 50% of the respondents had resided in their present neighbourhood for more than 16 years; 73.3% reported that they were satisfied with their present neighbourhood (table 1). The test-retest

Table 2 Factor analysis of neighbourhood quality index

	Mean (SD)	Factor loading	Variance explained (%)	Cronbach α
Factor 1: Perceived social capital	17.98 (5.55)*		38.3	0.84
Participating in activities together	2.66 (1.00)	0.58		
Greeting each other	1.88 (1.47)	0.47		
Mutual concern for each other	2.00 (0.87)	0.78		
Providing assistance during an emergency	2.13 (0.92)	0.79		
Being able to find somebody to talk with when in need	2.61 (0.97)	0.72		
Maintaining public hygiene in the neighbourhood	2.33 (0.91)	0.64		
Solving problems altogether	2.33 (0.92)	0.71		
Feeling happy with the neighbourhood	2.10 (0.83)	0.54		
Factor 2: Perceived security	9.20 (2.92)*		9.4	0.78
Quiet and peaceful environment	2.26 (0.97)	0.70		
Spacious and roomy environment	2.25 (0.92)	0.68		
Order and good public security in this neighbourhood	2.41 (0.94)	074		
Feeling safe in this neighbourhood	2.31 (0.91)	0.70		
Factor 3: Adequacy of services and facilities	6.44 (2.18)*		7.1	0.67
Adequate lighting	2.14 (0.91)	0.67		
Convenient transportation	2.04 (0.91)	0.79		
Adequate public facilities	2.27 (1.00)	0.65		
Overall score	33.58 (8.82)* (median 33, range 15–57)			
Variance explained (%)	54.8			

*Higher scores indicate lower perceived neighbourhood quality (see text).

reliability of our instrument was 0.80. Factor analysis with varimax rotation was performed, dropping those items with eigenvalue less than 1 and factor loading less than 0.40. The resulting index, with 15 items, could be further extracted into three factors: perceived neighbourhood social capital, perceived neighbourhood security, and perceived adequacy of services and facilities, with Cronbach's α of 0.85, 0.78, and 0.67, respectively. In total, 54.8% of the variance in responses to our index could be explained by these three factors (table 2).

FACTOR 1.
Perceived neighbourhood social capital
The eight items included: participating in activities with neighbours; greeting each other during encounters; having mutual concern for each other; providing assistance during emergencies; being able to find somebody to talk with during need; maintaining public hygiene in the neighbourhood; solving problems together; and feeling good about this neighbourhood.

FACTOR 2.
Perceived neighbourhood security
The four items included: sense of quiet and peace in the neighbourhood environment; sense of a spacious and roomy neighbourhood; sense of order and being secure in this neighbourhood; and sense of being safe in this neighbourhood.

FACTOR 3.
Perceived adequacy of services and facilities
The three items in this factor included: adequate and convenient lighting; convenient transportation; and public facilities. Perceived neighbourhood quality varied with respondent's income, marital status, and duration of residence. Those who were single tended to perceive a higher degree of neighbourhood social capital and security. Duration of residence in one's neighbourhood was associated with higher perceptions of neighbourhood quality. Higher incomes were associated with more *negative* perceptions of neighbourhood quality (table 1). Discriminatory analysis showed that the overall neighbourhood quality score had a predictive value of 80.4% in terms of

Key points

- Social epidemiologists have hypothesised that neighbourhood quality may exert an important contextual influence on mental and physical health.
- Validated instruments do not exist for measuring neighbourhood quality in Taiwan. We developed and tested a 15 item self reported instrument to measure perceived neighbourhood quality among 1084 residents of nine communities in southern Taiwan.
- Based on factor analysis with varimax rotation, three subscales explained 54.8% of the variance in reported neighbourhood quality: perceived social capital (Cronbach's α=0.84), perceived security (α=0.78), and adequacy of services and facilities (α=0.67).
- All three subscales were significantly associated with residential satisfaction.
- Further studies are needed to examine the association between our Neighbourhood Quality Index and mental and physical health outcomes.

distinguishing residents who were dissatisfied with their residential situation. After controlling for sex, religion, marital status, income, and duration of residence, backward stepwise logistic regression indicated that all three subscales were each associated with neighbourhood dissatisfaction. The odds ratios for being dissatisfied were 1.26 (95% confidence intervals (CI): 1.21 to 1.32) for lower perceived neighbourhood social capital, 1.37 (95% CI: 1.26 to 1.48) for lower neighbourhood security, and 1.17 (95% CI: 1.06 to 1.28) for lower adequacy of services and amenities (table 3).

DISCUSSION
We have developed for the first time a reliable and validated instrument to measure neighbourhood quality in the Taiwanese setting. Our factor analysis confirmed that neighbourhood quality is a multidimensional construct, with three factors encompassing perceived neighbourhood social capital, neighbourhood security, and adequacy of services and amenities. Fifty four per cent of the total variance in responses to our index could be explained by these three factors. However, it is possible that we missed other aspects of the neighbourhood

Table 3 Backward stepwise logistic regression of dissatisfaction with neighbourhood

	OR (95% CI)	p Value
Sex		
Male versus female	1.02 (0.71 to 1.47)	0.91
Religion		
Any worship versus none	0.62 (0.35 to1.12)	0.11
Marital status		
Married versus other	1.10 (0.74 to 1.63)	0.65
Monthly income (US $)		
<$1000 versus $1000 or more	1.15 (0.79 to 1.66)	0.47
Duration of residence in present neighbourhood	0.96 (0.82 to 1.13)	0.63
Low perceived social capital	1.26 (1.21 to 1.32)	<0.01
Low perceived security	1.37 (1.26 to 1.48)	<0.01
Low perceived adequacy of facilities	1.17 (1.06 to 1.28)	<0.01

environment that might be relevant to mental health outcomes. A longer list might include aspects of the physical environment (for example, crowded and dilapidated housing, overcrowding, noise, pollution, traffic), economic power relations, individual autonomy, as well as less tangible exposures such as "incivilities" (abandoned lots, graffiti, and other forms of vandalism), and the overall reputation of a neighbourhood.[1–3] In contrast with previous attempts to capture neighbourhood quality through census derived proxies (for example, percentage households in poverty), our index directly asked residents about their perceptions of the service environment, security, and quality of social interactions. The main limitation of census derived measures of neighbourhood quality is that they do not investigate the potential *mechanisms* through which residential context might influence health. Measures such as "percentage households in poverty" are themselves markers for other exposures, such as inadequate services and amenities, or perceptions of crime and disorder. Furthermore, census derived measures typically do not tackle aspects of social interaction, such as neighbourhood social cohesion or social capital. Our index therefore represents a potential addition to the range of variables routinely extracted from the population census that has characterised much of the existing literature on neighbourhoods and health. In conceptual terms, our approach to characterising neighbourhood quality is analogous to Pearlin's theory of the stress process as it relates to mental health outcomes.[14] Lack of neighbourhood security and inadequacy of facilities could be considered to be ambient stressors, while neighbourhood social capital could be considered to be moderating resources. It is probably the balance of stressors and resources in a neighbourhood that determines health outcomes, over and above individual attributes. The major limitation of our approach is that reliance on self reports of neighbourhood quality is susceptible to bias and contamination by general subjective wellbeing. For example, it is possible that people with depressive symptoms are less likely to rate their neighbourhood favorably, *and* to report overall dissatisfaction with their residential environment. The cross sectional nature of our study makes it difficult to drawn causal inferences. It remains to be determined whether our Neighbourhood Quality Index is associated with individual health outcomes, net of individual characteristics, including negative affectivity. Although studies have not yet reported an association between social capital and health at the neighbourhood level, aggregate measures of social capital have been found to correlate with state level mortality, self rated health,[15–17] and crime in the United States.[18] Considerable interest and debate has surrounded the importation of the concept of social capital in community health.[19–21] Researchers have pointed out the limitations of the concept in accounting for variations in population health status, includ-

ing the observation that an overly cohesive community or society may actually have detrimental effects on individual health.[22 23] An exclusive focus on social cohesion may also risk overlooking economic power differentials within and across neighbourhoods, resulting in a truncated diagnosis of why some communities are healthy and others are not.[20]

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APPENDIX
Translated items from the Neighbourhood Quality Index

1 Neighbours are willing to obey community regulations

2 Neighbourhood is quiet and peaceful

3 Neighbourhood is spacious and roomy

4 Neighbourhood has adequate lighting

5 Neighbourhood has convenient transportation

6 Neighbourhood has adequate public facilities

7 Neighbourhood is safe

8 Neighbourhood is orderly with good public security

9 Neighbours enjoy participating in community activities together

10 Neighbours chat and greet each other

11 Neighbours are mutually concerned for each other

12 Neighbours are willing to provide assistance when I am in need

13 Being able to find someone to talk with in my neighbourhood when in distress

14 Neighbours are willing to maintain public hygiene in the neighbourhood

15 Neighbours are willing to solve problems together

16 Feeling happy with my neighbourhood

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Authors' affiliations
M-J Yang, C-H Shih, Department of Psychiatry, College of Medicine, National Cheng Kung University, Taiwan
M-S Yang, School of Nursing, Kaohsiung Medical University, Taiwan
I Kawachi, Department of Health and Social Behavior, Harvard School of Public Health, USA

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