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

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I t has long been hypothesised that residential environment exerts a contextual effect on mental health. 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 found increasing rates of admission for schizophrenia the closer residents lived to the inner city. Their interpretation was that social isolation and disorganisation in the inner city housing areas near the inner city. It was postulated that social changes associated with community mobility may be relevant to mental health. Neighbourhood quality is likely to be a multi-dimensional construct. 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, AIlen, 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 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

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 $\alpha=0.84$), perceived security ($\alpha=0.78$), and adequacy of services and facilities ($\alpha=0.67$). Lower perceived neighbourhood social capital (odds ratio, OR 1.26; 95% CI: 1.21 to 1.32), lower perceived 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.
forms. Although we do not have information on non-
respondents, comparison of the sociodemographic character-
istics 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 literature3,13,14 as well as the responses from focus
groups carried out in a previously reported pilot
study.14 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, spa-
crease, 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 satisfac-
tion (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 pro-
portion (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 1 Characteristics of survey respondents and their mean (SD) score* on neighbourhood quality index

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N (%)</th>
<th>Perceived social capital</th>
<th>Perceived security</th>
<th>Perceived adequacy of facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>537 (49.6)</td>
<td>18.18 (5.40)</td>
<td>9.27 (2.80)</td>
<td>6.56 (2.09)</td>
</tr>
<tr>
<td>Female</td>
<td>545 (50.4)</td>
<td>17.78 (5.69)</td>
<td>9.15 (3.03)</td>
<td>6.32 (2.26)</td>
</tr>
<tr>
<td>Neighbourhood characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban: FengShan City and SanMin District</td>
<td>441 (40.7)</td>
<td>18.67 (5.76)</td>
<td>9.96 (2.95)</td>
<td>5.88 (2.14)</td>
</tr>
<tr>
<td>Suburban: Jen Wu Hsiang, Alien Hsiang, TianLiao Hsiang, and ZhongHsiang</td>
<td>543 (50.1)</td>
<td>18.14 (5.25)</td>
<td>9.82 (2.78)</td>
<td>6.78 (2.14)</td>
</tr>
<tr>
<td>Rural: SanMin Hsiang, TaoYuan Hsiang, and MaoLin Hsiang</td>
<td>100 (9.2)</td>
<td>14.07 (4.58)</td>
<td>7.40 (2.49)</td>
<td>6.99 (2.10)</td>
</tr>
<tr>
<td>Age means (SD)</td>
<td>40.94 (13.72)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;7 years or illiterate</td>
<td>337 (31.3)</td>
<td>17.30 (5.25)</td>
<td>8.70 (2.94)</td>
<td>6.34 (2.22)</td>
</tr>
<tr>
<td>7–12 years</td>
<td>548 (50.9)</td>
<td>17.96 (5.84)</td>
<td>9.42 (2.94)</td>
<td>6.45 (2.17)</td>
</tr>
<tr>
<td>&gt;12 years</td>
<td>192 (17.8)</td>
<td>19.28 (4.98)</td>
<td>9.41 (2.82)</td>
<td>6.55 (2.16)</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td>126 (11.7)</td>
<td>15.25 (5.01)</td>
<td>7.98 (2.63)</td>
<td>7.01 (2.14)</td>
</tr>
<tr>
<td>Buddhism, Taoism, and Folk Religion</td>
<td>832 (77.3)</td>
<td>18.17 (5.50)</td>
<td>9.35 (2.90)</td>
<td>6.36 (2.19)</td>
</tr>
<tr>
<td>Other or none</td>
<td>118 (11.0)</td>
<td>19.66 (5.56)</td>
<td>9.53 (3.17)</td>
<td>6.32 (2.10)</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home maker</td>
<td>223 (20.7)</td>
<td>16.81 (5.22)</td>
<td>8.68 (2.83)</td>
<td>5.92 (2.16)</td>
</tr>
<tr>
<td>Farmer and factory worker</td>
<td>306 (28.4)</td>
<td>18.12 (5.53)</td>
<td>8.99 (2.58)</td>
<td>6.77 (1.96)</td>
</tr>
<tr>
<td>Governmental worker</td>
<td>130 (12.1)</td>
<td>18.74 (5.42)</td>
<td>9.42 (3.01)</td>
<td>6.64 (2.32)</td>
</tr>
<tr>
<td>Professional and merchant</td>
<td>264 (24.5)</td>
<td>18.75 (5.89)</td>
<td>9.97 (3.08)</td>
<td>6.60 (2.22)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>154 (14.3)</td>
<td>17.71 (5.19)</td>
<td>8.92 (3.09)</td>
<td>6.11 (2.25)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>762 (71.5)</td>
<td>17.81 (5.67)</td>
<td>9.18 (2.97)</td>
<td>18.85 (5.14)</td>
</tr>
<tr>
<td>Single</td>
<td>229 (21.5)</td>
<td>9.48 (2.81)</td>
<td>6.84 (2.11)</td>
<td>17.27 (5.44)</td>
</tr>
<tr>
<td>Other</td>
<td>75 (7.0)</td>
<td>17.27 (5.44)</td>
<td>8.56 (2.76)</td>
<td>5.85 (2.09)</td>
</tr>
<tr>
<td>Monthly income (US $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1000</td>
<td>264 (24.5)</td>
<td>17.57 (6.34)</td>
<td>8.84 (3.08)</td>
<td>6.61 (2.30)</td>
</tr>
<tr>
<td>$1000 or more</td>
<td>513 (47.7)</td>
<td>18.48 (5.14)</td>
<td>9.58 (2.85)</td>
<td>6.36 (2.07)</td>
</tr>
<tr>
<td>Missing</td>
<td>299 (27.8)</td>
<td>17.48 (5.38)</td>
<td>8.88 (2.82)</td>
<td>6.42 (2.24)</td>
</tr>
<tr>
<td>Duration of residence in present neighbour hood [y]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6</td>
<td>151 (14.0)</td>
<td>19.20 (6.10)</td>
<td>9.41 (3.17)</td>
<td>6.54 (2.22)</td>
</tr>
<tr>
<td>6–10</td>
<td>151 (14.0)</td>
<td>19.28 (6.22)</td>
<td>9.82 (2.74)</td>
<td>6.77 (2.56)</td>
</tr>
<tr>
<td>11–15</td>
<td>186 (17.3)</td>
<td>18.42 (5.35)</td>
<td>9.23 (2.84)</td>
<td>6.60 (2.20)</td>
</tr>
<tr>
<td>&gt;15</td>
<td>588 (54.7)</td>
<td>17.24 (5.14)</td>
<td>8.98 (2.91)</td>
<td>6.27 (2.15)</td>
</tr>
<tr>
<td>Whether or not dissatisfied with neighbourhood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>795 (73.3)</td>
<td>16.19 (4.85)</td>
<td>8.32 (2.57)</td>
<td>5.95 (1.99)</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>289 (26.7)</td>
<td>22.91 (4.21)</td>
<td>11.63 (2.43)</td>
<td>7.77 (2.14)</td>
</tr>
</tbody>
</table>

*A higher score denotes lower satisfaction with neighbourhood quality.
Table 2  Factor analysis of neighbourhood quality index

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean (SD)</th>
<th>Factor loading</th>
<th>Variance explained (%)</th>
<th>Cronbach α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1: Perceived social capital</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participating in activities together</td>
<td>17.98 (5.55)*</td>
<td>38.3</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>Greeting each other</td>
<td>2.66 (1.00)</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mutual concern for each other</td>
<td>1.88 (1.47)</td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing assistance during an emergency</td>
<td>2.00 (0.87)</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being able to find somebody to talk with when in need</td>
<td>2.13 (0.92)</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintaining public hygiene in the neighbourhood</td>
<td>2.61 (0.97)</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solving problems altogether</td>
<td>2.33 (0.91)</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling happy with the neighbourhood</td>
<td>2.33 (0.92)</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling safe with the neighbourhood</td>
<td>2.10 (0.83)</td>
<td>0.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 2: Perceived security</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiet and peaceful environment</td>
<td>9.20 (2.92)*</td>
<td>9.4</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>Spacious and roomy environment</td>
<td>2.26 (0.97)</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order and good public security in this neighbourhood</td>
<td>2.25 (0.92)</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling safe in this neighbourhood</td>
<td>2.41 (0.94)</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 3: Adequacy of services and facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate lighting</td>
<td>6.44 (2.18)*</td>
<td>7.1</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Convenient transportation</td>
<td>2.14 (0.91)</td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate public facilities</td>
<td>2.04 (0.91)</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall score</td>
<td>33.58 (8.82)*</td>
<td>(median 33, range 15–57)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variance explained (%)</td>
<td>54.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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, income, 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 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 quality.
Measuring perceived neighbourhood quality

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. 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. 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 favourably, and to report overall dissatisfaction with their residential environment. The cross sectional nature of our study makes it difficult to draw 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, and crime in the United States. Considerable interest and debate has surrounded the importation of the concept of social capital in community health. Researchers have pointed out the limitations of the concept in accounting for variations in population health status, including the observation that an overly cohesive community or society may actually have detrimental effects on individual health. 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.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Ms Penelope Chen for her help with preparation of this manuscript.

APPENDIX

Translated items from the Neighbourhood Quality Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neighbours are willing to obey community regulations</td>
</tr>
<tr>
<td>2</td>
<td>Neighbourhood is quiet and peaceful</td>
</tr>
<tr>
<td>3</td>
<td>Neighbourhood is spacious and roomy</td>
</tr>
<tr>
<td>4</td>
<td>Neighbourhood has adequate lighting</td>
</tr>
<tr>
<td>5</td>
<td>Neighbourhood has convenient transportation</td>
</tr>
<tr>
<td>6</td>
<td>Neighbourhood has adequate public facilities</td>
</tr>
<tr>
<td>7</td>
<td>Neighbourhood is safe</td>
</tr>
<tr>
<td>8</td>
<td>Neighbourhood is orderly with good public security</td>
</tr>
<tr>
<td>9</td>
<td>Neighbours enjoy participating in community activities together</td>
</tr>
<tr>
<td>10</td>
<td>Neighbours chat and greet each other</td>
</tr>
<tr>
<td>11</td>
<td>Neighbours are mutually concerned for each other</td>
</tr>
<tr>
<td>12</td>
<td>Neighbours are willing to provide assistance when I am in need</td>
</tr>
<tr>
<td>13</td>
<td>Being able to find someone to talk with in my neighbourhood when in distress</td>
</tr>
<tr>
<td>14</td>
<td>Neighbours are willing to maintain public hygiene in the neighbourhood</td>
</tr>
<tr>
<td>15</td>
<td>Neighbours are willing to solve problems together</td>
</tr>
<tr>
<td>16</td>
<td>Feeling happy with my neighbourhood</td>
</tr>
</tbody>
</table>

* * *

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