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Associations of Perceived Neighborhood Attributes with Self-Report and Objective Measures of Walking in Hong Kong Adults: Preliminary Findings

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Background

- Health and walking
- Environment and walking
- Most research conducted in low-density urbanized areas of Western countries (Australia; Canada; USA)

- Asian urban areas:
  - Higher density
  - Greater reliance on public transport
  - Socio-cultural differences
  - Differences in the built environment
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Average household density (units/km²):

- Australia: 701
- Asian urban areas: 26,127
What does a high density, walkable neighborhood look like?

**Hong Kong**

Average pop. density 6295 persons/km²

**Adelaide, Australia**

Average pop. density 1687 persons/km²
Aim

- Examine relationships of perceived neighborhood characteristics with self-report and objective measures of walking in Chinese-speaking adults of Hong Kong
  - Self-reported walking within (& outside) the neighborhood
  - Moderate-intensity minutes of physical activity (accelerometers)
  - Step counts (accelerometers)

- Provide data for the International Physical Activity and the Environment Network initiative (Hong Kong representing the upper end of urban density spectrum)
Methods

- N = 195 (aged 20-65) – multi-stage stratified sampling strategy

- 32 small Tertiary Planning Unit groups in Hong Kong metropolitan area
  - High SES and high walkability
  - High SES and low walkability
  - Low SES and high walkability
  - Low SES and low walkability

Walkability (GIS) = dwelling density + street connectivity
Types of neighborhood

HWHSES: Tsan Yung Mansion

LWHSES: Discovery Bay
Midvale Village

HWLSES: Tai Fung House

LWLSES: Wing On Terrace
Methods

- Interviewer-administered questionnaire
  - Perceived attributes of local community
    - **Chinese Neighborhood Environment Walkability Scale**
      - Abbreviate (NEWS-AC)
        - Man-made barriers (car parked on sidewalks; hawkers; crowd)
        - Indoor places for walking
        - Non-direct access to services (through bridges; escalators)
        - Air pollution
        - Weekly minutes of walking for transport and recreation within and outside the neighborhood (NPAQ-C) (Giles-Corti et al., 2006)
        - Other (e.g., socio-demographics)
    - **Accelerometers (Actigraph GT1M); N = 106; 1 week; at least 4 valid days with 1 weekend day**
      - Average daily moderate-intensity minutes of physical activity (Freedson’s cut-off points)
      - Average daily step counts
Methods

- Generalized linear models
  - Gamma variance function
  - Identity or logarithmic link function
  - Robust standard errors (cluster effects)
  - Models adjusted for socio-demographic confounders
  - Models of objective measures of walking adjusted for total time of accelerometer wearing and number of weekend/holiday days
  - All continuous predictors centered around the mean
  - Separate models for each environmental attribute (small number of participants and clusters; preliminary findings)
### Results

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Low walkable areas</th>
<th>High walkable areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking for transport (min/wk)</td>
<td>202 (187)</td>
<td>289 (258)*</td>
</tr>
<tr>
<td>Walking for recreation (min/wk)</td>
<td>112 (187)</td>
<td>116 (202)</td>
</tr>
<tr>
<td>Moderate-intensity physical activity</td>
<td>59 (138)</td>
<td>20 (180)</td>
</tr>
<tr>
<td>(Actigraph; min/day)</td>
<td>43 (26)</td>
<td>46 (24)</td>
</tr>
<tr>
<td>Step counts (daily)</td>
<td>9753 (3783)</td>
<td>10324 (3579)</td>
</tr>
<tr>
<td></td>
<td>9299 (3703)</td>
<td>10238 (4708)</td>
</tr>
</tbody>
</table>

M (SD)  Median (IQR)  * p<0.01

87 min/wk difference

... between-area differences in walking variables ...
Results … associations between perceived environment and measures of walking …

<table>
<thead>
<tr>
<th>Perceived neighborhood attribute</th>
<th>WT</th>
<th>WR</th>
<th>MPA</th>
<th>Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household density (5 – 1275)</td>
<td>1.001*</td>
<td>0.997*</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Street connectivity (1 – 4)</td>
<td>1.41***</td>
<td>0.93</td>
<td>1.12</td>
<td>1.03</td>
</tr>
<tr>
<td>Traffic safety (1 – 4)</td>
<td>1.50**</td>
<td>0.98</td>
<td>1.09</td>
<td>1.14*</td>
</tr>
<tr>
<td>Crime (1 – 4)</td>
<td>1.17*</td>
<td>0.56*</td>
<td>1.00</td>
<td>1.01</td>
</tr>
<tr>
<td>Green areas (1 – 4)</td>
<td>0.96</td>
<td>1.80**</td>
<td>1.05</td>
<td>1.01</td>
</tr>
<tr>
<td>Indoor places for walking (1 – 4)</td>
<td>1.17*</td>
<td>0.85</td>
<td>0.95</td>
<td>0.98</td>
</tr>
<tr>
<td>Building aesthetics (1 – 4)</td>
<td>1.21</td>
<td>1.76*</td>
<td>1.03</td>
<td>1.03</td>
</tr>
<tr>
<td>Social environment (1 – 4)</td>
<td>1.09*</td>
<td>1.13</td>
<td>1.17*</td>
<td>1.09*</td>
</tr>
<tr>
<td>Indirect access to services (1 – 4)</td>
<td>1.16</td>
<td>1.90**</td>
<td>1.09</td>
<td>1.08*</td>
</tr>
</tbody>
</table>

WT = walking for transport; WR = walking for recreation; MPA = moderate-intensity physical activity; *P <.05; **P <.01; ***P <.001

Walking for different purposes is associated with different environmental attributes

Some attributes may facilitate one type but hinder another types of walking – effects cancel out
Results ... associations between perceived environment and measure of walking ...

<table>
<thead>
<tr>
<th>Perceived neighborhood attribute</th>
<th>Setting</th>
<th>WT</th>
<th>WR</th>
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<tbody>
<tr>
<td>Land use mix – diversity (1 – 5)</td>
<td>Within</td>
<td>1.22*</td>
<td>1.13*</td>
<td>1.13</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td>Outside</td>
<td>0.92*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic hazards (1 – 4)</td>
<td>Within</td>
<td>1.25</td>
<td>0.95</td>
<td>1.32***</td>
<td>1.13**</td>
</tr>
<tr>
<td></td>
<td>Outside</td>
<td>1.12</td>
<td>1.28**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fences separating traffic from pedestrians (1 – 4)</td>
<td>Within</td>
<td>1.00</td>
<td>0.97</td>
<td>1.08*</td>
<td>1.07*</td>
</tr>
<tr>
<td></td>
<td>Outside</td>
<td>1.10</td>
<td>1.12*</td>
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<tr>
<td></td>
<td>Outside</td>
<td>0.81**</td>
<td>1.00</td>
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Negative aspects of the environment are sometimes offset by walking outside the neighborhood
Results ... associations between perceived environment and measure of walking ...

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WT = walking for transport; WR = walking for recreation; MPA = moderate-intensity physical activity; *P < .05; **P < .01 slow speed differences btw steps and mpa

Associations between environmental characteristics and objectively-measured walking varied by measure

Moderate-intensity minutes of PA as measured by accelerometry may not capture the substantial amount of low-intensity walking in Hong Kong residents
Main points … discussion

- High level of walking … some at low intensity
- Outcome dependent on measure of walking
- Importance of examining location of walking
- Walking for transport:
  - Destinations matter … however …
    - Poor access within the neighbourhood offset by good public transport
- Walking for recreation
  - Aesthetics; crime; traffic and destinations matter …
  - Negative aspect of the neighbourhood environment offset by accessibility to other neighbouring areas
Presentations

Associations of Perceived Neighborhood Attributes with Self-Report and Objective Measures of Walking in Hong Kong Adults

February, 2009
Author:
Ester Cerin, Duncan Macfarlane, Cindy Sit, Wai San Tang, Lok Yan Chow, & Ka Yiu Lee
Topic:
Transportation, Pedestrian Facilities, Communities, Zoning and Mixed Land Use, Architecture and Building Design, Social and Cultural Environment
Population Served:
Adults
Location by State:
Outside of U.S.
Study Type:
Correlates
Description:
Presentation at the 2009 Active Living Research Annual Conference

Background:
Walking for different purposes can help accrue health-enhancing levels of physical activity. There is evidence that the neighborhood environment impacts on residents’ walking. Most research on environmental correlates of walking has been conducted in low-density urbanized areas of Western countries. The public transport networks and built and socio-cultural environments of Asian densely-populated urban areas differ from their Western counterparts. An analysis of the levels of walking and environment-walking associations in areas at the high end of the walkability spectrum (commonly defined as high residential density, street connectivity, and access to diverse destinations) can help determine the magnitude of the effects of environmental attributes on residents’ walking. As part of the International Physical Activity and the Environment Network initiative, a cross-sectional study exploring environment-physical activity associations in Chinese-speaking adult residents of Hong Kong is currently being conducted. We report on preliminary findings of the study.

Objectives:
To examine the relationships of perceived neighborhood characteristics with self-reported walking for different purposes within the neighborhood of residence, accelerometer-based daily minutes of moderate-intensity physical activity (MPA) and step counts.
Methods:
A stratified two-stage cluster sampling design was used to recruit 195 Chinese-speaking adults, aged 20-65, residents of private dwellings and able to walk without assistance. The study sample was drawn from residential addresses within 16 Tertiary Planning Units (TPU) and classified based on their objective walkability and socio-economic status (SES) into four strata: high walkable/ high SES; low walkable/ high SES; high walkable/ low SES; and low walkable/ low SES. Area SES was operationalized as the median weekly household income for a TPU. Walkability was defined using Geographic Information Systems data on dwelling density and street connectivity. Participants provided information on socio-demographics, transportation- and recreation-related walking within the neighborhood, and perceived attributes of the neighborhood environment (Chinese version of the Neighborhood Environment Walkability Scale). Accelerometry-based (Actigraph GT1M) objective data on weekly patterns of physical activity was collected on 106 participants. For the purpose of this study, average daily minutes of MPA and step counts (markers of walking) were examined. Generalized linear models with appropriate variance and link functions and with standard errors adjusted for clustering effects were used to determine the associations of interest. All models were adjusted for socio-demographic confounders. Models of objective measures of walking were also adjusted for total time of accelerometer wearing and number of weekend/holidays days during which accelerometer data were collected.

Results:
Participants reported an average of 246 (SD=238) weekly minutes of walking for transport and 114 (SD=195) weekly minutes of walking for recreation. The average daily minutes of MPA were 45 (SD=25), while the average step counts were 10,039 (SD=3,681). Residents of objectively high-walkable areas reported 87 more weekly minutes of transport-related walking within the neighborhood than did those from low-walkable areas (p<.01). No significant differences between residents of areas differing in walkability were found in walking for recreation, step counts, and accelerometry-based MPA. Significant positive associations were found between transport-related walking within the neighborhood and household density (p<.05), street connectivity (p<.001), indoor places for walking (p<.05), traffic safety (p<.01), land use mix - diversity (p<.05), social environment (presence of people; p<.001) and crime (p<.05). Walking for recreation was positively related with indirect access to services (p<.01), building aesthetics (p<.001), green areas (p<.05), and land use mix - diversity (p<.05). Negative associations were observed for crime (p<.05) and household density (p<.05). MPA were positively related to perceived traffic hazards (p<.001), places for pedestrians (p<.05), social environment (p<.05), and fences separating traffic from pedestrians (p<.05). With the exception of social environment, these neighborhood attributes were also positively related with step counts. Perceived indirect access to services (p<.05) and traffic safety (p<.05) were also positive correlates of step counts.

Conclusions:
Adult residents of Hong Kong reported high levels of walking. However, it appears that some of the walking they undertook was at low intensity. Recent studies indicate that low-intensity physical activity may also be health enhancing, as it replaces sedentary time. As expected, walking for different purposes was associated with different environmental attributes. These findings mirror those observed in Western countries. The sets of environmental predictors varied between objective and self-report measures of walking, which may be due to measurement bias, and different measures capturing different aspects of walking behavior (i.e., any walking, walking at a moderate pace, and walking within the neighborhood). The observed
between-area differences in within-neighborhood self-report but not objective measures of overall walking indicate that, unlike residents of many Western countries, Hong Kong residents may be able to overcome deficiencies in their local environment walkability by walking in areas outside of their neighborhood of residence, easily accessible thanks to an efficient public transport network.

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