Health & Place 36 (2015) 173–183

Contents lists available at ScienceDirect

Health & Place

journal homepage: www.elsevier.com/locate/healthplace

The building blocks of a 'Liveable Neighbourhood': Identifying the key performance indicators for walking of an operational planning policy in Perth, Western Australia

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ARTICLE INFO

Article history:
Received 30 January 2015
Received in revised form
22 October 2015
Accepted 24 October 2015

Keywords:
Planning policy
Liveable neighbourhoods
Walking
Health
Built environment

ABSTRACT

Planning policy makers are requesting clearer guidance on the key design features required to build neighbourhoods that promote active living. Using a backwards stepwise elimination procedure (logistic regression with generalised estimating equations adjusting for demographic characteristics, self-selection factors, stage of construction and scale of development) this study identified specific design features ($n=16$) from an operational planning policy ("Liveable Neighbourhoods") that showed the strongest associations with walking behaviours (measured using the Neighbourhood Physical Activity Questionnaire). The interacting effects of design features on walking behaviours were also investigated. The urban design features identified were grouped into the "*building blocks of a Liveable Neighbourhood*", reflecting the scale, importance and sequencing of the design and implementation phases required to create walkable, pedestrian friendly developments.

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1. Introduction

A vast body of evidence demonstrates associations between the built environment and levels of walking and physical activity (Hooper et al., 2012; Saelens and Handy, 2008; Saelens and Papadopoulos, 2008; Sallis et al., 2009; Transportation Research Board Institute of Medicine, 2005). Government policy and planning initiatives determine the way cities and towns are developed and therefore play a vital role in shaping the neighbourhoods where residents can safely and conveniently be physically active.

Despite a proliferation of evidence and increased attempts by active living researchers to promote research findings to change urban planning policy and practice, there is a dearth of prescriptive evidence about 'how much', of 'what types' of urban design features and infrastructure are needed to support health and active living behaviours. Planning professionals and policy makers have indicated that to help progress the influence of health research and its translation into planning policy and practice there is an urgent need for practice-based evidence evaluating the effectiveness of existing planning policies-using policy-relevant measures, (Allender et al., 2009; Brownson et al., 2009; Durand et al., 2011; Koohsari et al., 2013). They also require clearer guidance from active living researchers on the 'key' or 'essential' design features that promote health outcomes and behaviours such as walking (Allender et al., 2009).

In 1998 the Western Australian State Government introduced the 'Liveable Neighbourhoods Community Design Guidelines' (LN). A key intended outcome of the LN policy was to reduce suburban sprawl and car dependence and encourage more walking, cycling and public transport use. LN consists of four general design 'elements' (community design; movement networks; lot layout; public parkland) that provide design guidance to assist in creating more compact, self-sufficient, pedestrian-friendly neighbourhoods, with destination hubs (i.e., neighbourhood centres) and public transport links. Each element contains a list of requirements of different design features with a range of responses or criteria outlining how planners or developers could meet the element objectives.

The introduction of LN provided a unique opportunity for a natural experiment. As such the RESIDential Environments project (RESIDE) commenced with the aim of assessing the impact of the

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http://dx.doi.org/10.1016/j.healthplace.2015.10.005
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new planning policy on local residents' walking and cycling behaviours and health outcomes (Giles-Corti et al., 2008) and to provide longitudinal evidence to enhance the cross-sectional evidence that dominates this literature. As part of the RESIDE project a process evaluation was previously conducted to objectively measure the levels of on-ground policy implementation in in 36 housing developments across Perth using tailored spatial measures (Hooper et al., 2014). This study revealed that the greater the implementation the better the walking outcomes. Indeed, there was a dose-response relationship between overall levels of policy compliance and with each of its elements (i.e., community design, movement network and lot layout) and walking behaviours (Hooper et al., 2014).

The LN elements provide guidance on the built environment features considered to encapsulate good 'New Urbanist' design (Duany et al., 2000) and stimulate walking. A simple scoring system for quantifying levels of policy compliance was developed (Hooper et al., 2014). Additionally, a cluster analysis identified the different mix of design features that had been implemented in the developments and their associations with walking behaviour (Hooper et al., 2015). Both approaches also helped to identify the number and range of policy requirements implemented and the degree to which these had been implemented. However, these methods assumed that all of the design features were of equal importance to walking outcomes-which may not be the case.

The LN policy is complex and contains a large number of different design features (up to 25 within each of the four elements) for consideration. Western Australian planning policy-makers (including the custodians of the policy – the Department of Planning) and practitioners (i.e., those implementing the policy on-the-ground) have expressed interest in identifying whether any (and which) of the design features are more effective than others in promoting walking.

In response to this demand and building on earlier work investigating the levels of LN compliance and its associations with walking (Hooper et al., 2014), this paper sought to identify which of the specific design features currently required under the policy are more, or less important in encouraging walking. Using a backwards stepwise elimination procedure this paper considered all of the design features within each of the four elements of the LN policy (i.e., community design, movement network, lot layout and public parkland) to identify a hierarchy of 'key performance indicators' of liveable suburban neighbourhood design that promote active living behaviours, such as walking. The LN elements and their respective design features were not intended to be implemented in isolation. It was therefore important to investigate combinations or interactions of design features across the elements that were required to encourage walking behaviours, and to represent these as 'building blocks' of a "Liveable Neighbourhood", reflecting the sequencing required in the design and implementation phases.

The two specific objectives of this paper were to: (1) identify the LN requirements from each element that showed the strongest associations with walking behaviours; and (2) to investigate the interacting effects of selected policy requirements on different walking behaviours.

2. Methods

2.1. Measuring implementation of policy requirements

This paper follows the process evaluation that objectively measured the implementation of the quantifiable requirements from the LN policy across its four elements for 36 new housing

Table 1
Objective measures of the community design, movement network, lot layout and public parkland requirements from the Liveable Neighbourhoods policy that were entered into the multivariate analyses*.

Community design

Access to neighbourhood centres
- Distance to the nearest neighbourhood/town centre[1]
- Centre accessible within 400 m (yes/no)[2]
- Centre accessible within 800 m (yes/no)[2]
- Centre accessible within 1600 m (yes/no)[2]

Configuration of neighbourhood centre accessible within 1600 m
1. Main street layout
2. Big-box layout

Diversity of Destinations within Neighbourhood Centres
- Destination diversity score-number of different destination types present within the centre (score 1–8):
  1. Number of convenience goods stores: *supermarkets; deli's; speciality food stores(i.e., butchers, greengrocers, fishmongers); liquor stores and bottle shops; newsagents and confectionary retailers; service station shops*
  2. Number of retail goods stores: *fashion and apparel stores, footwear and accessories shops; jewellery stores; books, games, music, DVD/video stores; cards, souvenirs and gift stores; personal electronic and telecommunications; variety and discount stores*
  3. Number of general services: *hair and beauty; banks and finance; personal health (e.g., pharmacies); video/DVD rental; laundry and tailoring*
  4. Number of medical and health care services: *medical centres; other medical and health services (e.g., dentist, physiotherapist);*
  5. Number of places of worship: *churches, mosques, temples and synagogues*
  6. *Number of community services and facilities: community centres; day care centres / crèches; libraries*
  7. Number of eating and drinking out establishments: *restaurants, bars, fast food outlets, hotels, taverns, pubs, bars, nightclubs*
  8. Number of entertainment and amusement places: *cinemas; theatres; convert halls; museums, art galleries; gaming and gambling venues; sporting (spectator) venues*

Access to public transport
- Distance to the nearest bus stop[1]
- Bus stop accessible within 400 m (yes/no)[2]
- Number of bus routes through the development
- Number of bus services to/from the development
- Distance to the nearest train station[1]
- Train station accessible within 800 m (yes/no)[2]

Access to primary schools
- Distance to the nearest primary school[1]
- Primary school accessible within 1600 m (yes/no)[2]

Movement network

Connectivity of the street networks
- Connected node ratio (number of 3+4 way intersections ÷ total number of all intersections including cul-de-sacs)
- Mean block perimeter
- Block density=number of blocks ÷ constructed land area within the development
- Walkable block ratio=number of blocks ≤620 m perimeter ÷ total number of blocks

External connectivity
- Number of external access points=number of pedestrian-friendly access points along the development perimeter ÷ perimeter of development boundary (km)

Cul-de-sac provision and design
- Cul-de-sac length ratio=number of cul-de-sacs ≤120 m in length ÷ total number of cul-de-sacs
- Cul-de-sac link ratio=number of cul-de-sacs with a pedestrian cut through ÷ ⊖ total number of cul-de-sacs
- Cul-de-sac lot ratio=number of cul-de-sacs serving ≤20 residential lots ÷ total number of cul-de-sacs
- Percentage of residential lots on cul-de-sacs (≤/>15%)=number of residential lots served by a cul-de-sacs ÷ total number of residential lots
- Cul-de-sac street %=length of all road network segments terminating in a cul-de-sac ÷ total length of all road centrelines

Total footpath provision
- Footpath length per unit area (ha)=length of all footpaths ÷ constructed land area of housing development
- Footpath to road ratio=length of all footpaths within the development ÷ length of all roads within the development**Footpaths on both sides of the street?**
- % of road length with sidewalks (i.e., footpath segments that ran alongside the road)
- Sidewalk to road ratio=length of all footpath segments alongside/adjacent to roads ÷ length of all roads

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