Health & Place 15 (2009) 474–481

Contents lists available at ScienceDirect

Health & Place

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

Development of the Scottish Walkability Assessment Tool (SWAT)

Catherine Millington [a,*], Catharine Ward Thompson [a,*], David Rowe [b], Peter Aspinall [a], Claire Fitzsimons [b], Norah Nelson [b], Nanette Mutrie [b], (on behalf of SPARColl—the Scottish Physical Activity Research Collaboration)

[a] OPENspace Research Centre, Edinburgh College of Art, Lauriston Place, Edinburgh EH3 9DF, UK
[b] Department of Sport, Culture and the Arts, University of Strathclyde, 76 Southbrae Drive, Glasgow G13 1PP, UK

ARTICLE INFO

Article history:
Received 29 February 2008
Received in revised form
25 July 2008
Accepted 5 September 2008

Keywords:
Physical environment
Urban
Walking
Walkability
Audit tool
Reliability

ABSTRACT

The Scottish Walkability Assessment Tool (SWAT) was designed to objectively record aspects of the physical environment believed to be related to walking in urban Scotland. Reliability was assessed by three pairs of trained raters auditing 30 street segments on two occasions. Eighteen items were reliably audited and displayed adequate environmental variability, 25 items proved unreliable, and 69 items lacked adequate environmental variability. The large number of items that lacked environmental variability indicates a relatively uniform environment in terms of characteristics, which the literature indicates might be used to differentiate walkability; however, the 18 reliable items can potentially be used to differentiate walkability.

Introduction

There is growing recognition of the important role of the physical environment in influencing physical activity and consequently public health and wellbeing. In particular, it has been suggested that changes to the environment that promote physical activity may have more permanent and population-wide effects than other forms of exercise promotion targeted at individuals (Saelens et al., 2003). Although an association between the physical environment and physical activity has been identified, evidence regarding causality between specific characteristics of the physical environment and physical activity has yet to be established (Croucher et al., 2007; Handy, 2005). However, certain characteristics have been identified that appear to be positively associated with physical activity among adults, such as: (a) aesthetics (Humpel et al., 2002); (b) safety from traffic (Duncan et al., 2005); (c) residential density, land use mix, and street connectivity (Frank et al., 2005; Handy, 2005; Saelens et al., 2003); (d) well maintained footpaths (De Bourdeaudhuij et al., 2003; Duncan et al., 2005; Pikora et al., 2006) and street lighting (Saelens et al., 2003); (e) the presence of facilities that function as destinations, e.g. shops (De Bourdeaudhuij et al., 2003; Duncan et al., 2005; Pikora et al., 2006; Saelens et al., 2003); (f) access to facilities for physical activity, e.g. parks and recreation centres (De Bourdeaudhuij et al., 2003; Duncan et al., 2005; Humpel et al., 2002); and (g) accessible, safe green spaces (Croucher et al., 2007; Giles-Corti et al., 2005; Sugiyama and Ward Thompson, 2007a, 2008).

In order to determine whether environments support physical activity, information on those characteristics of the physical environment believed to be related to physical activity should be recorded. This information may be obtained from self-reported perceptions of the physical environment by local residents (e.g. De Bourdeaudhuij et al., 2003; Humpel et al., 2004; Saelens et al., 2003), or from more objective measures based on audit tools used by trained raters (Boarnet et al., 2006; Brownson et al., 2004; Giles-Corti et al., 2005; Pikora et al., 2002), or from data derived using Geographical Information Systems (GIS) (e.g. Frank and Pivo, 1994; Frank et al., 2005; Wendel-Vos et al., 2004). These different methods have benefits and drawbacks, and researchers increasingly use multiple methods to investigate associations between the physical environment and physical activity (e.g. Cerin et al., 2007; Leslie et al., 2005; Sugiyama and Ward Thompson, 2007b).

Audit tools developed to measure objectively the street-scale or fine grain attributes of the physical environment that may be related to physical activity have focused on the urban and

* Corresponding authors. Tel.: +44 131 221 6269 (C. Millington); Tel.: +44 131 221 6176; fax: +44 131 221 6157 (C. Ward Thompson).
E-mail addresses: c.millington@eca.ac.uk (C. Millington), c.ward-thompson@eca.ac.uk (C. Ward Thompson).

1353-8292/$ - see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.healthplace.2008.09.007

suburban contexts that form the local environment for the vast majority of residents in the developed world. The characteristics of the environment that are relevant to walking will vary according to climate, landscape, built form and cultural traditions, and audit tools should be sensitive to such differences and tailored accordingly. Audit tools have been developed in Australia, for example the Systematic Pedestrian and Cycling Environmental Scan (SPACES) (Pikora et al., 2002) and in the United States for example, the St. Louis Instrument (Brownson et al., 2004) and the Irvine-Minnesota Inventory (Boarnet et al., 2006). However, the environments for which these tools have been developed differ from urban areas in many European towns and cities. The US and Australian environments encompassed many low-density neighbourhoods and suburban street patterns as well as denser urban areas, so that the presence or absence of 'sidewalks' or shade trees, for example, might be significant, and the presence of private garages and parking spaces for each home were commonplace (Boarnet et al., 2006). European urban contexts typically reflect higher density residential patterns (although this is a complex issue, see Huang et al., 2007), lower levels of car ownership (Melbourne Transport Forum, 2005) and more consistent use of pavements and on-street parking. Other features, such as the presence of gated communities within US residential areas, or architectural details such as front porches on US houses (Boarnet et al., 2006), are culturally specific. To the authors' knowledge, no appropriate audit tool has been developed for the traditional European urban context where residential neighbourhoods commonly contain a comparatively high density of dwellings, including a high proportion of terraced housing and apartment buildings, within a well-connected pattern of streets. This paper describes the development and evaluation of the Scottish Walkability Assessment Tool (SWAT), an audit tool developed in Scotland, UK, which may have applicability more widely across northern Europe. If demonstrated to be reliable, SWAT could help with planning active transport in urban European settings, identifying areas in need of intervention to improve walkability and identifying aspects of the environment that could be modified to greatest effect.

Context for development of the SWAT research tool

SWAT was developed to objectively assess the walkability of the physical environment in the west of Glasgow, Scotland. The study forms one element of a wider project called Walking for Well-being in the West (WWW). WWW is a multi-disciplinary project designed to assess whether a pedometer-based walking programme, in combination with a physical activity consultation, would increase and maintain walking behaviour over a 12-month period. The study examines the complex relationships between behavioural change, health consequences and the role of the environment, in conjunction with the cost-effectiveness of this approach and a detailed insight into the participants' experiences of the intervention.

The study sample was drawn from men and women living in the West of Glasgow (aged 18–65 years) who were not achieving the current physical activity recommendation of 30 min of moderate intensity physical activity on 5 or more days of the week (Department of Health, 2004). In order to recruit participants, all households within the study area received a leaflet advertising the project and it was further advertised through the local newspaper, community stands in local shops, libraries, high rise blocks of flats, etc.

Participants were randomised into two groups: Group 1: immediate intervention (pedometer-based walking programme combined with a series of physical activity consultations); Group 2: waiting list control group for 12 weeks (followed by minimal pedometer-based intervention with no consultations). Physical activity was assessed objectively using pedometer step counts and subjectively using the International Physical Activity Questionnaire (IPAQ-long, Craig et al., 2003). Psychological processes were measured using questionnaires relating to the Transtheoretical Model of Behaviour Change (Marcus and Simkin, 1994), mood (PANAS) (Watson et al., 1988) and quality of life (Euroqol EQ-5D, Euroqol Group, 1990). The physiological response to the intervention was assessed using anthropometric and metabolic outcomes. The Neighbourhood Quality of Life Survey (NQLS, no date) was used to gain an insight into the participants' subjective assessment of their environment in relation to physical activity, and in particular walking. The participants' local environment was assessed objectively using the audit tool reported in this paper (SWAT) and data, derived using GIS, on land use mix and building density, access to services, density of road intersections, and traffic accidents. A qualitative evaluation explored participants' experiences of the intervention and an economic evaluation assessed cost-effectiveness. Further details on the study methods and rationale for the WWW study as a whole are presented in a separate paper (Fitzsimons et al., 2008).

The study area

The study area covered approximately 25 km^2 and was located 3 km North West of the Merchant City in Glasgow, on the north bank of the River Clyde (see Fig. 1). Land use was predominantly residential with some commercial destinations, although industries border the river. There were four main urban parks and a botanical garden. The population density of the study area at the time of the study (2007) was approximately 3302 persons/km^2. Based on the Scottish Index of Multiple Deprivation (Scottish Executive Statistics, 2006), the study site covers some of the most and least deprived areas within Scotland.

Methods—developing SWAT

SWAT was based on the SPACES instrument developed in Australia by Pikora et al. (2002). Unlike SPACES, however, SWAT focuses on walking rather than both walking and cycling because the wider WWW project only recorded participants' walking behaviour. The items in SWAT were adapted for use in a Scottish urban context.

The SPACES audit tool considered the different factors identified in the literature as being likely to influence walking and cycling behaviour. In developing SWAT, we recognised that the majority of these factors were common across different geographic locations (e.g. attractive views, aids to crossing roads safely) but we changed the details in order to reflect the Glasgow environment (e.g. the use of different kinds of road crossing aids such as tactile paving, and different paving materials, such as stone setts) and any additional factors such as density of adjacent vegetation (Sugiyama and Ward Thompson, 2008; Alves et al., 2008 in press) and steepness of slope on the street (Southworth, 2005), that the literature or expert opinion suggested were likely to be relevant. The final audit tool included aspects of the physical environment that have correlated with physical activity, and particularly walking, in prior research, for example path quality (De Bourdeaudhuij et al., 2003; Duncan et al., 2005; Pikora et al., 2006) and access to destinations such as shops, recreational facilities, parks, and public transport stops (De Bourdeaudhuij et al., 2003; Humpel et al., 2004; Pikora et al., 2002), as well as additional aspects that seem likely to be influential in the UK