Building a Reliable Measure for Unobtrusive Observations of Street-Connecting Pedestrian Walkways

Nick Wilson, Bill Brander, Osman D. Mansoor, and
Amber L. Pearson

ABSTRACT *There is evidence that good urban design, including street connectivity, facilitates walking for transport. We, therefore, piloted a short survey on 118 such walkways in nine suburbs in Wellington, New Zealand's capital. The instrument appeared feasible to use and performed well in terms of inter-rater reliability (median Kappa score for 15 items: 0.88). The study identified both favorable features (e.g., railings by steps), but also problematic ones (e.g., concerning graffiti, litter, and insufficient lighting and signage). There is scope for routinising the monitoring of walkway quality so that citizens and government agencies can work together to enhance urban walkability.*

KEYWORDS *Walkway quality, Walkability, Active transport, Street connectivity, Survey instrument, Signage*

BACKGROUND

Increased physical activity is important for the prevention of chronic diseases, especially cardiovascular disease,¹ cancer,² and diabetes.³ Walking and cycling for transport can provide such activity and can also, via reduced car usage, reduce greenhouse gas emissions and other associated problems (e.g., traffic congestion, local air pollution, and noise pollution).

One review of urban design features found beneficial impacts on physical activity from open space and street connectivity.⁴ Another review of “utilitarian walking” by adults also reported evidence favoring the functional aspects of routes (sidewalks and street connectivity in 50 % of studies).⁵ It also reported that for recreational walking, “route aesthetic” was sometimes found to be relevant (35 % of studies).

Perceptions of safety may also impact on walking levels. Indeed, a systematic review has found that there is “some evidence for the effectiveness of specific environmental interventions in reducing some indicators of fear of crime.”⁶

Most of the research around monitoring walkway quality relates to “formal” sidewalks and footpaths (e.g., Williams et al.⁷) and not for street-connecting walkways. However, many places in the world have walkways that connect streets (especially in hilly terrain), and these can be important for pedestrians to access other parts of the community and for commuting.

Wilson and Pearson are with the Department of Public Health, University of Otago, Wellington7343Wellington South, New Zealand; Brander and Mansoor are with the Wellington, New Zealand.

Correspondence: Nick Wilson, Department of Public Health, University of Otago, Wellington7343Wellington South, New Zealand. (E-mail: nick.wilson@otago.ac.nz)

Given this background, and the lack of simple survey instruments that citizens can use for assessing and monitoring street-connecting walkway quality, we performed a pilot survey on this topic. Specifically, we aimed to (i) examine the feasibility of using a simple survey instrument to assess the quality of street-connecting walkways; (ii) determine whether such walkways would be suggested routes on a commonly used internet-based service (Google Maps); and (iii) gain initial information on the quality of such walkways in a major New Zealand urban area (including by area deprivation level).

METHODS

For the purposes of this study, street-connecting pedestrian walkways were defined as those providing pedestrian-only (non-vehicle) access that connected two or more streets, which involved defined paths, were at least 20 m in length, and which were on public land (i.e., were the responsibility of the City Council). We excluded walkways that passed through the conserved spaces of the town-belt as these were less likely to be used by commuters (i.e., they are more for weekend recreational use and for access to dog walking areas).

The selected suburbs were a convenience sample within Wellington City, the capital of New Zealand. These suburbs covered a contiguous set from the west to east of the city: Karori ($n=35$ walkways), Wilton ($n=7$), Wadestown ($n=16$), Northland ($n=16$), Kelburn ($n=18$), Highbury ($n=3$), Aro Valley ($n=10$), Mt Cook ($n=8$), and Newtown ($n=5$), (suburb boundaries from Google Maps). Data were collected on all walkways identified in each suburb, except for Kelburn where the sampling area was defined as south of the botanic gardens and excluding walkways inside a university campus. The walkways were all identified from lists and maps on the “Living Streets Aotearoa” website and examination of various maps, particularly Google Maps.

Directions were requested in each suburb using Google Maps to test whether walkways were included in the recommended shortest walking route. Next, visits by individual researchers to the walkways were conducted from October 2013 to January 2014 and observation data collected on a standardized form covering a range of walkway quality aspects (a copy of the form is available: <http://www.otago.ac.nz/wellington/departments/publichealth/research/otago065896.html>). Data collection focused on such aspects as signage, lighting, railings, and features relating to potential personal safety perceptions (e.g., graffiti). The analysis included consideration of a commonly used New Zealand measure of area deprivation level (NZDep2006)⁸ for the 13 relevant census area units (CAUs) in which the walkways were located.⁹ That is, several suburbs were composed of multiple CAUs with different deciles of area deprivation. Data were compiled in Excel and analyzed using EpiInfo (CDC Atlanta, v7.1.3.0). Analyses included ANOVA and the Kruskal–Wallis Test (the latter when the data were not normally distributed).

An inter-rater reliability assessment involved the two authors who did the data collection (NW and BB) studying a random sample of 20 of the 118 walkways. Data collection was done independently by the two observers on the same days. For the inter-rater reliability study, Cohen’s Kappa scores and associated grading (“poor”,

“good,” etc.) were calculated using GraphPad Software (<http://graphpad.com/quickcalcs/kappa1/>).

RESULTS

It was found to be very feasible to survey these walkways, albeit with relatively simple approaches to data collection (e.g., just counting discrete items of graffiti and not trying to estimate the size of each item). Inter-rater reliability in the 20 randomly selected walkways was favorable with Kappa scores graded for 15 items as “very good” or higher (10/15), “good” (2/15), “moderate” or “fair” (2/16), and “poor” (1/15) (Kappa scores could not be determined for four items due to divisions by zero values). The mean Kappa score was 0.78 and median was 0.88. Those items with agreement graded less than “good” (Kappa <0.6) were the exact number of lights at the start of the walkway (see Table 1 footnote for grading system), number of lights on route, and the presence of any guttering. Scores varied depending on the precision required, e.g., for “any litter” and “any graffiti” Kappa scores were good (0.66) and perfect (1.0), respectively, but agreement for the precise number of items identified was poor (0.01) and fair (0.38), respectively. The latter was despite fairly similar total number of items identified by the two observers (59 vs. 57 litter items; 52 vs. 48 graffiti items in the sample of 20 walkways).

Almost all selected walkways were identified as pedestrian routes by Google Maps, i.e., showing the walkway as a highlighted route option to connect two streets (92 % when requesting the “pedestrian” option, and 86 % for the “cycling” option, Table 1). Around two thirds (65 %) of the walkways had signage at both the start and end of the walkway, although some of these signs were partly obscured by vegetation or were in less than obvious places. In street cul-de-sacs with walkways, only 12 % had walkway signage at the entrance to the cul-de-sac.

Positive walkway features included nearly all having a paved surface (only three having gravel or other surfacing), and when there were steps, there were also usually rails by all the sets of steps (84 %). Other notably positive features included some walkways with planted flower beds or tended shrubs on the path verge, seating, community art works, and non-slip surfaces applied to wooden steps.

On the less favorable side, the lighting could be considered to be insufficient at walkway entrances (as only 20 % had lighting for both entrances). Walkways with steps rarely had some (3 %) or all (5 %) of the step edges painted to assist with visibility at night. Most of the walkways with guttering had these overflowing in at least one place with plant debris or living plants (89 %). Graffiti was commonly visible (51 % of walkways) and so was at least some litter (58 %). Litter involving glass (broken or unbroken) was present on 17 % of walkways.

Other problematic aspects included some walkways with very obscure entrances (which looked like a property entrance), broken railings, loose steps, water running over the whole path due to blocked drains, obstructive vegetation (that would typically force adult pedestrians to bend down), and the path width completely covered in leaves (increasing the risk of slipping). Some litter items were large (e.g., a discarded supermarket trolley and a full garbage bag) and some of the graffiti covered several square meters of adjacent walls.

There were some statistically significant differences by area deprivation, with litter and graffiti levels increasing along with the deprivation level (Table 2). Signage levels at walkway entrances also varied significantly (lowest in the more deprived

TABLE 1 Results from the survey of characteristics of 118 walkways in nine Wellington City suburbs

Walkway characteristics (<i>n</i> =118 unless stated otherwise)	<i>N</i> value	Percent	% (95 % CI)	Mean number of items per walkway (Median)	Range per walkway
<i>Visible on maps and signage</i>					
Walkway traced out on the route finder function in “Google Maps”	86	72.9	63.9–80.7	–	–
– yes, for pedestrians and cycling					
– yes, for pedestrians but not for cycling	23	19.5	12.8–27.8	–	–
– does not show up for either of the above	9	7.6	3.6–14.0	–	–
“Cul-de-sac” street with walkway – with sign for the walkway at the street entrance (<i>n</i> =74)	9	12.2	6.1–21.1	–	–
Signage for the walkway (usually a walking symbol plus the destination street)	65	55.1	45.7–64.3	–	–
– both start and end					
– neither at the start or end	30	25.4	17.9–34.3	–	–
<i>General structure</i>					
Walkway shape is curved (vs. straight)	100	84.8	77.0–90.7	–	–
Walkway has steps	81	68.6	59.5–76.9	–	–
<i>Lighting and safety features</i>					
At least one light out of the two entrances	87	73.7	65.2–81.1	–	–
Lights at both entrances	24	20.3	13.5–28.7	1.1 (0.5) ^a	0–2
Lights along the walkway – any	73	61.9	52.9–70.3	1.4 (1.0)	0–11 ^b
Walkways with steps (<i>n</i> =80) have the edges painted white/yellow – all steps, yes	4	5.0	1.4–12.3	–	–
– just some steps painted (<i>n</i> =80)	2	2.5	0.3–8.7	–	–
– just faint traces of previous paint (<i>n</i> =80)	4	5.0	1.6–12.3	–	–
Any part of the gutters with leaves/debris overflowing the rim or otherwise blocked with soil (sub-sample of <i>n</i> =35 walkways, of which 26 had any guttering) ^c	23	88.5	71.7–97.0	–	–
Walkways with steps (<i>n</i> =80) have rails beside all steps	67	83.8	73.8–91.1	–	–

TABLE 1 *Continued*

Walkway characteristics (<i>n</i> =118 unless stated otherwise)	<i>N</i> value	Percent	% (95 % CI)	Mean number of items per walkway (Median)	Range per walkway
<i>Damage by users (litter and graffiti)</i>					
Graffiti – any (on adjacent walls, path surfaces and rails)	60	50.8	41.9–59.8	3.1 (1.0) ^d	0–10+
Litter present on actual path (above a cigarette butt in size and ignoring litter in gutters and verges, and ignoring plant debris)	68	57.6	48.6–66.3	2.2 (1.0) ^d	0–10+
Glass on the path (broken or unbroken, and also included in the litter count above)	20	16.9	11.0–24.5	0.3 (0)	0–4
Dog feces on the path	5	4.2	1.6–9.1	0.05 (0)	0–2

^aMean out of up to two lights and includes lights that were <5 m from the walkway entrance. For lights that were directly across the road from the entrance or which were 5–10 m away to the side, these were scored as “0.5”

^bIncluded LED lights on two walkways, some lights were in pairs pointing in different directions (counted as two lights).

^cData collection on gutters was added part-way through the survey process.

^dCounts limited to a maximum of ten items per walkway, so the estimated means will be underestimates.

suburbs but highest in the middle tertile for deprivation). But the number of lights did not vary significantly by deprivation level.

DISCUSSION

In this pilot study, the surveying method and instrument appeared to be feasible and worked well. The inter-rater reliability (Kappa scores) was very good overall, with only a few low scoring items. Nevertheless, various methodological aspects could be improved further in future work (which we were unable to do in this small unfunded pilot study). Such additional aspects could include measurement of lighting quality at night with a light meter; systematically assessing path surface quality and quality of steps (including loose steps); assessing inter-rater reliability with citizen observers; and GPS measurement of walkway length and gradient change. Perhaps generating a single score for an overall quality index for such walkways is desirable. But collecting such additional information would come at the cost of reducing simplicity which is important in terms of developing tools that facilitate citizen monitoring.

This study found that some of the quality aspects of these sampled walkways appear good (e.g., railings beside most of the steps), but many others aspects were potentially suboptimal from a pedestrian perspective (e.g., lighting at entrances, signage, and graffiti). But the size of study was limited in scale (*n*=118 walkways) and so the results may not necessarily be generalizable to the rest of the Wellington Region or to other New Zealand cities (which are typically less hilly than Wellington).

TABLE 2 Selected walkway characteristics by tertile of area deprivation for the walkway location (13 census area units, Wellington City)

Walkway characteristic	Low deprivation (deciles 1–3) (<i>n</i> = 65 walkways)	Medium deprivation (deciles 4–6) (<i>n</i> = 32)	High deprivation (deciles 7–10) (<i>n</i> = 21)	<i>p</i> value ^a
Graffiti (mean pieces per walkway) ^b [medians]	1.7 [0]	3.7 [2]	6.3 [8]	<0.00001
Walkway signage at both entrances (mean number out of potentially two signs) [medians]	1.3 [2]	1.6 [2]	0.8 [0]	0.002
Walkway signage at both entrances (mean number out of potentially two signs)	1.3	1.6	0.8	0.002
Lights at the entrances (mean number out of potentially two lights)	1.2	0.9	1.0	0.209
Mean number of all lights (entrances and along the walkway) ^b	2.3	2.7	3.0	0.394

^aANOVA, except that the Kruskal–Wallis Test for two groups used for the litter analysis (given the data were not normally distributed).

^bResults not adjusted for walkway length.

It was reassuring that some structural aspects of walkway quality such as lighting did not vary by area deprivation level of the locality. The high levels of litter and graffiti along walkways in the more deprived areas may reflect such factors as differing population densities, higher rates per capita of litter deposition and graffiti application, and differing walkway characteristics, e.g., walls on the sides of walkways may make graffiti easier to apply. Such issues could be explored in studies with larger samples.

Some of the potential improvements that a local government (in this case Wellington City Council) could perform would be fairly low cost, e.g., improved signage as suggested by a local pedestrian advocacy organization,¹⁰ with example signs used in other countries shown on a website (http://www.pedestrians-int.org/content/112/5living_.pdf). Other responses might even be cost-saving in the long-term. For example, the use of motion-sensitive and highly-directional LED lighting may both improve lighting and reduce electricity and maintenance costs (relative to the predominant high pressure sodium lighting used in this city).

Central government could also play a greater role in funding research on the most cost-effective approaches to walkway improvements in countries like New Zealand. It could also work with local government on establishing monitoring systems that the citizens can easily participate in (perhaps using the type of method developed in this survey but in a smartphone format). There is also scope for either government or non-government agencies to support a crowdsourcing approach¹¹ to walkway quality assessment, as per having specific apps for assessing such walkways along the lines of the “Love Clean Streets” app (<http://www.lovecleanstreets.com/>).

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