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The effect of a trail use intervention on urban trail use in Southern Nevada

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ABSTRACT

Objective. Communities are building or improving trail networks for biking and walking to encourage physical activity, but the relationship between trail environments and physical activity is not well understood. We examined the effect of a trail use intervention in Southern Nevada.

Methods. We monitored the usage of urban trails (n = 10) in Southern Nevada before, during, and after an intervention which included a marketing campaign promoting trail use and the addition of way-finding and incremental distance signage to selected trails (October 2011–October 2012). Data were collected with infrared monitors placed on the trails for three periods of 7 days. We compared pre-, mid-, and post-intervention usage rates on the 6 trails where signage was added to usage rates on the 4 control trails.

Results. The groups of trails experienced different patterns of increases and decreases over the 1-year study period. Mean users per hour increased 31% for the study trails and 35% for the control trails ($p < 0.001$), but the total increase did not vary between the groups.

Conclusion. Trail use increased about 33% during the 1-year study period for the intervention. Adding wayfinding and incremental distance signage appeared to support the increase in usage which followed the marketing campaign.

Introduction

Although the multiple health benefits of PA are well documented, many Americans still do not meet PA guidelines (CDC, 2011). In past decades, efforts to increase PA focused on the behavior of individuals, but more recently researchers and evaluators have investigated the role of the built environment in promoting or discouraging PA (Frank et al., 2003; Humpel et al., 2002). This work has led to an increased interest in providing public spaces that support PA, including community trails (Booth et al., 2005).

The Southern Nevada Health District (SNHD) received a Communities Putting Prevention to Work (CPPW) from the Centers for Disease Control and Prevention (CDC) in 2010 to prevent chronic disease and support healthy living through policy, systems, and environmental change (Bunnell et al., 2012). Like other CPPW communities, the SNHD used a portion of their grant funds to support PA. The SNHD's strategies to increase PA included the promotion and improvement of local trails. We have previously reported on the characteristics and effect of its media campaign promoting trail use, where we observed a 52% increase in mean users per hour over six months (Clark et al., in press). This portion of the project involves the same trails but a longer time period and also includes an alteration to the trail environment.

A recent review of trails and PA completed by Starnes et al. (2011) reports that trail use has been both positively and negatively associated with age, racial and ethnic minority status, and gender. The reviewers also reported mixed results from studies investigating access to trails and levels of PA, and called for further research to investigate the relationship between trails and PA. Price et al. (2013) recently studied correlates of trail use in Michigan and reported higher levels of use among males, those with higher levels of education, and White race/ethnicity.

Most previously published studies of trail usage are cross-sectional and rely on self-reported behaviors (Starnes et al., 2011). Few studies have reported on objective measures of trail use or changes in trail usage over time. Evenson et al. (2005) analyzed PA among those living near a new trail, before and after construction, but their study showed no significant increase in PA. Another study of the promotion of a newly constructed trail in Australia used data from telephone surveys and objective counts to assess PA changes among people living nearby (Merom et al., 2003). The authors reported both an increase in cycling traffic and an increase in PA among one subgroup (Merom et al., 2003). Fitzhugh et al. (2010) reported a positive effect on PA in adults when trail access was improved, but they did not report on the effect of signage. Price et al. (2012) studied seasonal variations in trail use among older adults, but they did not assess the effect of changing the trail environment. Although the presence of trail signage is noted in trail environment assessment tools (Troped et al., 2006), to our knowledge there are no published articles on the effect of trail signage on trail usage. Accordingly, the purpose of our study was to assess the longer

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Table 1
Descriptive characteristics of 10 Southern Nevada trails included in 2011–2012 usage study.

Trail	Length (mi)	Setting	Signage changes	Amenities
1	4.0	Commuter	No	Bicycle bridge(s), adjacent to road
2	5.3	Commuter	Yes	Bicycle bridge(s), adjacent to road, some landscaping
3	5.63	Park-like	Yes	Landscaping, lighting, benches, picnic shelters, residential access, planned connectivity
4	3.1	Park-like	Yes	Landscaping, lighting, benches, picnic shelters, residential access, current connectivity
5	0.95	Park-like	No	Landscaping, lighting, benches, picnic shelters, residential access, current connectivity
6	1.6	Drainage channel	No	Trail-specific lighting
7	8.7	Drainage channel	Yes	Lighting only from nearby structures
8	5.5	Park-like	Yes	Landscaping, lighting, benches, picnic shelters, residential access, current connectivity
9	1.3	Park-like	No	Landscaping, lighting, benches, picnic shelters, residential access, current connectivity
10	3.5	Park-like	Yes	Landscaping, lighting, benches, picnic shelters, residential access, planned connectivity

term effects of the marketing campaign and to compare usage on trails which were altered by adding way-finding and incremental distance signage to usage on control trails which were not altered, using longitudinal data obtained from objective measures of trail use.

Methods

Trail selection

We employed a quasi-experimental design with a comparison group to assess the effect of signage additions on trail use in Southern Nevada. The six trails which received the signage were selected by local jurisdictions because they currently offered or planned to offer connectivity to other trails within or outside of their immediate area. We chose the four comparison trails because they matched the six study trails on length, trail environment, amenities, and neighborhood demographics as closely as possible. Whenever possible we selected a similar trail with current or planned connectivity, but the pool of possible control trails was small, and length and connectivity were limiting factors.

Since the study trails included a commuter trail for cyclists, a trail paralleling a drainage channel in an urban setting, and several park-like suburban trails, the group of control trails included at least one trail of each type (Table 1). The commuter trails paralleled different sections of the same highway, and the drainage channel trails were both located in central neighborhoods of lower SES. The remaining study trails were clustered in the northern and southern suburban areas, so we selected one control trail in each area. The mean length of the 10 trails we studied was 3.96 miles, with a range of 0.95 miles to 8.7 miles. Lighting was present on seven (70%) of the trails, and seven (70%) of the trails featured landscaping to enhance the trail environment. Six (60%) of the trails included both features (Table 1). This study was submitted to UNLV's IRB and deemed excluded.

Data collection

We collected usage data on each trail for three periods of seven days. Data collection periods began at midnight and continued for 168 consecutive hours. Data were collected on each trail by an infrared sensor that was installed near a trail access point. The sensor (Infrared Trail Counter (ITC), TRAFx Research Ltd., Canmore, Alberta, Canada), is triggered when a trail user moves past it, breaking its infra-red beam. It is designed to collect hourly totals of trail traffic and can be used for extended periods of time. We collected pre-intervention data in Fall 2011, mid-intervention data in Spring 2012, and post-intervention data in Fall 2012, during periods with similar weather conditions, Table 2. We consulted local school calendars and avoided placing sensors during holiday periods which might affect trail traffic.

During the week-long monitoring periods, the research team conducted two-hour manual audits at each sensor location. Audits were conducted by one of four members of the research team who were trained to record trail activity manually using a standardized data collection form. We conducted a 2-hour training session on using the audit form, recording groups of users, and noting possible exceptions, i.e. traffic occurring exactly as the audit period ended. The training session was conducted both indoors and in the trail setting with actual trail traffic to establish standards for auditing. The audit form was simple, and after training, inter-rater reliability was perfect (Kappa = 1.00). After collecting the sensors, we then compared the counts collected during the audits to the sensor counts to validate their accuracy.

The ITC sensors are designed to register multiple users only when the infra-red beam is triggered in intervals greater than 1.5 s. This approach prevents multiple counts of a single user, but may underestimate the number of users who pass the sensor in groups. In order to account for this source of potential discrepancies, we noted the presence of groups during manual count periods. If the manual counts and the electronic counts could not be reconciled by considering group traffic, the sensor was placed again for another week and the audit was repeated until the electronic and manual counts corresponded. Recounts were required for less than 5% of our data collection periods. Since some groups may have been counted as individuals, the counts of trail users reported here might represent an underestimation of actual trail usage.

Signage

In the spring and summer of 2012, after the marketing campaign promoting PA and trail use was completed, the Southern Nevada Health District (SNHD) altered the study trails by adding signage, using funds from their Communities Putting Prevention to Work (CPPW) grant. The distance markings were embossed into the surface of the trails at 0.25 mile intervals by a local contractor. Way-finding signs were placed on the trails at major access points, as suggested by the local jurisdictions, and were mounted on square metal posts. Each side of the post was marked with a trail map, the name of the trail, the logo of the responsible jurisdiction, and icons for acceptable and unacceptable uses.

Statistical analysis

We characterized trails using descriptive statistics and calculated the mean number of users per day to compare pre-, mid-, and post-intervention trail traffic. The normality assumption for the usage data was not satisfied ($p < 0.0001$ based on the Shapiro–Wilk test for normality). For this reason, nonparametric tests were used for data analysis. The Friedman test was used for testing the difference in three rounds for the control group and the intervention group. The Wilcoxon signed rank test was then used for testing the difference of pre–post and mid–post usage for the control group and intervention groups. In addition, the Wilcoxon rank sum test, a nonparametric test, was performed to compare the control group and the signage group based on the paired daily differences.

Table 2
Weather conditions in Southern Nevada during study periods, October 2011, April 2012, and October 2012.

Weather characteristic	October 2011	April 2012	October 2012
Mean temperature	71 °F (85 °F max, 58 °F min)	69 °F (85 °F max, 52 °F min)	72 °F (86 °F max, 60 °F min)
Mean precipitation	0.01 in	0.00 in	0.03 in
Mean wind speed	7 mph	10 mph	8 mph

Table 3
Friedman test for overall difference within each study group for Southern Nevada trails included in 2011–2012 usage study.

Study group	Pre-intervention Mean users per day (SE)	Mid-intervention Mean users per day (SE)	Post-intervention Mean users per day (SE)	p-Value
Control trails	112 (13.51)	144 (24.06)	147 (18.45)	0.039
Trails receiving signage	79 (10.28)	141 (12.80)	107 (12.63)	<0.001

Alpha was set at 0.05 to determine significance for all statistical procedures. We conducted our analyses using SAS (version 9.3).

Results

The *p*-values for testing the overall difference in three rounds for each group are less than 0.05, which indicates that the overall difference in per day usage over the study period is significant for both the control group and the intervention group (Table 3). Pre–post trail usage increased by 31% (from 112 to 147 mean users per day) and 35% (from 79 to 107 mean users per day) for the control trails and the trails receiving signage, respectively. Both the control group and the intervention group experienced significant increases ($p < 0.01$) in mean users per day, pre- to post-intervention, based on the Wilcoxon signed rank test (Table 4).

Table 5 isolates the results for the signage change period of the study, and it shows that mid- and post-intervention counts decreased for the intervention group, but not for the control group. We found no significant difference between the groups with $p = 0.3226$ based on the Wilcoxon rank sum test (Table 6).

Discussion

We found that mean daily users increased overall and on most of the individual trails over the study period. The largest increases in trail traffic were observed shortly after the media campaign at the mid-intervention observation point. While both the study group and the control group experienced increases, the group of trails which received the signage changes were not able to maintain these increases over the second 6-month period. Although usage on the study trails remained higher than baseline at follow-up (35%), the increase observed midway through the intervention was more than twice as high (78%). The control trails experienced a smaller increase at the mid-intervention observation (29%), but trail usage was similar post-intervention (31%) and did not decrease over the second 6-month period. Despite these different patterns over the 1-year observation period, the final post-intervention increase in mean users per day was similar.

We used objective measures and a longitudinal study design to assess the effect of a marketing campaign to promote PA and trail use, as well as an intervention adding way-finding and incremental distance signage to selected trails. The study group experienced a decrease in trail usage from mid- to post-intervention, but overall trail usage increased for both the study and control groups, pre- to post-intervention. Future evaluators may want to consider a different approach to determine if incremental distance signage increases trip length. Since we used one sensor on each trail, we were only able to detect the number of users passing that single point. If a user decided to extend his or her trip length because of the signage, that incremental distance was not reflected in our counts. A study design with multiple ITC sensors on each trail may better detect if incremental distance signage affects patterns of trail use. Intercept surveys with trail users, such as the instrument developed by Troped et al. (2009), could also help clarify changes in PA behavior.

This study has several limitations, including the non-random nature of the control trails. When selecting trails for our comparison group, we were limited by the availability of similar local trails, but we attempted to match our study trails on environment, length, amenities, and the demographics of the surrounding neighborhoods. Since the marketing campaign portion of the intervention affected all trails in the study, we were unable to compare these trails to a control group and can only report an ecological association. Also, several issues may have affected the precision of the electronic counters, such as the presence of animals or of trail users walking in groups, but these conditions were present during both pre- and post-data collection periods.

Conclusions

Our data show a one-third increase in trail usage on mixed-use trails in Southern Nevada over the one year period of an intervention to increase trail use. Strengths of the study include the use of direct measures to assess trail usage, the collection of seven days of consecutive data three times at each sensor location, and the full year interval between pre- and post-intervention data collection periods. Although altering trails with way-finding signage and incremental distance markings was not associated with more consistent increases in trail traffic, trail use did increase significantly for all trail types. More evaluation is needed to determine the best approach to increasing trail use.

Conflict of interest statement
The authors declare that there are no conflicts of interest.

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Table 4
Mean users per day, pre- and post-intervention, by study group, for 10 Las Vegas trails included in 2011–2012 usage study.

Study group	Pre-intervention Mean users per day (SE)	Post-intervention Mean users per day (SE)	p-Value
Control trails	112 (13.51)	146.82 (18.45)	<0.01
Trails receiving signage	79.38 (10.28)	106.95 (12.63)	<0.01

Table 5
Mean users per day, mid- and post-intervention, by study group, for 10 Las Vegas trails included in 2011–2012 usage study.

Study group	Mid-intervention Mean users per day (SE)	Post-intervention Mean users per day (SE)	p-Value
Control trails	144 (24.06)	146.82 (18.45)	0.69
Trails receiving signage	141 (12.80)	106.95 (12.63)	<0.01

Table 6
Comparison between the control group and the intervention group based on the Wilcoxon rank sum test.

	Test statistic	*p*-Value
Trails receiving signage VS control trials	0.9892	0.3226

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References

Booth, K., Pinkston, M.M., Carlos Poston, W.W., 2005. Obesity and the built environment. J. Am. Diet. Assoc. 105, S110–S117.

Bunnell, R., O'Neil, D., Soler, R., Payne, R., Giles, W.H., Collins, J., Bauer, U., Communities putting prevention to work program group, 2012. Fifty communities putting prevention to work: accelerating chronic disease prevention through policy, systems and environmental change. J. Community Health 37, 1081–1090.

Centers for Disease Control, Prevention (CDC), 2011. Behavioral Risk Factor Surveillance System Survey Data. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Atlanta, Georgia.

Clark, S., Bungum, T., Meacham, M., Coker, L., 2014. Happy trails: the effect of a media campaign on urban trail use in Southern Nevada. J. Phys. Act. Health (in press).

Evenson, K.R., Herring, A.H., Huston, S.L., 2005. Evaluating change in physical activity with the building of a multi-use trail. Am. J. Prev. Med. 28, 177–185.

Fitzhugh, E.C., Bassett Jr., D.R., Evans, M.F., 2010. Urban trails and physical activity: a natural experiment. Am. J. Prev. Med. 39, 259–262.

Frank, L., Engelke, P., Schmid, T., 2003. Health and Community Design. Island Press, Washington, DC.

Humpel, N., Owen, N., Leslie, E., 2002. Environmental factors associated with adults' participation in physical activity — a review. Am. J. Prev. Med. 22, 188–199.

Merom, D., Bauman, A., Vita, P., Close, G., 2003. An environmental intervention to promote walking and cycling — the impact of a newly constructed rail trail in Western Sydney. Prev. Med. 36, 235–242.

Price, A.E., Reed, J.A., Long, S., Maslow, A.L., Hooker, S.P., 2012. The association of natural elements with physical activity intensity during trail use by older adults. J. Phys. Act. Health 9, 718–723.

Price, A.E., Reed, J.A., Grost, L., Harvey, C., Mantinan, K., 2013. Travel to, and use of, twenty-one Michigan trails. Prev. Med. 56, 234–236.

Starnes, H.A., Troped, P.J., Klenosky, D.B., Doehring, A.M., 2011. Trails and physical activity: a review. J. Phys. Act. Health 8, 1160–1174.

Troped, P.J., Cromley, E.K., Fragala, M.S., Melly, S.J., Hasbrouck, H.H., Gortmaker, S.L., Brownson, R.C., 2006. Development and reliability and validity testing of an audit tool for trail/path characteristics: the Path Environment Audit Tool (PEAT). J. Phys. Act. Health 3, S158–S175.

Troped, P.J., Whitcomb, H.A., Hutto, B., Reed, J.A., Hooker, S.P., 2009. Reliability of a brief intercept survey for trail use behaviors. J. Phys. Act. Health 6, 775–780.