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Effectiveness of a Point-of-Decision Prompt to Encourage Physical Distancing on Greenways and Rail-Trails During the COVID-19 Pandemic

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Abstract

Adherence to public health messaging recommending physical distancing in public outdoor spaces during the early months of the COVID-19 pandemic and strategies to promote physical distancing are currently unknown. This study examined the effectiveness of a point-of-decision prompt to increase physical distancing (maintaining at least 6 ft of distance) on greenways and rail-trails using systematic observation with passive infrared cameras. Results indicate that the intervention did not have a significant effect on interacting groups maintaining physical distance. However, groups maintaining physical distance increased from baseline (72%) to post-intervention (79%) and likelihood of maintaining physical distance at baseline and post-intervention was higher when: passing in the opposite direction compared to passing in the

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same direction; using 12-foot-wide trails compared to 10-foot-wide trails; and only one person was in each group. These results provide important implications for public health and parks and recreation professionals to promote physical distancing on multi-use trails.

Keywords

built environment, coronavirus disease 2019, multi-use trails, physical activity, social distancing

During the early months of the coronavirus disease 2019 (COVID-19) pandemic, state governments across the United States (US) sought to decrease the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that causes COVID-19 by implementing various policies and mandates related to masking, stay-at-home orders, and physical distancing (University of Oxford's Blavatnik School of Government, 2020). Some of these policies placed restrictions on indoor and outdoor settings for physical activity, including the closure of fitness centers, gyms, parks, and trails (Shahidi et al., 2020).

Outdoor spaces have been identified as important places to promote physical activity as well as physical and mental health and social well-being during COVID-19 (Denay et al., 2020; Freeman & Eykelbosh, 2020); however, results from studies on park use during the pandemic have been inconsistent. Alizadehtazi et al. (2020) reported an increase in park usage with greater population density, while Curtis et al. (2022) reported decreased park visits in the US during the early weeks of the pandemic. Another study by Lopez et al. (2021) found that community concerns around physical distancing behaviors and overcrowding had a negative impact on park usage. However, despite closures and restrictions that impact access to outdoor spaces beginning in March 2020, there is some evidence that greenways and rail-trails in the United States have seen an increase in use during this time. According to publicly available data from the Rails-to-Trails Conservancy, weekly trail traffic increased by approximately 56% in 2020 compared to the same week in the previous year (Rails-to-Trails Conservancy). To reduce the risk of transmission of SARS-CoV-2, which causes COVID-19, various strategies have been proposed in outdoor spaces at the individual level such as physical distancing, hand-washing, and quarantining as well as the community level such as carefully managed opening/closure of parks, transportation policies, and limiting certain park services (Combs et al., 2020; Slater et al., 2020).

During the early months of the pandemic, the Centers for Disease Control and Prevention (2020) recommended maintaining at least 6 ft of distance, including while active outdoors, to prevent the spread of COVID-19. States varied widely in terms of requirements to physical distance in outdoor public spaces (University of Oxford's Blavatnik School of Government, 2020). Adherence to physical distancing recommendations in outdoor settings is currently unknown, although one study found that less than half of visitor groups to trails in urban areas maintained 6 ft of distance from other groups (Wynveen et al., 2021) while another found that almost three quarters of group interactions maintained 6 ft of distance (Bias et al., 2021).

Point-of-decision prompts have the potential to promote trail users maintaining at least 6 ft of distance. Such prompts encourage healthy behavior by using signs and motivational messages at a moment when individuals are faced with a choice. This strategy has been successfully employed to encourage stair use over using escalators or elevators as well as walking rather than taking a train between concourses in an airport (Fulton et al., 2017; Soler et al., 2010). Importantly, point-of-decision prompts are a strategy recommended by the Community Preventive Services Task Force (Task Force on Community Preventive Services, 2010). Established in 1996 by the U.S. Department of Health and Human Services, the Community Preventive Services Task Force brings together expertise from various areas of research and practice to develop evidence-based guidance for community health promotion. While many parks and public land managers have installed signage to encourage physical distancing, there is little evidence on the effectiveness. In addition, a potential barrier to maintaining at least 6 ft of distance is knowing what 6 ft looks like on a specific trail. Therefore, a point-of-decision prompt to maintain 6 ft of distance with a visual representation of that span may help trail users visualize the recommended distance to maintain from others.

The purpose of this study was to examine the effectiveness of a point-of-decision prompt intervention to increase the adherence to physical distancing guidelines on greenways and rail-trails. Specifically, this study sought to determine whether the intervention increased the likelihood of maintaining at least 6 ft of distance among trail users.

Materials and Methods

Study Locations

This study was conducted at two multi-use trails: (1) a greenway trail in Boone, North Carolina and (2) a rail-trail in Morgantown and the adjacent community of Star City, in West Virginia. Both trail locations are located within the Appalachian Mountain region and have populations that are predominantly White (93.4% and 87.9%, respectively), and educated (89.2% and 93.6% with at least a high school diploma, respectively).

During the study period, neither North Carolina nor West Virginia had a requirement during this time to physical distance outdoors, however these states differed in terms of indoor mandates with North Carolina being under a governor's executive order until September of 2020 that closed indoor fitness and recreation facilities while by June of 2020 West Virginia had a governor's executive order allowing previously closed indoor fitness and recreation centers to resume limited operations and allowing low-contact outdoor sports (State of North Carolina, 2020; State of West Virginia, 2020). The town of Boone was under a state-of-emergency declaration that imposed multiple restrictions on indoor spaces (including fitness facilities) and physical distancing requirements including maintaining at least 6 ft of distance when outdoors in public spaces (Town of Boone, 2020). Unlike Boone, during this time Morgantown-Star City was under the West Virginia governor's executive order with no additional city-level policies and therefore no physical distancing requirement for public outdoor spaces was in effect in Morgantown-Star City during the study period (Office of the Governor, 2021).

During June to July 2020, reported cases of COVID-19 infection in Watauga County, NC (population 54,086), which includes Boone, averaged 3.1 daily confirmed cases (ranging from 1 to 21 total daily cases) or 1 case per 17,447 residents (North Carolina Department of Health and Human Services, 2021). In Monongalia County, WV (population 105,822), which includes Morgantown-Star City, daily confirmed cases averaged 12.6 or 1 case per 8,399 residents (West Virginia Department of Health & Human Resources, 2021).

Intervention

Once baseline data was collected, a point-of-decision prompt was installed at two points on the greenway in Boone, North Carolina and two points on the Morgantown-Star City-area rail-trail in West Virginia. The prompt was a pavement marking that illustrated what 6 ft of distance looks like on the respective trail. Montana Chalk Spray (Montana-Cans, Heidelberg, Germany) was used for the pavement markings. Figures 1 to 2 illustrate the pavement markings for each site. Pavement markings were individually tailored for Boone and Morgantown-Star City by working with local officials at the public health and parks and recreation departments. For instance, the Morgantown-Star City

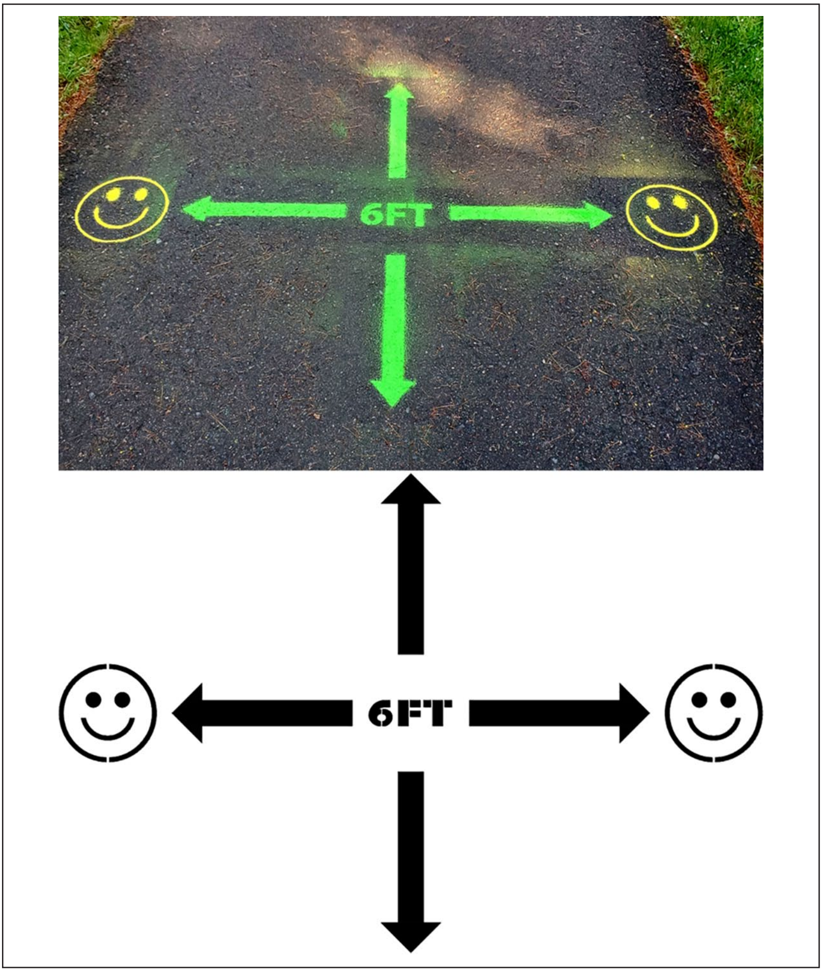

Figure 1. Point-of-decision prompt on greenway in Boone, NC.

pavement marking design was based on a well-known "incident" that occurred the prior year, when a 15-foot python escaped its cage from a driver's vehicle at a gas station near the rail-trail one week before a 600-person half marathon took place (Wilson, 2019). Alternatively, after consultation with the public health and parks and recreation departments in Boone, it was decided that the Boone pavement marking would be more generic. All pavement markings included arrows that showed 6 ft of distance.

Figure 2. Point-of-decision prompt on rail-trail in Morgantown-Star City, WV.

Each of the intervention locations varied slightly. All of the intervention locations on the Boone greenway were asphalt surfaces, though one section was 10-ft wide and the other was 12-ft wide. Both greenway sections had soft surface shoulders that did not drop off from the trail (see Figure 3). One of the sections had a wood, split rail fence on one side of the trail and tall grass with a stream on the other side. Another section had wooded areas on either side of the trail. Both of the Morgantown-Star City-area intervention locations were asphalt, 12-foot-wide trails. However, one location had crushed stone shoulders that dropped off (about 10 ft at 25%, see Figure 4) while the other location had a soft surface shoulder level with the trail on one side and a

Figure 3. Example intervention location in Boone, NC.

wooden, split rail fence on the other side to protect users from a ~40 to 50 foot river bank (see Figure 5).

Data Collection

This study was determined to be exempt from institutional review board oversight by the Institutional Review Boards at Appalachian State University and West Virginia University. The study collected two independent cross-sections of data during June and July 2020. For one week during early June, researchers installed four passive infrared cameras (PICs) in different locations on the greenway trail and four PICs on the rail-trail (Moultrie XV7000i and Moultrie M40i in Boone and Morgantown-Star City, respectively). Two PICs observed 12-foot-wide trails and two PICs observed 10-foot-wide trails on the greenway, while all four PICs observed 12-foot-wide trails on the rail-trail. All trail surfaces were paved. The PICs were set to record short 30 to 90 second videos each time motion was detected, with no time delay in between recorded videos (i.e., once a recorded video was completed, the next detected motion immediately triggered another 30–90 second video

Figure 4. Intervention location in Star City, WV.

Figure 5. Intervention location in Morgantown, WV.

recording). After the initial data collection, the PICs were removed and the point-of-decision pavement marking prompts on each trail were installed. The following week, the PICs were reinstalled in the same locations. For each week of data collection, one weekday and one weekend day of videos were selected to be coded for the hours between 10 a.m. to 8 p.m., when trail use was heaviest. These days were selected to ensure similar weather (cloud cover and precipitation) and temperatures on all days analyzed across the two study locations with partly to mostly cloudy skies, no precipitation, and average daily temperatures ranging from 23°C to 25°C and 20°C to 26°C in Boone and Morgantown-Star City, respectively.

Data Coding

The intervention encouraged distancing between trail users, thus the unit of analysis for coding was an interaction between independent groups on the trail. A coding procedure was developed and a team of 10 coders was trained to ensure that at least 80% agreement was obtained. The coding procedure consisted of viewing each video, verifying whether there was an interaction (users passed by each other) between more than one individual who did not appear to be part of the same group, and then coding the variables of interest using an online Qualtrics survey form. All variables were coded at the point in time of the interaction when separate individuals/groups of trail users were passing each other. If the entirety of an interaction between groups occurred across multiple consecutive videos, then coders watched all of these videos to determine the group size and the point in time when separate groups were closest to each other when passing. Observation coding averaged about 6 minutes per coder at baseline and post. Inter-rater reliability was established at baseline ($\kappa = .67$, $SE = 0$, 95% CL [0.54, 0.80]; Bias et al., 2021).

Variables Coded

Maintained distance of at least 6 ft. The distance between the closest two people in separate groups at the time of the interaction was coded as either less than or at least 6 ft of distance. To account for differences in size and scale of viewing videos on different computer screens, distance was determined on the video by comparing two measurements taken directly on the computer screen using a tape measure. The two measurements were as follows: (1) half of the measured distance of the 12-ft trail width at the point of the subjects' feet in the interaction (60% of the measured distance for 10-ft width trails) and (2) measured distance between the heads of the closest two people in separate groups at the time of the interaction.

Trail width. Each PIC was installed on either a 10-foot-wide trail or a 12-foot-wide trail. Therefore, trail width was determined based on the PIC from which the video was taken.

Group passing direction. The direction of travel of the subjects involved in the interaction was coded as either traveling in the same or opposite direction.

Size of each group. The number of people in each group involved in the interaction was coded, with a minimum group size of one.

Data Analysis

Groups with three or more participants ($n_{baseline}=13$, 0.8%; $n_{post}=9$, 0.8%) were omitted from the analysis to ensure statistical assumptions for logistic models were met, such as the expected cell counts be at least five within a minimum of 80% of the cells. Frequencies and valid percentages were used to describe trail characteristics and user behaviors. A series of logistic regressions were used to determine the likelihood of maintaining at least 6 ft of distance during a trail interaction (the dependent variable). The predictors (independent variables) in the regression analyses were trail width (*12 ft* vs. *10 ft*); passing direction (*opposite* vs. *same*); and size of each group (*1:1* vs. *not 1:1; 1:2* vs. *not 1:2*; and *2:2* vs. *not 2:2*). Time (*post* vs. *baseline*) was included as a statistical interaction effect within each logistic model (Jaccard, 2001). Thus, each model adjusted for the main effect of the predictor, time, and predictor × time (interaction). That is, the association between the trail interaction (maintaining at least 6 ft of distance) and predictor is dependent on the intervention (time). Model fits were determined using the Akaike Information Criteria (AIC) and a re-scaled R^2 (Allison, 2014). Logistic model estimates were reported as odds ratios (OR) and adjusted odds ratios (AOR) with 95% confidence limits (CL) to demonstrate the magnitude of association between study indicators. Statistical significance was determined with an alpha-level set to 0.05 using a two-tailed distribution. SAS 9.4©, Cary, NC (SAS Institute, 2013) was used to perform statistical analyses. As there were no significantly meaningful differences between study locations, data were combined to ensure statistical assumptions were met (see Supplemental Table 1 for statistical comparisons between locations and brief description of findings).

Results

Table 1 provides descriptive frequencies and valid percentages for both waves of data collection. Data coders observed 1,708 (baseline) and 1,128

Table 1. Descriptive Frequencies and Valid Percentages for Variable Characteristics.

	Baseline (n = 1,708)		Post (n = 1,128)	
Indicator	*n*	%	*n*	%
Maintained 6 ft distance				
Yes	1,234	72.3	894	79.3
No	474	27.8	234	20.7
Pass direction				
Opposite	1,366	80.0	898	79.6
Same	342	20.0	230	20.4
Trail width				
12 ft	1,147	67.1	766	67.9
10 ft	561	32.9	362	32.1
1 × 1 interactions				
Yes	687	40.2	461	40.9
No	1,021	59.8	667	59.1
1 × 2 interactions				
Yes	619	36.2	361	32.0
No	1,089	63.8	767	68.0
2 × 2 interactions				
Yes	155	9.1	71	6.3
No	1,553	90.9	1,057	93.7

Note. n = 2,836. n = number of observations; % = total valid percentage.

(post) group interactions from trail camera videos. At baseline and post, most group interactions were observed as maintaining at least 6 ft of physical distance (72% and 79%, respectively), passing in the opposite direction (80% and 80%, respectively), and being on 12-foot-wide trail sections (67% and 68%, respectively). Interactions between single-member groups (1:1) were the most common (40% and 41%, respectively); two people per group (2:2) interactions were observed the least (9% and 6%, respectively).

Table 2 displays the associations between maintaining at least 6 ft of physical distance, study predictors, and baseline versus post. Trail users who passed in the opposite direction were more than twice as likely to maintain 6 ft of physical distance compared to passing in the same direction (AOR = 2.32; 95% CL [1.81, 2.970) at baseline and 1.80 (95% CL [1.29, 2.50]) times as likely at post. Results for trail width suggest trail users were nearly twice as likely to maintain 6 ft of physical distance on the 12-foot-wide versus 10-foot-wide trail at both baseline (AOR = 1.97; 95% CL [1.59, 2.46])

Table 2. Logistic Regression Results of the Unadjusted and Adjusted Odds of Groups Maintaining at Least 6 ft of Distance While Passing on a Greenway or Rail-Trail at Baseline and Post-Intervention ($n = 2{,}836$).

		Baseline ($n = 1{,}708$)		Post ($n = 1{,}128$)		Interaction[a]		
Indicator	*OR*	AOR	95% CL	AOR	95% CL	AOR	PR^2	AIC
Pass direction								
Opposite vs. Same	2.10*	2.32*	[1.81, 2.97]	1.80*	[1.29, 2.50]	0.77	0.04	3,122.58
Trail width								
12 ft vs. 10 ft	1.97*	1.97*	[1.59, 2.46]	1.97*	[1.46, 2.65]	0.99	0.04	3,120.73
1 × 1 trail interactions								
Yes vs. No	4.47*	4.70*	[3.60, 6.10]	4.17*	[2.91, 5.99]	0.89	0.12	2,946.38
1 × 2 trail interactions								
Yes vs. No	0.86	0.93	[0.74, 1.15]	0.80	[0.59, 1.09]	0.87	0.01	3,174.76
2 × 2 trail interactions								
Yes vs. No	0.33*	0.28*	[0.20, 0.40]	0.52*	[0.31, 0.88]	1.84	0.04	3,118.41

Note. *OR* = odds ratio unadjusted for the indicator; AOR = odds ratio adjusted for the indicator and interaction; 95% CL = confidence limits; PR^2 = Pseudo max-rescaled; AIC = Akaike Information Criteria.

[a]Interaction between indicator and time (baseline and post-intervention).

*$p \leq .01$.

and post (AOR = 1.97; 95% CL [1.46, 2.65]). One-to-one group interactions (1:1) were four times as likely as group interactions of other sizes to maintain 6 ft of physical distance at baseline (AOR = 4.70; 95% CL [3.60, 6.10]) and post-intervention (AOR = 4.17; 95% CL [2.91, 5.99]). Comparatively, two-to-two (2:2) group interactions were nearly four times less likely than group interactions of other sizes to maintain 6 ft of physical distance at baseline (AOR = 0.28; 95% CL [0.20, 0.40]) and roughly twice as likely to not maintain 6 ft of physical distance post-intervention (AOR = 0.52; 95% CL [0.31, 0.88]). All logistic model interaction effects returned insignificant results. This suggests the intervention did not have a significant effect on the rate at which groups maintained 6 ft of distance when passing.

Discussion

The results of the study indicate that the point-of-decision prompt intervention did not have a significant effect on trail users maintaining at least 6 ft of distance from others, though the percentage of interactions of groups maintaining at least 6 ft of distance was high at baseline (72%) and increased post-intervention (79%). Furthermore, there was no significant difference found in terms of maintaining at least 6 ft of distance between passing direction, trail width, and group size of the interaction from baseline to post-intervention. At both baseline and post-intervention, interacting groups were more likely to maintain 6 ft of distance when: passing in the opposite direction compared to passing in the same direction; using 12-foot-wide trails compared to 10-foot-wide trails; and only one person was in each group (1:1).

To the authors' knowledge, this is the first study to evaluate the effectiveness of a point-of-decision prompt intervention to promote physical distancing among trail users. Although point-of-decision prompts have been shown by previous research to promote stair use (rather than elevator) and walking (rather than taking a train) in airports (Fulton et al., 2017; Soler et al., 2010; Task Force on Community Preventive Services, 2010), the current study showed no influence on physical distancing among greenway and rail-trail users. Previous research has also found that signage does not promote other desired behaviors on trails such as not walking off-trail (Goh, 2020; Guo et al., 2015). A potential explanation for the current study's result is that stair use and airport walking are inherently different from physical distancing behaviors, with distinct differences in related health outcomes. In terms of point-of-decision prompts for stair use, the health messaging revolves around the primary benefit of getting more physical activity to improve personal health, whereas for physical distancing behaviors the messaging is focused on reducing risk of COVID-19 transmission both for oneself and for others.

Furthermore, the choice to maintain distance while on the trail encouraged by the point-of-decision prompt could be complicated by beliefs about physical distancing guidelines and mandates, the potentially lower likelihood of transmission outdoors versus indoors, and the societal/political divide in regard to the seriousness of the COVID-19 pandemic.

Another consideration is that the potential of point-of-decision prompts to encourage physical distancing on multi-use trails may not be sufficient on their own. In examining COVID-19-related messaging by state parks, Perry et al. (2021) found that while information was more readily available to park visitors during the visit, there was a lack of messaging prior to visitation. This pre-visit information may be important for potential visitors to plan for safe recreation as has been done in Boulder, Colorado through an app identifying open trails and trails designated for one-way traffic (O'Keefe, 2020). According to Perry et al. (2021), pre-visit information goes beyond park visits to include messaging to the greater community to practice recommended health guidelines at all times in order to reduce community infection rates to levels where park operations can return to normal. Therefore, providing pre-visit information along with reinforcing messaging during the visit such as point-of-decision prompts may prove the best strategy.

In the current study, most (over 70%) interactions among groups of trail users occurred in accordance with the recommended 6 ft of distance at baseline and post-intervention, indicating that prior to implementing the intervention most trail users were practicing physical distancing. This could be due to the fact that during the entire study period physical distancing guidelines were provided at the federal level and mandates were in effect in the locations (Centers for Disease Control and Prevention, 2020; Office of the Governor, 2021; Town of Boone, 2020), thus creating a cultural environment around the importance of physical distancing. This is evident with policy interventions such as placing taxes on the purchase of tobacco products and alcohol as well as indoor smoking bans that have been shown to be highly effective in reducing morbidity and mortality related to these substances compared to other types of interventions such as mass media campaigns (Chisholm et al., 2006). Therefore, implementing point-of-decision prompts alone may not have promoted physical distancing on multi-use trails beyond the effect of policies, guidelines, and mandates. There is also a possibility that individuals naturally distance when passing on trails, regardless of a global pandemic. However, given that no data exists prior to the COVID-19 pandemic for these study sites regarding physical distance among trail users, this is difficult to assess.

Although the results of the current study indicated that most interactions between trail users maintained physical distance, Wynveen et al. (2021) reported that less than half of trail users maintained 6 ft of distance on urban trails in six US states with similar guidelines and recommendations. Differences in study locations, timing of data collection, and observational methods could account for these conflicting results. For instance, Wynveen et al. (2021) conducted on-site in-person observations of mixed-surface trails (paved and natural surface) of various widths (from 4 to 15 ft wide) in large urban metropolitan cities between March and June whereas the current study conducted observations utilizing PICs on paved trails (from 10 to 12 ft wide) in less urban areas during June and July. Differences in recreational behavior change among urban and rural areas due to the COVID-19 pandemic could also contribute. As Rice et al. (2020) report, urban residents may have disproportionately altered recreational behaviors in terms of greater reductions in participation and changes to the types of outdoor places visited.

As indicated by previous research, multi-use trails such as greenways and rail-trails may be practical places for physical activity that allow for physical distancing with some considerations (Bias et al., 2021). Given that maintaining at least 6 ft of distance was more likely on wider trail segments (12-ft vs. 10-ft), park and recreation land managers should consider the width of multi-use trails when constructing new trails or renovating existing trails. Planning and renovating the built environment to allow for physical distancing has been proposed to plan for future pandemics (Salama, 2020). More research is needed to determine whether trails wider than 12-ft and trails with more edge buffer space (i.e., area immediately on the sides of the trail) further promote physical distancing. As groups of trail users larger than one person passing when traveling in the same direction were the least likely to maintain 6 ft of distance, another consideration is to develop messaging around limiting group size and taking precaution when passing others to pass single file (Bias et al., 2021).

Limitations

Several limitations to the current study need to be addressed. First, as this study was only conducted on two multi-use trails within two states, physical distancing behaviors and strategies to promote these behaviors may be different in other areas. The contexts of current mandates, guidelines, and recommendations that are in place must be considered because other research has shown varied results due to differences in local policies (Curtis et al., 2022). Specifically, Curtis et al. (2022) reported that park visitation rates varied with local policies related to physical distancing. Second, during the coding process this study made the assumption that trail users that appeared to be on the trail together were from the same household and therefore physical distancing between these individuals was not necessary. However, it is possible that individuals from more than one household could have been on the trail together, appearing as a single group, and this could have introduced error in the results. Third, the single-group pre-post intervention design did not permit analysis of intervention effects against a control group. Lastly, given that there is little to no data on the distancing behaviors between trail users prior to the start of the COVID-19 pandemic, it is difficult to determine the unique influence of individual strategies to promote physical distancing such as mandates, guidelines, and point-of-decision prompts.

Conclusions

Multi-use trails such as greenways and rail-trails may be places for physical activity where physical distancing guidelines can be met. While this study indicates that point-of-decision prompt interventions to maintain 6 ft of distance alone may not increase physical distancing behaviors on multi-use trails such as greenways and rail-trails beyond the effect of policies and guidelines, more research is needed to ascertain whether timing of other messages and strategies may be more effective. Specifically, messaging related to limiting group size and taking particular care when passing others traveling in the same direction may be more impactful (such as "pass single file"). More research is also needed to determine the potential influence that trail usage and characteristics of trail users (e.g., volume of usage, types of activities, etc.) might have on physical distancing behaviors. Furthermore, during construction or renovation of multi-use trails, trail width should be considered to allow space for physical distancing during the current COVID-19 pandemic and for future pandemics.

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Supplemental Material

Supplemental material for this article is available online.

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