Randomized Informational Intervention and Adult Park Use and Park-Based Physical Activity in Low-Income, Racially Diverse Urban Neighborhoods

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Background: Neighborhood parks are important locations to encourage and stimulate physical activity (PA) among the urban population. This study aims to evaluate the impact of an informational intervention on adult park use and PA behaviors in 3 low-income, racially diverse urban neighborhoods in Minneapolis, MN. **Method:** The study employed a household-level randomized controlled trial and collected baseline and follow-up data from 171 participants. Within each neighborhood, participants were randomized to an informational intervention or to a no-intervention comparison. Intervention households received monthly, neighborhood-specific newsletters about park-based PA opportunities, park program brochures, trail maps, and activity guides. **Results:** The average treatment effect of the newsletter intervention was positive yet moderated by respondent age. For a 20-year-old resident, treatment was associated with 0.97 ($P < .05$) additional park visits and 31.24 ($P < .05$) additional minutes of park-based PA over a 3-day recall period. For 40-year-old respondents, these positive effects are smaller at 0.36 ($P < .05$) additional visits and 4.66 ($P < .05$) additional minutes, respectively. **Conclusions:** An intervention to increase awareness about park-based PA opportunities and benefits increased self-reported park visits and in-park PA among adults who lived in low-income, racially diverse neighborhoods.

Keywords: intervention study, built environment, municipal parks, outdoor space, active recreation

Parks can improve local population health in urban neighborhoods by providing outdoor physical activity (PA) opportunities.^{1,2} PA has direct physical and mental health benefits and is associated with a reduced risk of many chronic diseases.³⁻⁵ In addition, parks can potentially improve public health through biological stress reduction mechanisms and the enhancement of social interactions.⁶⁻⁸ Given the multiple health benefits, parks can be useful when addressing health disparities. First, parks are often a community's "living room," and therefore may be a promising place to penetrate for community-wide behavior changes in poor, under-resourced communities.^{9,10} Second, public parks and recreation services can provide free or low-cost PA facilities and programs at the community level that can be broadly accessible to low-income residents, potentially reducing disparities in PA and health outcomes.¹¹⁻¹³ However, evidence suggests that parks are often underutilized in low-income neighborhoods.¹⁴⁻¹⁶ This points to the untapped potential of parks and park programs and services to better address health disparities in low-income, racially diverse communities.

Adult park use behavior is often dependent on people's information levels and awareness of park services. Municipalities could promote and encourage healthy park use by increasing awareness about the benefits of park-based PA and by publicizing convenient PA opportunities.^{17,18} However, although increasing research has been conducted to investigate how interventions of adding park PA amenities (eg, PA equipment) and adding PA programs in parks (eg, park-based fitness classes) may affect park use and park-based PA,^{15,19} there is limited research on the impacts of informational and

outreach intervention programs on promoting park use and park-based PA. Among the few studies that included an informational intervention component, Bush et al²⁰ used a randomized controlled trial (RCT) design and found that a park-based physical fitness and nutrition education improved PA performance and nutrition knowledge in overweight minority children. Cohen et al¹⁷ used a RCT design and found that park-based marketing and outreach efforts increased park-based PA behavior in 50 racially diverse neighborhoods in Los Angeles. It is worth noting that the actual formats of the marketing and outreach efforts in Cohen et al¹⁷ were determined by park directors and/or park advisory boards rather than the researchers. Three types of marketing and outreach efforts were evaluated, including (1) signage to improve the park image (eg, banners, bulletin boards, floor mats, staff shirts, and table covers); (2) promotional incentives like water bottles, bags, or park-branded key chains or individually targeted email communications; and (3) outreach and support for group activities. Among the 3 types, signage was found to be most effective to promote park-based PA.

This study contributes to the limited literature on the effects of informational interventions on park-based adult PA behavior by using a RCT featuring a newsletter campaign in 3 low-income, racially diverse neighborhoods in Minneapolis, MN. Specifically, we examine how a series of informational newsletters advertising already existing park amenities, features, and services affected individual survey respondents' park visitation frequency and amount of park-based PA.

Methods

Study Setting

Figure 1 shows the location of the 3 study neighborhoods in Minneapolis, MN, which are home to a diverse array of park services. The Harrison neighborhood includes a portion of the

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759-acre Theodore Wirth Park (which is Minneapolis's largest regional park) and the 6.9-acre Harrison Park. The Powderhorn neighborhood contains the 65.88-acre Powderhorn Park. The Phillips neighborhood contains several small parks including the 6.46-acre East Phillips Park and the 6.27-acre Stewart Park. Despite the differences in park size, due to the long-term efforts by the Minneapolis Park and Recreation Board (MPRB) to increase equity in parks and recreation services, the 3 study neighborhoods have access to similar amenities including community centers, baseball fields, basketball courts, soccer fields, softball fields,

tennis courts, picnic areas, playgrounds, wading pools, walking paths, and restrooms. The Theodore Wirth Park, being a regional park, also includes hiking and biking paths, a golf course, and numerous winter activities such as sledding/tubing, snowboarding, snowshoeing, and cross-country skiing.

The study neighborhoods offer opportunities to examine park use behavior in low-income, racially diverse urban settings (Table 1). As shown in Table 1, the proportion of white residents in the 3 neighborhoods is significantly lower when compared with Minneapolis as a whole. Phillips and Powderhorn have a larger

Figure 1 — Study neighborhoods.

Table 1 Demographics (Census, 2010) and Income Estimates (American Community Survey, 2009) of Study Neighborhoods

Demographic variables	Minneapolis	Phillips	Powderhorn	Harrison
Race/ethnicity, %				
White	70	29	55	32
Black or African American	16	29	15	40
American Indian and Alaska Native	2	13	3	2
Asian	5	3	2	17
Native Hawaiian/other Pacific Islander	0	0	0	0
Some other race	5	21	18	4
Two or more races	3	6	6	5
Hispanic	9	33	26	8
Gender, %				
Male	50	52	50	50
Income, %				
Less than \$10,000	11	23	8	17
\$10,000 to \$24,999	18	21	22	21
\$25,000 to \$49,999	25	26	26	40
\$50,000 to \$74,999	18	17	24	10
\$75,000 to \$99,999	11	8	10	4
\$100,000 or more	18	5	10	9

proportion of Hispanic residents; and Harrison has larger proportion of black and Asian residents compared with Minneapolis. Phillips also has a significantly larger proportion of American Indian residents compared with rest of the city. Additionally, all 3 neighborhoods have slightly higher proportions of low-income (under \$25,000) residents than the whole city.

Experimental Design

Between September and November 2010, the MPRB conducted a Survey of Parks, Leisure-time Activity, and Self-reported Health (SPLASH) of 433 households across the 3 neighborhoods. Survey households were determined by randomly selecting Census blocks within each neighborhood and attempting to reach all residents on a given block. The 2010 SPLASH served as the baseline data, which gathered data on a single adult from each household about respondent demographics, perceptions of park services, and recalled park visit frequency and park-based PA duration over the previous 3 days. Park visit frequency was captured by a count of total visits to a park over the 3-day recall period, and park-based PA was captured by the total minutes spent engaging in PA at a public park during the 3-day recall period.

Of the 433 households, 6 households had incomplete home address information recorded in the baseline data and were excluded from randomization in the follow-up intervention study in 2011. The remaining 427 households were randomized so that 50% of them (214/427) were expected to receive treatment in the form of informational newsletters and promotional materials about nearby parks and the health benefits of park use between May and August 2011. However, due to high neighborhood turnover rates and the need to find the same persons in the baseline survey to participate in the follow-up, the research team was only able to confirm 91 adults out of the 214 intervention home addresses who had participated in the baseline survey, resulting in a 57% loss to follow-up. Of the 213 control home addresses, the research team was only able to confirm 80 adults who had participated in the baseline survey, resulting in a 62% loss to follow-up. The high loss to follow-up could be a combination of high turnover rates in low-income neighborhoods and the limited home visits (up to 3 due to funding constraints) that the research team made to track down the persons who participated in the baseline survey. It is possible that the loss to follow-up would have been smaller if the research team had made more home visits. See [Supplemental Material](#) (available online) for a Consolidated Standards of Reporting Trials (CONSORT) flow diagram illustrating the randomization and follow-up process.

Each confirmed adult in the treatment group ($n = 91$) received 4 monthly informational and promotional packets over the course of the summer between May and August 2011. The information packets were hand delivered by student researchers to each home monthly. For the first information packet, the student researchers were required to have a face-to-face conversation. The remaining 3 packets were either delivered to the respondent in person or left at their home depending on their availability at the time of delivery.

In October and November 2011, the follow-up survey of the confirmed adults in both treatment ($n = 91$) and control groups ($n = 80$) was administered. Due to the large loss to follow-up, we compared baseline outcomes between the study sample (confirmed treatment and control groups) and the group lost to follow-up. We find no statistically significant differences, as shown in Table 2. We also checked for differences in sociodemographic composition. The comparison shows relatively similar gender and race distributions between the treatment and control groups. However, age distribution shows significant differences. As a result, we limit our analysis to respondents aged 18–70 years at the time of follow-up because 4 respondents aged 70 years and older were in the control group, but the highest age of the treatment group was 66 years. Thus, the final study group included the 167 individuals surveyed both years who were between the ages of 18 and 70 during the treatment year.

The Newsletter Intervention Program

The team created a total 4 newsletters that were distributed monthly. All 4 newsletters, while tailored to each neighborhood, were standardized in terms of the broader contents. The contents of each newsletter were based on research conducted on similar interventions, project team meetings, and input from MPRB staff in charge of day-to-day operation of the parks and community centers in the study neighborhoods. Contents of newsletters included locations of parks and trails in each neighborhood, list of amenities available, programs offered at parks, special events, links to helpful pages on the MPRB website, and fun facts about the Minneapolis park system. Figure 2 shows one of the newsletters used for the intervention.

The treatment was designed to generate interest in neighborhood park services and encourage participants to use park services more frequently. Information was targeted at the neighborhood level to reduce problems associated with overly general mass media style campaigns. For instance, newsletters featured upcoming events held in nearby parks and programs at nearby recreational centers. Sections on the bottom right corner of Figure 2 display these features for a newsletter passed out to Powderhorn neighborhood study participants. The tailored focus of each newsletter emphasized nearby amenities and programming based on each participant's neighborhood ensuring that treatment reflected the differences between each neighborhood's parks. Furthermore, the contents of the newsletter targeted the adult population in general. There were no adult population sub-segments (eg, women, older adults, or other groups) that were specifically targeted. We hypothesized that treatment group membership was associated with increases in self-reported park visitation and park-based PA, compared with the control group. In this context, park visitation represents the extensive margin of park use, while park-based PA represents an intensive margin of park use that has direct health effects. Note that the measurement of park visitation and park-based PA behavior was about people's park use in general and not specific to the respondents' neighborhood parks.

Table 2 Differences in Baseline Outcome—Study Sample Versus Lost to Follow-Up

Variable	Mean (study sample) $n = 171$	Mean (lost to follow-up) $n = 262$	Difference	SE
Total 3-day recall park visits (visits)	1.287	1.187	0.010	0.150
Total 3-day recall physical activity (minutes)	65.409	70.542	−5.133	9.481

SPLASH Issue 2
June 2011

Survey of Parks, Leisure-time Activity, and Self-reported Health (SPLASH)

Lets work together to create more active and healthier communities!

Add to your health and wealth
2 easy ways to make money while having fun

\$100 postcard drawing program
Directions:
- Fill out the postcard included in the packet
- Answer all questions*
- Fill out your address, phone number and email so we can contact you if you win
- Drop into a mailbox
*Incomplete postcards will not be eligible to win \$100

Drop n Win \$50 drawing Program
Directions:
- Make two separate visits to the Stewart or East Phillips recreation center in the next three weeks
- Find the SPLASH drop-off box at the front desk
- Fill out a Drop n Win coupon included in the packet
- Drop the filled coupon into the drop-off box*
*To be eligible for the drawing both coupons need to be dropped into the drop-off box.

IT'S that simple!
Makes sure to complete the programs before the following dates
Drawing 1 Friday, 17th June 2011
Drawing 2 Friday, 24th June 2011
Drawing 3 Friday, 22nd July 2011
Drawing 4 Friday, 19th Aug 2011

Don't forget to get out and have fun at parks and trails in your neighborhood
• Play baseball, football, basketball, soccer or softball
• Take a walk, run or bike on trails
• Take children to the playgrounds and wading pools
• Attend programs at Recreation Centers
• Have a picnic and relax in natural areas

Places to access the Greenway in your neighborhood
⇒ Nicollet Avenue
⇒ 5th Avenue
⇒ Park Avenue
⇒ Midtown Exchange
⇒ 13th Avenue
⇒ Bloomington Avenue
⇒ 18th Avenue
⇒ 28th Street
⇒ Hiawatha Avenue

Midtown Greenway
The 5.6-mile Midtown Greenway connects the Mississippi River to the Chain of the Lakes giving you a chance to bike, run or walk 24 hours a day, 7 days a week, 365 days a year.

HELPFUL MPRB LINKS
MPRB Program Guide
http://www.minneapolis-parks.org/documents/parks/2011_Summer_Guide.pdf
Minneapolis Park System Map
http://www.minneapolis-parks.org/documents/parks/system_map.pdf
Grand Rounds Scenic Byway Districts Map
<http://www.minneapolis-parks.org/grandrounds/home.htm>
Activenet (Online program registration)
<http://activenet18.active.com/minneapolis-parks/>

DID YOU KNOW?
In the 2010 SPLASH survey respondents from Phillips identified nature and the environment, health and fitness, sports, water recreation, and language and culture as the five most important programs offered by the MPRB.

Together, you have chances to win up to \$600. Your chances of winning are very high because only 100 households are selected to participate in each of the programs.

For more information contact us at splash@umn.edu ph:612-626-9861

SPLASH Issue 2
Survey of Parks, Leisure-time Activity, and Self-reported Health (SPLASH)

Where can you have fun in your community?

East Phillips Park Cultural/Comm. Cen
2307 17th Ave. S
Ph: 612-370-4888
Summer Hours (Memorial-Labor Day)
Mon-Thur 12-9 pm
Fri 12-6 pm
Sat 11 am-6 pm
Sun 12-4 pm

Stewart Recreation Center
2700 12th Ave. S
Ph: 612-370-4932
Summer Hours (Memorial-Labor Day)
Mon-Thur 12-9 pm
Fri 12-6 pm

DID YOU KNOW?
The Minneapolis Park and Recreation Board has:
• 22 Seasonal programming sites
• 8,000+ programs annually
• 1.8 million annual program participants
• 32,000 Adult Sports League participants
• 10,000 Citywide Youth Sports League participants

Programs you can enjoy at the East Phillips Cultural and Community Center

For Adults (Over 18)
• Adult Yoga: Each Tuesday from 6:30 to 7:30pm
June 28 to August 16
• Activity Fee - Resident: \$35, Non-Resident: \$52.50

Youth (Under 18)
• Fundamental Baseball: Each Thursday and Saturday from 6 to 7:30pm
June 23 to August 20
• Activity Fee - \$5

Youth 9 - 17
• Track and Field: Each Tuesday, Thursday and Saturday from 5:30 to 8pm
May 19 to July 14
• Activity Fee - \$10

Children 8 - 12
• Kids Game Day: Each Tuesday and Thursday from 3 to 5pm
June 21 to August 18
• Activity Fee - Free

Free community events at Stewart Park this month
Outdoor Movie Night
6/15 Stewart Park (At sundown)
Despicable Me

For more information contact us at splash@umn.edu ph:612-626-9861

Figure 2 — Interventional newsletter example.

The following language was used when asking about park-based PA duration in the past 3 days: "How many minutes did you spend on moderate physical activity, vigorous physical activity, and muscle strengthening activity on DAY 1/2/3 at parks and trails, including recreation centers or exercise rooms in parks?" The consent process, newsletter intervention program, and survey instruments were approved by the Human Subjects Committee at the University of Minnesota Institutional Review Board on August 19, 2010.

Study Variables

Table 3 shows descriptive statistics of the variables used in our study between the treatment and control groups. The dates associated with each participant's 3-day recall period were used to derive objective weather information of these dates, using data from the Minneapolis-St. Paul International Airport Weather Station daily records, which is publicly available at the National Climatic Data Center. Because there were slight differences in the 2 groups' demographic compositions, 3-day recall period weather, and average life circumstances, as illustrated in the 2 panels of covariates included in Table 3, it was necessary to control for such factors in regression models. Additionally, 2010 baseline outcomes between the 2 groups were different, necessitating their inclusion as control variables to avoid treatment effect estimate bias associated

with regression to the mean.²¹ The number of observations is occasionally inconsistent between variables because unanswered SPLASH questions were dropped for the nonresponsive participant.

Statistical Analysis

Given the hypotheses above, we compared outcomes between 2010 and 2011 for 2 dependent variables. To assess the effect of the SPLASH behavioral intervention on park visits and park-based PA, we regress 2010–2011 change scores for both dependent variables on a binary variable indicating treatment group membership and several control variables. Using change scores accounts for each respondent's baseline values and allows the data to fit a more normal distribution. At the recommendation of Vickers and Altman²² and Twisk et al.,²¹ we control for regression to the mean by including 2010 baseline outcomes as a control variable. As Twisk et al.²¹ point out, this approach is analogous to analysis of covariance, with covariate coefficients capturing correlations between the covariate and the posttreatment outcome, as opposed to the change score. However, in our context, the use of change scores reduces the need to use nonlinear specifications because specifying change scores as dependent variables helps hold the ordinary least squares normality assumption and allows for more consistent estimation.

Table 3 Summary Statistics of Relevant Variables

Variable	Treatment group					Control group				
	n	Mean	SD	Minimum	Maximum	n	Mean	SD	Minimum	Maximum
Dependent variables										
Change score in 3-day recall park visits (visits)	91	0.47	1.76	-4	6	76	-0.12	2.07	-6	6
Change score in 3-day recall park-based PA (minutes)	91	-2.91	84	-240	210	75	-19.07	108.58	-360	312
2010 baseline values										
3-day park visits at baseline (visits)	91	0.96	1.28	0	6	76	1.68	1.63	0	6
3-day park-based PA at baseline (minutes)	91	51.32	70.03	0	300	76	80.99	93.85	0	510
Continuous covariates										
Distance to nearest park (miles)	91	0.25	0.1	0.05	0.49	75	0.23	0.09	0.06	0.51
Respondent age	91	39.77	12.18	18	66	76	41.13	13.70	18	68
Δ Days precipitation >0: 2011–2010 change in number of days during 3-d recall period with nonzero precipitation	90	0	0.62	-1	1	76	0.13	0.68	-1	1
Δ Days temperature >65: 2011–2010 change in number of days during 3-d recall period with average temperature over 65°F	90	-0.12	0.86	-1	1	76	0.01	0.84	-1	1
Binary covariates										
-Child: Decreased child presence (aged less than 18 y) in the household at follow-up	n	%				n	%			
	91	16				76	3			
+Child: Increased child presence (aged less than 18 y) in the household at follow-up	91	13				76	9			
-Health: General health declined at follow-up	91	12				75	15			
+Health: General health improved at follow-up	91	37				75	32			
-Auto: Lost automobile at follow-up	89	22				73	12			
+Auto: Added automobile(s) at follow-up	89	22				73	8			
Harrison resident	91	23				76	21			
Phillips resident	91	35				76	26			
Powderhorn resident	91	42				76	53			
Female	91	69				76	62			
Black	91	14				76	11			
Hispanic	91	9				76	5			
Foreign born	91	16				76	16			

While the inclusion of additional controls is not essential to analyze data from RCTs, it allows for more nuanced analysis, especially when treatment might interact with individual participant characteristics.²³ Thus, we include several control covariates in both models. First, we control for the effect of other potential phenomena that could alter park use behavior such as changes in auto ownership, changes in the number of children aged less than 18 years living in a respondent's household, and changes in a respondent's self-reported general health. Each of these effects is incorporated into regression models using 2 binary variables, one representing an increase in the relevant measure and the other representing a decrease. To capture unobservable circumstantial changes associated with a respondents' neighborhood, we include binary variables capturing a participant's neighborhood. Additionally, the timing of each survey could affect 3-day recall scores because of local weather conditions during the previous 3-day time span before SPLASH administration. Thus, we control for 2011–2010 changes in the number of 3-day recall days with nonzero precipitation and with average temperatures over 65°F.

Finally, to capture the effect of differences in composition between the treatment and control groups, we include several demographic binary variables, as well the distance of each respondent's home from the nearest park. In this vector of covariates, we include respondent age and an interaction term between the treatment binary variable and respondent age. This interaction term captures the heterogeneous effect of the behavioral intervention on individuals of different ages. Figure 3 below shows interaction in the data between age and treatment for both dependent variables, necessitating the inclusion of an interaction term to fully statistically estimate a treatment effect.

Thus, our final models are estimated according to the below equation. Each model uses heteroskedasticity consistent standard errors to ensure robustness. Huber–White standard errors were used instead of cluster-robust estimators because the number of clusters (3 neighborhoods) was too small, because randomization occurred within neighborhoods, and because within-neighborhood intraclass correlation was low. Specifically, intraclass correlation was estimated less than 10% of total variation for change scores in park visits and near 0% of the variation in change scores in park-based

PA. All statistical analysis was conducted using Stata SE (version 16.0, manufactured by StataCorp in College Station, TX) in 2019.

$$\Delta \text{Outcome}_{2011-2010} = \beta_0 + \beta_1 \text{treatment} + \beta_2 \text{treatment} \times \text{age} \\ + \beta_3 \text{baseline}_{2010} + \beta_4 \text{age} + \gamma \text{controls} + \varepsilon.$$

Results

Table 4 displays results of the 2 main ordinary least squares models estimating the treatment effect on change scores of 3-day recall park visits and park-based PA. Both models control for baseline 2010 outcomes, year-to-year circumstantial effects, and demographics. We also report coefficients in year-to-year differences in average precipitation and temperature during the 3-day recall period for park visits and park-based PA. The sample sizes differ slightly between both models because not all respondents answered all questions, and respondents with blank responses were dropped from analysis.

The average treatment effect is statistically significant at 95% confidence for both models, controlling for a full set of covariates. Additionally, the interaction between respondent age and treatment is associated negatively with change scores and is statistically significant at 90% confidence. Phillips residents experienced lower increases in year-to-year 3-day recall park visits and PA than residents in Powderhorn and Harrison, perhaps reflecting the Phillips neighborhood's lack of one single large park with a wide range of amenities in the same park. Additionally, East Phillips Park underwent construction during the study period, likely limiting public use and drawing fewer neighborhood visits. Respondents who reported declines in general health also saw less pronounced increases in park visits and park-based PA durations. Hispanic respondents also reported lower outcomes compared with non-Hispanic participants. This finding may be due to Hispanics being less sensitive to an informational intervention that was delivered in English only. However, this finding merits further research given the limited number of Hispanic participants in the sample. Our sample included a total of 12 Hispanic participants, including 8 in the intervention group and 4 in the control group.

Figure 3 — Scatter plots and fitted lines—interaction of age and treatment. Note that the relatively flat line in the figures above represents the treated group and the slightly upward line in the figures represents the control group.

Table 4 Results From Regressions of Park Use Outcomes on Treatment and Covariates

Dependent variable	1: OLS		2: OLS	
	Change score in 3-day recall park visits (total visits)		Change score in 3-day recall park-based PA (minutes)	
	Coefficient	P value	Coefficient	P value
Treatment/baseline effects				
Treatment	1.592**	.031	57.82**	.09
Age × treatment	−0.0308*	.085	−1.329*	.093
2010 baseline	−0.646***	0	−0.774***	0
Circumstantial/neighborhood effects				
−Child	0.270	.492	12.77	.517
+Child	−0.277	.385	−12.00	.309
−Health	−0.866***	.005	−44.93***	0
+Health	−0.0157	.955	−16.81	.135
−Auto	0.286	.454	−2.776	.872
+Auto	0.123	.684	−1.597	.906
Δ Precipitation days	0.149	.426	5.152	.533
Δ Warm temperature days	0.0211	.885	3.576	.574
Harrison	0.530	.181	−9.870	.489
Phillips	−0.777***	.009	−27.62*	.059
Demographics				
Age	0.0168	.209	0.900	.113
Distance to nearest park	−1.868	.134	−114.4**	.018
Female	0.146	.563	4.268	.718
Black	−0.179	.656	9.443	.616
Hispanic	−1.347***	.001	−48.90***	.009
Foreign born	0.376	.237	21.68	.178
Constant	0.712	.352	46.17	.139
Summary				
Observations	159		158	
R-squared	.461		.569	
Neighborhood ICC	.08359		0	

Abbreviations: ICC, intraclass correlation; OLS, ordinary least squares; PA, physical activity. Note: Robust SEs used to determine statistical significance. Neighborhood ICC was statistically insignificant at 95% confidence for both dependent values. Coefficients with $P < .1$ are given in bold.

***Significance at 99% confidence, **at 95%, and *at 90%.

Future research may oversample racial and ethnic minorities to further investigate whether informational interventions would be less effective among some racial and ethnic minorities than others, and whether multilingual interventions could improve outcomes across racial and ethnic minorities.

The heterogeneity of treatment effect by age is notable and statistically significant at 90% confidence. Table 5 provides average treatment effect estimates by age, calculated by subtracting the coefficient on age × treatment from the coefficient on treatment. Increasing respondent age moderates the effect of treatment such that, by age 50 years, treatment is associated with reductions in 3-day recall park visits and park-based PA.

Discussion and Conclusions

This research contributes to the limited literature on the impacts of individual-level informational interventions on park use and park-based PA behaviors. Because this study finds that informational interventions can successfully induce positive park-related health outcomes, its findings align with the conclusions of Cohen et al,¹⁷

Table 5 Average Effect of Informational Intervention by Age

Age	1: OLS	2: OLS
	Change score in 3-day recall park visits (total visits)	Change score in 3-day recall park-based PA (minutes)
20	0.976	31.24
30	0.668	17.95
40	0.36	4.66
50	0.052	−8.63
60	−0.256	−21.92

Abbreviations: OLS, ordinary least squares; PA, physical activity.

Cavill and Bauman,¹⁸ and Bush et al.²⁰ Furthermore, this study additionally shows that tailoring messaging at a highly localized level can increase park use and at-park PA. Additionally, it helps explain why parks are often underutilized places for PA.⁹

This study also provides the first evidence in the literature that age plays a significant role in moderating the impacts of informational interventions targeting the promotion of park use and park-based PA. The newsletter campaign was found to be more effective among younger adults than among older adults. It is possible that older residents may have long-established PA and park use habits such that the informational intervention less effectively altered their behavior. In addition, our sample size is small and the interactive effect of age and treatment is only significant at the 90% confidence level. The finding on the interaction effect may not be generalizable to other study settings. Future research is recommended to use larger samples across multiple cities to examine the generalizability of the interactive effect of age and treatment. In addition, correlates of age such as years of residency and time-use variables could explain the effect and allow for more acute policy interventions such as better tailored information and outreach methods based on these potentially age-confounding factors. Regardless, this finding underscores the importance of conducting population-specific examinations, which will provide more accurate and comprehensive understanding of the park-based behavior intervention effects across population groups.

The distance between a participant's household and the nearest park only affected results for 3-day recall park-based PA, but not park visits. A closer examination of this effect in future studies may allow for more tailored interventions. It is possible that people who live farther from parks engage in PA in the process of traveling to parks and thus use parks for other leisure purposes. It is also possible that parks may be less attractive PA locations when other PA locations are closer in proximity to one's place of residence.

This study has several major limitations. First, the large loss to follow-up—57% in the treatment group and 62% in the control group—introduces concerns about the validity of the study findings. Although we made efforts to remove and control for the heterogeneity in sociodemographic composition between the treatment and control groups (eg, the removal of 4 adults aged 70 y and older in the control group and controlling for age, gender, and race), the efforts may not be sufficient to avoid bias. It is possible that people who lost to follow-up were less connected to their neighborhoods and less likely to have visited parks as a result of the intervention. The observed positive effects of the information intervention may be overestimated due to possible selection bias. Second, 3-day recall park visits and park-based PA are relatively volatile metrics of general park use. Although the inclusion of weather controls helps to improve the reliability of 3-day recall estimates, there may be other omitted variables that affect the reliability of the 3-day recall measures. Third, our final study sample—while demographically diverse—is disproportionately female and white. The percentage of black participants in the final sample was 14 in the treatment group and 11 in control group, which was significantly lower than the percentage of black residents in the study neighborhoods (shown as 15%–40% in Table 1). The underrepresentation of residents of color in the final sample is a weakness of the study. Future research should examine the gap in outcomes associated with Hispanic participants and identify potential explanations. It is possible that multilingual information interventions are necessary to ensure effective interventions across race and ethnic minorities. Future research should also oversample racial and ethnic minorities to ensure the generalizability of the findings associated with minority population groups. Additionally, while limiting the study to the Phillips, Powderhorn, and Harrison neighborhoods provides important insight into how residents of economically diverse park-rich neighborhoods respond

to informational behavioral intervention, a study conducted across an entire city could identify more heterogeneous affects across neighborhoods. For instance, research could examine how residents of different socioeconomic status may respond to similar informational interventions in neighborhoods with different park resources. Additionally, effects could be interacted with measures of park quality. It is possible that such interventions may be less successful if park quality is low. Furthermore, the 3 study neighborhoods all have ample park infrastructure. Further research can and should be conducted to investigate the effectiveness of informational interventions on park use and park-based PA across urban neighborhoods with different levels of park accessibility. Finally, the paper-based delivery mechanism of the informational intervention may be outdated and labor intensive. The same information may be delivered electronically. Future research may compare paper-based newsletter campaigns with digital campaigns to check whether the delivery mechanism may affect the effectiveness of the intervention.

Despite the major limitations, evidence from this RCT demonstrates that targeted and tailored informational interventions can spur increased park use. The positive effects of the informational intervention are especially evident among residents aged 50 years and younger of low-income neighborhoods with parks in close proximity. Simply providing digestible information to residents significantly increases their use of surrounding park facilities, amenities, and services. This is an important finding that further confirms the effectiveness of informational interventions to increase PA.²⁴ More importantly, this study confirms that parks are a promising resource for community-wide informational interventions that aim to increase PA in poor, underresourced communities. While cities have been prevented from buying new parkland due to budget shortfalls,²⁵ this study suggests that cities can increase park use and park-based PA without substantial expenditure. Municipal policymakers are recommended to provide more informational resources for park-related community outreach activities.

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