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Impact of Park Renovations on Park Use and Park-based Physical Activity

Deborah A Cohen^{1,*}, Bing Han¹, Jennifer Isacoff², Bianca Shulaker², Stephanie Williamson¹, Terry Marsh¹, Thomas L. McKenzie³, Megan Weir⁴, and Rajiv Bhatia⁴

¹RAND Corporation, Santa Monica, CA

²Planning and Landscape, The Trust for Public Land, San Francisco, CA

³Dept. of Exercise and Nutritional Sciences, San Diego State University, CA

⁴San Francisco Dept. of Public Health, San Francisco, CA

Abstract

Background—Given the concerns about low rates of physical activity among low-income minority youth, many community based organizations are investing in the creation or renovation of public parks, in order to encourage youth to become more physically active. To what degree park renovations accomplish this goal is not known.

Methods—We used the System for Observing Play and Recreation in Communities (SOPARC), to measure park users and their physical activity levels before and after two parks were renovated. We compared findings to 4 parks-- 2 that were unrenovated parks and 2 that were undergoing renovation. We also surveyed parks users and local residents about their use of the parks.

Results—Compared to parks that had not yet been renovated, the improved parks saw more than a doubling in the number of visitors and a substantial increase in energy expended in the parks. Increased park use was pronounced in adults and children, but was not seen in teens and seniors. Park renovations were associated with a significantly increased perception of park safety.

Conclusions—Park improvements can have a significant impact on increasing park use and local physical activity.

Keywords

playgrounds; green space; community intervention

Introduction

Concerns about children not having safe places to play coupled with the rapid acceleration of the prevalence of childhood obesity have galvanized many organizations to consider investing in the improvement of existing public parks and playgrounds and the creation of new park spaces. Nonprofit organizations and private funders are choosing to partner with and donate funds to municipal park departments in order to improve public parks and

*Corresponding author (dcohen@rand.org).

playgrounds.¹ In some cases, this private investment allows for innovative design and site features or expanded community involvement in the design of a park. Investment in public parks can accrue multiple benefits to both funders and local residents, including improved property values.^{2,3} Funders can be proud of aesthetically appealing, tangible physical structures that are improvements over previous conditions. Local residents gain a well-equipped, novel and engaging place for recreation. When the funders involve the residents and broader community in the design of park improvements, it can also generate greater feelings of ownership, responsibility and sense of stewardship, improve perceptions of safety, and encourage more frequent use of the park.^{4,5}

Yet the capital costs of park improvements can be quite large. Increasingly strict building codes cover more details, from the materials for the park surfaces to the safety standards for playground equipment. In many cities, constructing a new park (if land is available) or renovating one can cost well upwards of one million dollars, and once built, there are also considerable costs for maintenance and repairs.

However, these costs should be considered in light of the cost of physical inactivity to health and well-being, estimated to be about 5% of all health care costs (\$420 of the \$8,402 US per capita costs in 2010).⁶ Physical inactivity is considered the underlying cause of 6.7% of the burden of disease from coronary heart disease, 8.3% of type 2 diabetes, 12.4% of breast cancer, 12% of colon cancer, and 10.8% of premature mortality.⁷ According to accelerometer measures of physical activity in the National Health and Nutrition Examination Survey (NHANES), fewer than 5% of American adults, 8% of teens, and 42% of children meet national physical activity guidelines. Time spent in moderate to vigorous physical activity (MVPA) declines with age and is lower among females than males.⁸ Furthermore, physical activity is associated with better academic performance among youth^{9,10} and in many studies, with reduced rates of obesity.¹¹

Previous research has shown that people, especially children, are more likely to engage in moderate to vigorous physical activity (MVPA) when they are outdoors, rather than indoors.¹² Additionally, being outdoors is increasingly recognized as important for ensuring appropriate exposure to sunshine, necessary for Vitamin D production, and vital in decreasing exposure to indoor pollution.^{13,14} Thus, finding ways to increase park use, exposure to the outdoors, and MVPA is of critical importance to improving health and well-being.

Previous evaluations of park renovation impacts on physical activity have been mixed.^{2,15,16} Two studies show large increases in both use and physical activity for a renovated playground and skate park,^{2,16} while others showed no increases in either for renovated gyms and landscape improvements.^{4,16} This paper reports the impact of significant park renovations on both park use and park-based MVPA in two San Francisco parks. One renovation (West Sunset) was managed by the City of San Francisco and the other (Hayes Valley) was managed by The Trust for Public Land (TPL), a nonprofit organization. TPL involved community stakeholders and potential park users in designing the park improvements.

Methods

This study involved the systematic assessment of three pairs of parks. Pairs were matched on size, socio-economic and demographic composition of local neighborhoods (defined as a ½ mile radius around the park), and one park in each pair was scheduled for renovation. We measured park use before and after the park renovations using the System for Observing Play and Recreation in Communities (SOPARC),¹⁷ a validated method using momentary time sampling to assess the characteristics of parks and their users, including their physical activity levels. We mapped each park, dividing it into distinct target areas. Field staff systematically rotated through all target areas in each of the 6 parks 4 times each day (early morning, mid-day, afternoon and early evening) for 7 days in May 2009 (baseline) and May 2012 (follow-up). During each area rotation, park users were counted by gender, age group, and physical activity level (sedentary, walking, vigorous) and areas were coded as to whether they provided direct supervision and organized activities and whether they were vacant (Table 1). Because we could not discern if the same or different people visited the park during the different days and hours we observed, we summarized the use in person-hour visits. Additionally, we interviewed approximately 75 adult park users and 75 residents from randomly selected households within ½ mile of the park during the respective seven-day observation period. In locations where households could not be directly accessed, we conducted on-street intercept interviews of adults living within ½ mile of the park. Measures included questions about their use of the park, frequency and location of exercise, activities engaged in at the park, perception of safety, and living within ½ mile of the park. Measures included questions about their use of the park, frequency and location of exercise, activities engaged in at the park, perception of safety, and self-rated health. All methods were approved by the RAND IRB.

Of the six parks studied, at follow-up two were renovated (West Sunset and Hayes Valley Playground), two partially renovated (Mission Playground and Balboa Park), and two not renovated (comparison) parks (Margaret Hayward and Boeddeker Park). The two renovated parks underwent extensive restorations including the installation of completely new play equipment, landscaping and ground surfaces. Hayes Valley added adult outdoor fitness equipment and a new 2,500 square foot recreation center. The two partially renovated parks continued to undergo renovations at the time of the follow-up; several areas were open and actively used, though other areas were inaccessible due to construction. The remaining two parks were not renovated and remained completely unchanged from baseline.

Data analysis

We translated the levels of physical activity observed into MET-hours, a measure of energy expenditure with 1 MET-hour equivalent to the amount of energy spent to maintain the body at rest. We used 1.5 METs for sedentary activity (sitting or standing), 3.0 METs for walking or moderate activity, and 6 METs for vigorous activity. This essentially weighted physical activity to give extra credit for greater energy expenditure.

Total park use and METS expended in the park were estimated by a mixed-effect(s) model, in which we used a fixed effect to control for any park-level confounders and two random effects for observation times (i.e., hours of the day and days of the week) to account for the

variations in use trajectories. Changes in use were estimated by a linear contrast between the two measurement periods. Using the same modeling approach, we also examined changes in park use by age group.

Self-reported park use, exercise frequency, and perceptions of safety were estimated by a set of logit models, since survey outcomes are either binomial or Bernoulli random variables. Relevant respondent-level characteristics (e.g., age, gender, race/ethnicity) as well as the fixed-effect for parks were controlled.

We also estimated the cost-effectiveness of the renovations. One park spent \$2,635,866 for the new building, and of that total \$1,234,134 was spent for the outdoor equipment and landscaping. The second park spent \$1,424,624 for the outdoor renovations. We amortized the costs over 15 years, conservatively estimating the additional MET-hours expended in the parks, if they were useable for 45 weeks, based upon the average annual 48 days with at least 1 mm of rain in San Francisco.¹⁸ We calculated the cost per MET-hours generated each year, extrapolating from the findings based upon the one week of measurement. Because these parks already existed, we did not add additional maintenance costs, as we expected these to be similar to the amount previously expended.

Results

Baseline (2009)

The six parks ranged in size from less than one acre to 25 acres and they served a population of between 9,735 and 45,714 residents within in a ½ mile radius. Of the six parks studied, the two parks that later completed renovation were the least and most used at baseline. In all the parks, males outnumbered females substantially at baseline, in one case by 3 to 1. Adults were the largest proportion of park users (57%), while seniors were rarely observed (4.5%), except in one park where they comprised 13% of park users. The majority of park users were sedentary when observed (60%), with one exception where slightly over half of those observed were engaging in MVPA (Table 1).

We observed few organized or supervised activities over the observation week, ranging from zero to 66 organized activities at the 17 acre park (West Sunset). In 70.6% of all observations of the target areas across the 6 parks, no people were observed (range of 53.8% to 88.8%). In the smaller renovated park (Hayes Valley) the vacancy rate in the commonly used areas, including playground and basketball courts, was 79% and 30% in the larger park (West Sunset) at baseline.

Survey responses

The survey response rate was estimated at 61% (n= 503) among park users and 50% (419) for households solicited at baseline, but improved at follow-up to 70% (n= 410) for park users and 86% (n=633) for households. At baseline, the average age of the 922 survey respondents was 42 years old for residents and 44 years for park users. Slightly more than half of all survey respondents were male. The race/ethnicity reported by residents and park users was similar, with about 9% Hispanic, 17% African American, 40% white, 15% Asian, with 17% considering themselves multi-racial or other (Table 2).

Residents lived closer to the parks than the park users (mean = 0.25 vs. 1.1 miles) and were more likely to walk there (83% vs. 56%, $p < .001$). Nonetheless, park users were more than twice as likely as residents to visit the parks at least once a week. Additionally, the park users were more likely to report that they exercised at the parks (33% vs. 20%, $p < .001$). Park users were significantly more likely than residents to consider parks safe (93% vs. 80%, $p < .0001$). Most other survey responses were similar between park users and residents, including frequency of seeing people they knew at the park, frequency of participating in park programs, and the percentage who exercised at health clubs (Table 2).

Changes in park use at follow-up (2012)

At follow-up the average distance park users lived from the park was 1 mile and the percent of users who walk to the parks was similar (56 % vs. 57%). However, use of the two renovated parks increased substantially compared to baseline. Based upon the counts per hourly observation, the estimated number of person-hour visits in the smallest park (Hayes Valley) increased more than 6-fold, from 156 to over 1,000 person-hour visits per week. Use of the second renovated park (West Sunset) increased from an estimated 5,500 person-hour visits to more than 9,300 person-hour visits per week (percentage changes shown combined, Table 3). The increase, however, was not uniform across age groups. Use by children and adults in these two parks increased substantially, while there was no change in use by seniors, and a 51% decline in use by teens (Table 3). The play areas saw the largest gains in use and at follow-up surpassed soccer fields as the park areas previously supporting the largest amounts of vigorous activity. Vacancy rates decreased from 79% to 60% at Hayes, but did not change at West Sunset – which at baseline had a relatively low vacancy rate relative to other study parks.

Similar patterns, but of a slightly different magnitude, were seen for changes in estimated energy expenditure in the two renovated parks. For example, energy expenditure increased more than 700% from baseline at Hayes Valley and 53% at West Sunset.

In the two comparison parks that did not undergo physical renovations, the combined number of visits declined by 49% (approximately 760 person-hour visits per week) and estimated energy expended declined by 53% (approximately 2,000 MET-hrs/week). Both declines were statistically significant ($p < .001$). In one of these parks, the decline could partly be explained by reductions in accessibility, since the park's hours of operation were reduced since baseline.

No significant change in use was noted for the parks continuing to undergo construction, in spite of several areas being inaccessible. However, a difference-in-differences comparison indicates that the two partially renovated parks had a relative increase in use ($p < .001$) compared to the two parks with no renovation.

The self-reported survey data did not match observed findings entirely. Park users and residents both reported using the renovated parks more frequently, but so did residents living near parks that were not renovated. In addition, local residents and users of the two parks being renovated reported fewer visits to them per week ($p < .001$). Even though at baseline most residents and park users considered their parks safe, park renovations were associated

with a significantly increased perception of park safety (residents $p<.001$, park users $p<.05$) (Table 4). Park renovations, either finished or ongoing, were not positively associated with the self-reported number of exercise sessions, but the frequency of park visits was positively associated with the number of exercise sessions ($p<.001$).

When considering the total dollars spent, the cost of the West Sunset renovation was amortized to \$94,975/year but yielded an estimated gain of 7,722 MET-hours per week. For Hayes Valley Playground, amortization was \$258,000 per year and we estimated a net increase of 2,154 MET-hours/week expended. The cost effectiveness of the total renovation of the parks thus ranged substantially, from \$0.27/MET-hour for West Sunset to \$2.66/MET-hour for the smaller park (Hayes Valley). However, if only the expense of the outdoor renovations in the smaller park is included, the cost would be amortized to \$82,276/year. Counting only the increases in the park use in the outdoor areas (1460 MET-hours/week), the cost per MET for the smaller parks would be \$1.25/MET-hour. Previous benchmarks consider a physical activity intervention as cost-effective if the cost is less than \$0.50–\$1.00/MET-hour.¹⁹ Each MET-hour gained is roughly equivalent to a person engaging in MVPA for about 15 minutes.

Discussion

Park renovations were followed by dramatic increases in park use and physical activity levels among park users, as well as improvements in the perceptions of park safety. While it is a common perception that people will not travel far to a neighborhood park, we were surprised to find that many park users came from distances much further than ½ mile from the parks. This suggests that distance may not be a substantial barrier when parks are well-equipped and have attractive features. Most people rely on cars for transit, so distance may not be very relevant in any case.

As in other studies, we found that park use was highly correlated with the frequency of self-reported exercise.^{20,21} Park renovations can be relatively cost-effective for promoting MVPA, especially when primarily considering the expenses associated with outdoor upgrades. While indoor facilities other than gymnasias provide benefits to a neighborhood, these typically contribute little to MVPA. However, it appears they may contribute to an improved perception of safety. This increase in perception of safety might lead to greater active transport in general, and not just in walking to the park. This remains to be tested in future research.

Nevertheless, although park use increased substantially with the renovation, there are still substantial periods of the day when the parks are underutilized and many target areas are empty. It might be expected that parks would draw fewer adults during work hours and fewer youth during school hours, but there is still a significant population who neither work nor go to school and could use the parks during these times. It remains a challenge to find out how to consistently increase park use.

We saw a differential use of the parks by age group with greater increases among children and adults than teens and seniors. Renovations included novel playground equipment that

allowed for climbing, spinning, and swinging in attractive structures. After renovations, the focus of after-school programming in Hayes Valley Playground shifted toward children, as a tutoring program for elementary students replaced more general programming that existed previously. In West Sunset Park, some of the features of benches, concrete seat-walls, and landscape borders were designed to preclude the use of skateboards, and so may have discouraged teenagers. In future projects, increasing park use by all age groups could be addressed by offering outreach and age-specific programming (such as for teens or seniors), and by building park features that appeal to different age groups in areas or ways that will not adversely affect other park users. All the parks were least utilized during the weekdays and in the mornings, times during which it may be possible to develop programs to attract seniors and others who are not working during those periods. Programming and continued outreach may be an important component to support the use of renovated parks.^{5,22}

Our study has several limitations. We studied only a small number of parks in one city and thus our findings may not be generalizable to other localities. It is possible that the changes may be due to unique local characteristics of the places and the population. Although our observations occurred during the spring at baseline and follow-up, our findings may not reflect activities and park use that might occur in other seasons. Furthermore, there was a long gap between baseline and follow-up measures due to delays in construction. We are not aware of changes in the local neighborhoods that might have accounted for changes in the survey responses; indeed, there was no difference between baseline and follow-up of the respondents' duration of residence. Perceptions of safety improved, but it is not possible to say whether it was due to the new construction or a change in perception of crime or safety, independent of the new construction. (Usually perception of crime is better predictor of attitudes than actual crime rates.^{23,24})

Just as commercial businesses refresh their images, products, and marketing materials over time in order to maintain or increase their customer base, parks that adopt these same strategies may be more successful in attracting users and facilitating MVPA among local populations. Parks must compete with the growing electronic media industry, which primarily requires indoor, sedentary behavior. Unless parks provide novel and stimulating activities and settings, they may continue to lose their patronage, as seen with the comparison parks that did not benefit from any special programming or renovations. However, since parks traditionally do not generate income, resources for renovations or to support outreach and programming must come from elsewhere (e.g., private funders, government investment).

In these parks, organizations wanting to increase patronage and MVPA among park users achieved their goals. The results are highly promising and suggest the need for replication elsewhere. Because we found a strong correlation between organized and supervised activities and park use, future efforts to improve parks should also consider the inclusion of funding to support programming that would further motivate the use of the unique park features and equipment.

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Table 1

Baseline Park Characteristics

Park Characteristics	Renovated Parks		Parks Under Renovation		Comparison Parks (No Renovation)	
	Hayes Valley	West Sunset	Balboa	Mission	Hayward	Boeddeker
Park Acres	0.6	17	25	2	2.5	1
# of sports fields	0	7	5	0	0	0
# of facilities	4	6	4	4	4	3
% households in poverty in ½ mile radius *	17.3%	7.6%	9.4%	15.1%	18.1%	25.1%
Estimated population in a ½ mile radius *	25,129	9,735	12,553	26,474	30,969	45,714
Park Observations						
Average number of people per observation	3.2	106.1	47.7	42.5	24.6	12.0
# organized activities **	0	66	0	0	1	1
# supervised activities **	0	51	0	0	2	1
# activity areas vacant/all obs. **	66/ 84 (79%)	83/ 272 (31%)	159/ 265 (60%)	26/ 83 (31%)	55/ 90 (61%)	57/ 68 (84%)
% all areas vacant	80.9%	55.7%	72.1%	53.8%	79.9%	88.8%
Average total METs per observation	10.3	274.0	114.9	101.5	66.5	23.0
% Female	38.2%	33.6%	35.8%	36.4%	40.7%	24.0%
% Male	61.8%	66.4%	64.2%	63.6%	59.3%	76.0%
% Children	20.2%	26.6%	14.8%	29.2%	42.1%	14.2%
% Teenagers	23.6%	22.6%	25.6%	4.5%	6.3%	2.0%
% Adults	56.2%	45.2%	54.1%	65.0%	50.2%	70.6%
% Seniors	0.0%	5.6%	5.5%	1.3%	1.4%	13.2%
% Sedentary activity	51.0%	55.2%	60.1%	62.7%	49.9%	79.5%

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	Renovated Parks		Parks Under Renovation		Comparison Parks (No Renovation)	
	Hayes Valley	West Sunset	Balboa	Mission	Hayward	Boeddeker
Park Characteristics						
% Moderate activity	27.0%	31.0%	30.8%	26.2%	33.0%	15.5%
% Vigorous activity	22.0%	13.8%	9.1%	11.0%	17.1%	5.0%

* 2000 block group estimates, 2000 summary file 1 (ESRI)
** in outdoor fields, courts and play areas

Table 2

Baseline Park User/Residents Reports

	Local Residents (n=419)	Park Users (n=503)	P value
Gender (% male)	55.1%	56.3%	0.7306
Average age (years)	42	44	0.0192
% Hispanic only	9.4%	8.3%	0.5889
% African American only	17.7%	16.1%	0.5036
% White only	39.9%	41.5%	0.6354
% Asian only	13.3%	18.1%	0.0509
% other race/ethnicity	14.5%	10.8%	0.0897
% multi race/ethnicity	5.2%	5.3%	0.9401
Median distance living from the park (miles) ¹	0.25	0.49	<.0001
Mean distance living from the park (miles)	0.25	1.05	<.0001
% ever visit the park (local residents only)	58.2%		
Frequency of park use (at least once/week) ²	30.8%	64.9%	<.0001
Average # of visits in past 7 days	2.1	2.8	0.0069
Average length of stay (hours)	1.3	1.5	0.5509
% walking to the park	83.3%	56.3%	<.0001
% seeing people they know often/sometimes	33.6%	31.0%	0.4820
% ever participated in park sponsored program	24.6%	27.9%	0.2629
% user fees prohibit participation	2.9%	2.6%	0.7979
% perceive park safe/very safe	80.1%	92.9%	<.0001
% who usually exercise at park	18.2%	31.0%	<.0001
% who usually exercise at home	7.5%	10.1%	0.1725
% who usually exercise at health club	17.5%	17.6%	0.9574
% who usually exercise on streets or sidewalks	42.0%	31.0%	0.0006
% who usually exercise in other locations	6.6%	4.5%	0.1641
% who report they don't usually exercise	8.3%	5.9%	0.1605
Mean Frequency of exercise (sessions/week)	4.4	4.4	0.9970

¹Note: distance for residents based on survey type (1/2 mile ¼ mile type). Distance for park users based on geocoded intersections. Intersections missing for n=158 of 503.

²This if only calculated for people who visit the park. If they report they never visit the park, the number of visits is set to missing, not zero.

Table 3

Changes in observed park use and energy expenditure, all and by age group.

	No renovation Beta (SE)	Under Construction Beta (SE)	Renovations Complete Beta (SE)
% change in total park use	−48.6 (10.3) ***	30.4 (21.9)	233.1 (55.9) ***
% change in METS-hours expended in park	−53.1 (11.1) ***	28.2 (25.3)	254.8 (70.1) ***
% change in # of children observed	−7.4 (23.1)	58.8 (33.5) *	434.0 (112.7) ***
% change in # of teens observed	0.3 (24.7)	−7.3 (19.7)	−51.1 (10.4) ***
% change in # of adults observed	−53.7 (8.2) ***	29.8 (19.2)	169.6 (39.9) ***
% change in # of seniors observed	−10.7 (15.1)	−8.8 (13.1)	25.4 (18.0)

Significance levels are at .001 (***), .01 (**), and .05 (*).

Table 4

Models predicting self-report of park visit, safety perception and exercise.

	Frequency of visiting neighborhood park in the past 7 days Estimate (se)	Consider neighborhood park safe Estimate (SE)	# Weekly exercise sessions (SE)
Residents	N=856	N=883	N=833
Unrenovated parks	.52 (.13) ***	.33 (.33)	.05 (.28)
Partially renovated parks	-.50 (.12) ***	.67 (.55)	.29 (.11) **
Renovated parks	.73 (.15) ***	12.6 (.47) ***	.02 (.11)
Intercept	-1.35(0.42) **	24.5(1.2) ***	0.03(0.35)
Age >= 18 years old	-1.68(0.33) ***	1.21(0.94)	0.22(0.30)
Gender: female	-0.04(0.07)	-0.34(0.20)	0.00(0.06)
Race: black	0.68(0.10) ***	0.80(0.32) *	-0.34(0.09) ***
Race: Latino	0.21(0.11)	-0.33(0.33)	-0.37(0.09) ***
Race: Other non-white	0.28(0.09) **	-0.20(0.24)	-0.21(0.07) **
Visits other parks >1x/month	0.04(0.08)	0.04(0.22)	0.13(0.08)
Consider park safe	1.43(0.15) ***	-	0.15(0.07) *
Does physical activities at work	0.16(0.08) *	0.47(0.24)	0.10(0.06)
Self-rated health	-0.07(0.10)	0.42(0.25)	-0.04(0.08)
# park visits last 7 days	-	-	0.11(0.01) ***
Park users	N=830	N=850	N=821
Unrenovated parks	.22 (.12)	.79 (.58)	.29 (.15)
Partially renovated parks	-.51 (.09) ***	.43 (.91)	-.17 (.09)
Renovated parks	.31 (.11) **	1.70 (.81) *	-.43 (.10) ***
Intercept	-0.59(0.84)	27.5(1.2) ***	-1.02(0.35) **
Age >= 18 years old	-0.20(0.29)	-22.36(0.00)	0.92(0.28) **
Gender: female	-0.04(0.77)	-0.59(0.34)	0.03(0.06)
Race: black	0.29(0.10) **	0.79(0.60)	-0.45(0.09) ***
Race: Latino	0.02(0.09)	-0.59(0.58)	-0.18(0.09) *
Race: Other non-white	0.13(0.07)	-0.93(0.41) *	-0.30(0.07) ***
Visits other parks >1x/month	-0.27(0.07) ***	0.36(0.39)	0.05(0.13)
Consider park safe	0.42(0.15) **	-	-0.09(0.07)
Does physical activities at work	-0.01(0.06)	0.13(0.37)	0.09(0.06)
Self-rated health	0.08(0.10)	0.32(0.45)	0.07(0.09)
# park visits last 7 days	-	-	0.15(0.01) ***

Significance levels are at .001 (***), .01 (**), and .05 (*).

All effects are on the logit scale.

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