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Zachary D. Miller
National Park Service

Amy Tendick
National Park Service, amy_tendick@nps.gov

Caleb Meyer
Utah State University, caleb.meyer@usu.edu

David Pettebone
National Park Service

Bret Meldrum
National Park Service

Steve Lawson
Stak Inc.

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Comparing Visitor Perceptions, Characteristics, and Support for Management Actions before and during a Pilot Timed Entry System at Arches National Park

Zachary D. Miller [1], Amy Tendick [2,*], Caleb Meyer [3], David Pettebone [4], Bret Meldrum [4] and Steve Lawson [5]

[1] National Park Service, Lakewood, CO 80228, USA
[2] National Park Service, Moab, UT 84532, USA
[3] Department of Environment and Society, Quinney College of Natural Resources, Utah State University, Logan, UT 84341, USA
[4] National Park Service, Fort Collins, CO 80525, USA
[5] Otak Inc., Portland, OR 97204, USA
* Correspondence: amy_tendick@nps.gov

Abstract: Over the past decade, many national park units in the United States broke visitation records. Arches National Park (UT, USA) is no exception. Between 2011 and 2021, visitation increased 74%. As part of considering management options to address the issues from sustained and concentrated visitation, Arches implemented a pilot timed entry system from 3 April to 3 October 2022. This article compares visitor perceptions, characteristics, and support for management actions before and during the pilot timed entry system using data from visitor intercept surveys. Findings suggest visitors experience quality improved across the park and on hiking trails during the pilot timed entry system. Visitor characteristics were extremely similar, and there were no differences in local residency, group size, vehicle occupancy, race, ethnicity, first time visitation, education level, or household income. Visitors were more likely to plan for the trip further in advance and were less likely to re-enter the park during the pilot timed entry system. Lastly, visitors demonstrated more support for timed entry and lower levels of support for expanding parking, site specific reservations, and temporary closures during the pilot timed entry system. These results reflect unique insights for managers considering managed access systems like timed entry to sustainably manage visitor use in parks and protected areas.

Keywords: visitor use management; managed access; national parks; sociodemographics

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1. Introduction

Since 2017, national park units in the United States welcomed approximately 1.8 billion visits [1]. Although this provides outstanding opportunities for visitors to experience the fundamental resources and values of our national parks, deleterious impacts may also occur with sustained and high levels of visitation. This includes resource impacts [2], negative impacts to visitor experience quality [3], strained facilities [4], and staff stress [5]. The sustainability of parks and protected areas are challenged under these conditions as parks strive to provide visitor access while conserving resources unimpaired [6,7].

As the initial impacts of the COVID-19 pandemic began to wane, the public descended upon outdoor spaces as a reasonably safe alternative to indoor spaces and events [8]. In the face of already high visitation and an emerging public health crisis, several national park units implemented temporary managed access systems [9]. A managed access system is any system that is designed to redistribute the timing, type, amount, and/or locations of visitor use. Many tourism and recreation agencies, businesses, and other entities have a long history of managing access to balance sustainable visitor access while protecting visitor experience quality and resources. This includes backcountry permits, tour reservations,

campground reservations, river permits, and other forms of access. Managed access is also widely used across jurisdictions, including federal agencies [10,11], state agencies [12,13], and tribal entities [14,15].

However, the temporary managed access systems implemented in response to COVID-19 across several National Park Service (NPS) units were somewhat unique in that they managed day use access across wide geographic regions. The result of this was a set of new and varied questions about these systems including how managed access systems influence visitor experiences or transportation networks, what degree of visitor support is there, and what potential differences are there between visitors utilizing a park before, during, and after managed access. Exploring questions like these can help parks weigh the benefits and impacts of managed access systems as a form of sustainable visitor use management.

Arches National Park (ARCH) is uniquely positioned to provide initial insights into many of the questions raised about managed access systems that are large in both scale and scope. From 3 April to 3 October 2022, ARCH implemented a pilot timed entry system (PTES, a specific form of managed access) to assess management strategies related to sustained and high visitation. Under ARCH PTES, visitors arriving by private vehicle needed a reservation to enter the park between 06:00 and 17:00 daily. Timed entry reservations were allotted in hourly entry time blocks. Visitors could book these reservations up to three months in advance or the day before their intended visit through www.recreation.gov accessed on 19 June 2023. If tickets were available, visitors could reserve a timed entry ticket on the day of their intended visit. Additionally, visitors could enter the park before 06:00 and after 17:00 daily without a timed entry reservation. The primary goal of PTES was to spread visitation more evenly throughout the day.

The year prior to ARCH PTES (2021), the park contracted the collection of socioeconomic monitoring data. These data provide information about visitor experience evaluations, trip characteristics and planning, and visitor demographics collected via on-site and mail-back surveys [16]. During the same time period as 2021, ARCH contracted a repetition of the socioeconomic monitoring data collection while the PTES was being implemented. The purpose of this study is to provide a unique, quasi-experimental approach to address questions about managed access systems by comparing visitor perceptions, characteristics, and support for management actions before and during ARCH PTES.

2. Materials and Methods

2.1. Site Description

ARCH is situated in the red rock desert near Moab, Utah. The park contains over 2000 sandstone arches and is a major tourist draw to the area (NPS, 2013). The purpose of ARCH is "to protect extraordinary examples of geologic features including arches, natural bridges, windows, spires, balanced rocks, as well as other features of geologic, historic, and scientific interest, and to provide opportunities to experience these resources and their associated values in their majestic natural settings" [17]. ARCH visitation increased by 74% between 2011 and 2021. Record high visitation was observed in 2021 with 1.8 million visits [1]. Visitors to ARCH arrive almost exclusively by vehicle, with over 96% of visitors entering the park through the main entrance just north of Moab [18].

2.2. Data Collection

Groups of visitors with at least one member being 18 years of age or older were surveyed on site in ARCH (see Figure 1). A two-phase survey methodology following methods outlined by Dillman [19] was used. This included an onsite intercept survey administered via tablet (phase 1) and a mail-back survey to obtain information from the duration of their trip (phase 2). Visitors completing the intercept survey were asked to take a printed mail-back follow-up survey and provide their name and address. Visitors that agreed to take the mail-back survey were contacted in three phases: (1) via an on-site distribution of a questionnaire, (2) a post-card reminder sent about a week after contact, and (3) up to two replacement mailings of the questionnaire if necessary. Visitors were

asked to complete the questionnaire post-trip to ARCH and to return via a provided self-addressed postage-paid envelope. International visitors were asked to complete and mail their questionnaires before leaving the country.

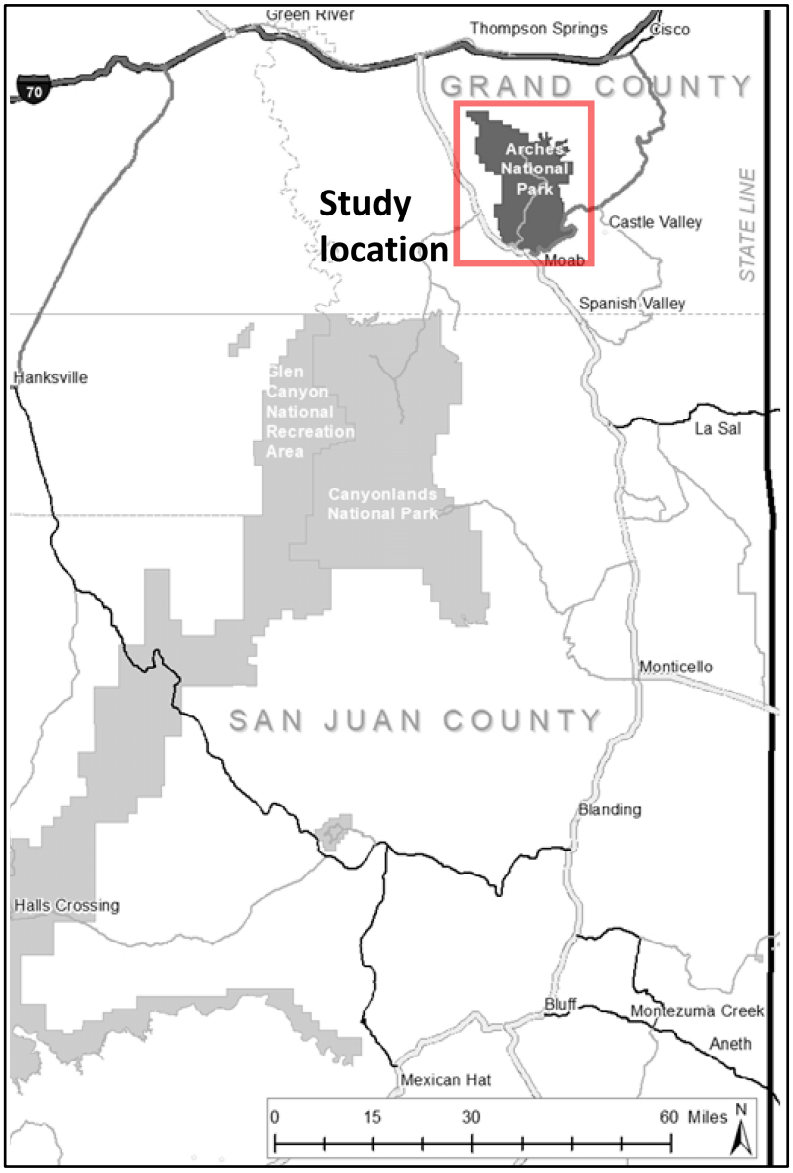

Figure 1. Map of Arches National Park and the local area.

2.3. Sampling Details

Preceding PTES (2021), sampling was done onsite at ARCH from 27 May through 7 June 2021 from 08:00 to 16:00. Sampling included both weekends and weekdays. 1 June 2021 was not included as a sampling day due to staffing requirements. During PTES (2022), sampling was done onsite at ARCH from 27 May through 6 June 2022. Sampling times varied from 2021 to sample visitors who may have entered the park before or after the timed entry reservation period. From 27 May through 31 May 2022 sampling occurred from 07:00–15:00. From 2 June through 6 June 2022 sampling occurred from 11:00–19:00. Sampling on 1 June 2022 was not included to staffing requirements.

During both 2021 and 2022, surveys were administered via roadway intercept sampling, which occurred at a pullover location on the inbound side of the park road approximately 13 miles past the park entrance. The sampling location was selected because traffic flow was relatively unaffected by park operations during the sampling period and

was a place where vehicles could safely be pulled over without causing traffic to become congested or interfering with park operations.

Survey administration in both years used a first-after-last approach. Specifically, researchers pulled over the first vehicle to approach the sampling location in an inbound direction and asked the occupants of the vehicle to participate in the study. The survey administration team continued to pull over vehicles until a group agreed to participate. Upon completion of a visitor contact, the next vehicle to approach in an inbound direction was pulled over and asked to participate in the survey. The team continued this process throughout the sampling period.

Each contacted visitor group was greeted, briefly introduced to the purpose of the study, asked to participate, and screened for eligibility. Visitor groups were considered eligible for the study if they had not previously participated in the study, were not a park employee, were able to communicate with the English-speaking survey administrator (i.e., did not have a language barrier), and had at least one group member 18 years of age or older. The surveyor noted the gender of the first individual contacted, group size, and whether the visitor group arrived in a commercial vehicle. If visitors were eligible for the study and agreed to participate, they were asked which member (at least 18 years old) had the next birthday. The individual with the next birthday was selected to complete the questionnaire for the group. This was done to randomize selection of the individual within the group to complete the questionnaire. The survey administrator then conducted an interview, lasting approximately five minutes, to complete the on-site questionnaire with the visitor.

A shorter interview, lasting approximately two minutes was conducted with eligible visitors who refused to participate in the survey. These visitors were asked how many adults and children were in their group, whether they were a first-time visitor to ARCH, whether visiting ARCH was the primary purpose for their overall trip away from home, whether they planned to stay overnight in ARCH or the local area, and whether they planned to visit ARCH on more than one day. For all "hard refusals" (groups who refused to participate in the study and in the brief interview), only the observational data (gender of first-contacted group member, group size, whether the group arrived in a commercial vehicle, and time of contact) and refusal reasons were recorded on the contact log.

In 2021, 840 visitor groups were invited to participate in the survey. Of these groups, 789 agreed to participate in the on-site survey (94% on-site response rate) and 730 agreed to participate in the mail-back survey by accepting a mail-back survey packet (87% cooperation rate). A non-response bias check was not completed for this sample, as federal guidelines only require a non-response bias check when the response rate is less than 80% [20]. Questionnaires were completed and returned by 369 visitor groups, resulting in a completion rate of 51% among those visitor groups that accepted a mail-back questionnaire and an overall mail-back response rate of 44% for the study. A non-response bias check was not performed for these data.

In 2022, 1121 visitor groups were eligible for and invited to participate in the survey. Of these groups, 942 agreed to participate in the on-site intercept survey (84% on-site response rate) and 840 agreed to participate in the mail-back survey by accepting a mail-back survey packet (75% cooperation rate). A non-response bias check was not completed for this sample, as federal guidelines only require a non-response bias check when the response rate is less than 80% [20]. Questionnaires were completed and returned by 465 visitor groups, resulting in a completion rate of 55% among those visitor groups that accepted a mail-back questionnaire and an overall mail-back response rate of 42% for the study.

A non-response bias check was performed for mail-back questionnaires in 2022 using 8 pre-selected questions and one observation variable. Questions included assessments of number of adults in group, number of children in group, first time visitation to ARCH, visiting ARCH as the primary trip purpose, staying overnight in ARCH or the local area on the trip, visiting ARCH for more than 1 day on the trip, number of days planned to visit (if more than 1 day), number of hours spent in ARCH (if less than 1 day), and gender

(observed). Two significant differences were identified using chi square analyses. First, there were more adults per group in mail-back respondents ($\chi^2 = 8.08$, $df = 3$; $p = 0.044$). Second, mail-back respondents were more likely to report their visit to ARCH as the primary purpose of their trip ($\chi^2 = 2.29$, $df = 3$; $p = 0.038$). Results should be interpreted with these differences in mind.

2.4. Analysis

The IBM Statistical Package for the Social Sciences (SPSS) Version 29 was used to analyze the data. Likert-type variables were treated as continuous variables [21,22] and compared between 2021 and 2022 (PTES) using *t*-tests. All *t*-tests were interpreted using Levene's test for equality of variances. Effect size for *t*-tests was calculated using Hedge's *g* to account for unequal sample sizes [23]. Respondents that answered "Do not know" or "Not sure" were removed for analytical purposes. Categorical variables were compared between 2021 and 2022 (PTES) using χ^2 tests. Effect size was calculated using *Phi* when the test is a 2 × 2 table and Cramer's *v* when larger than 2 × 2.

3. Results

3.1. Visitor Perceptions

Visitor perceptions about general park resources and conditions were measured through a battery of questions (Table 1). There were significant differences for three variables. Visitors during PTES were significantly more likely to agree with the statements that "ARCH is a safe place to visit" and that "historic and cultural features in the park were well preserved." There was a small effect size for both variables. Visitors during PTES were significantly more likely to disagree with the statement that "ARCH is too crowded." There was a medium effect size for this variable.

Table 1. Mean [1] comparison between 2021 and 2022 samples for visitor perceptions of park resources and conditions.

Variable	2021 Mean (SD; N)	2022 Mean (SD; N)	*p*-Value [2]	Effect Size (Hedges' *g*)
Arches National Park is a safe place to visit	1.37 (0.52; 365)	1.29 (0.53; 461)	0.027	Small 0.152
Arches National Park is too crowded	2.71 (1.02; 360)	3.30 (0.96; 453)	<0.001	Medium 0.60
Natural resources in Arches National Park are in pristine condition	1.77 (0.71; 356)	1.79 (0.70; 455)	0.634	-
Graffiti and litter are not a problem in Arches National Park	1.84 (0.88; 358)	1.82 (0.92; 454)	0.744	-
Arches National Park is not accessible to persons with physical disabilities	3.19 (0.92; 242)	3.13 (0.99; 334)	0.427	-
Historic and cultural features in Arches National Park are well maintained/preserved	1.80 (0.68; 336)	1.70 (0.64; 419)	0.038	Small 0.152
Development of facilities INSIDE the park detracts from visitors' experiences at Arches National Park	3.75 (1.00; 333)	3.78 (1.06; 426)	0.695	-
Development of adjacent areas OUTSIDE the park detracts from visitors' experiences at Arches National Park	3.72 (0.98; 333)	3.80 (0.99; 427)	0.279	-

[1] Variables were measured on a scale where 1 = strongly agree, 3 = neither agree nor disagree, and 5 = strongly disagree; [2] *p*-values are interpreted using Levene's test for equality of variances.

In addition to visitor perceptions of general park resources and conditions, visitors were also asked about perceptions of their hiking experience (Table 2). For every variable measured, there were significant differences with small effect sizes.

Table 2. Mean [1] comparison between 2021 and 2022 samples for visitor perceptions of their hiking experience.

Variable	2021 Mean (SD; N)	2022 Mean (SD; N)	*p*-Value [2]	Effect Size (Hedges' *g*)
There were fewer people on the trail than I would prefer to see when hiking in Arches National Park	3.85 (0.90; 327)	3.70 (0.86; 402)	0.023	Small 0.171
There were more people on the trail than I think is acceptable to reduce environmental impacts	3.04 (0.96; 316)	3.25 (0.94; 404)	0.004	Small 0.221
The number of people on the trail was acceptable to protect the quality of visitors' experiences (i.e., to prevent crowding)	2.59 (0.89; 335)	2.31 (0.85; 412)	<0.001	Small 0.322
There were more people on the trail than I think is acceptable to provide opportunities for solitude	2.69 (1.02; 322)	2.94 (1.09; 411)	0.002	Small 0.236
The number of people I encountered while hiking on trails in Arches National Park positively impacts my experience	3.05 (0.89; 323)	2.90 (0.91; 404)	0.028	Small 0.166

[1] Variables were measured on a scale where 1 = strongly agree, 3 = neither agree nor disagree, and 5 = strongly disagree; [2] *p*-values are interpreted using Levene's test for equality of variances.

3.2. Visitor Characteristics

Visitor characteristics were measured through several variables. Nearly all visitors reported non-local residency (Table 3). So few visitors reported local residency that no statistical comparisons are made.

Table 3. Frequency comparisons between 2021 and 2022 samples for local residency [1].

Residency Status	2021	2022
Non-local residency	99.5% (*n* = 785)	99.6% (*n* = 938)
Local residency	<1% (*n* = 4)	<1% (*n* = 4)

[1] Local residency was defined by providing a map to participants (see Figure 1). The low number of visitors reporting local residency violated assumption of chi-squared tests and thus no statistical comparisons are made.

There were no significant differences between proportion of first-time visitors to ARCH (Table 4), nor significant differences for group size, number of people in vehicle, or age (Table 5). Visitors were significantly less likely to re-enter the park on the same day during PTES (Table 6).

Table 4. Frequency comparisons between 2021 and 2022 samples for first time visitors to the park.

Year	No	Yes
2021	22% (*n* = 169)	78% (*n* = 613)
2022	25% (*n* = 235)	75% (*n* = 706)

$\chi^2 = 2.69$, $df = 1$; $p = 0.101$.

Table 5. Mean [1] comparison between 2021 and 2022 samples for group size, number of people in vehicle, and age.

Variable	2021 Mean (SD; N)	2022 Mean (SD; N)	*p*-Value [1]	Effect Size (Hedges' *g*)
Group size	3.12 (2.04; 789)	3.00 (2.26; 447)	0.268	-
Number of people in vehicle	2.84 (1.35; 785)	2.72 (1.24; 941)	0.054	-
Age	49.99 (16.74; 356)	49.27 (15.73; 447)	0.533	-

[1] *p*-values are interpreted using Levene's test for equality of variances.

Table 6. Frequency comparisons between 2021 and 2022 samples for re-entry on the day of contact [2].

Year	No	Yes
2021	83% (n = 646)	17% (n = 136)
2022	92% (n = 861)	9% (n = 80)

χ^2 = 30.78, df = 1; p < 0.001. Phi = 0.134; [2] Percentages do not equal 100 due to rounding.

The timing of the decision to visit ARCH was significantly different between 2021 and 2022 and had a small effect (Table 7). Practically, visitors had longer trip planning horizons during PTES than 2021 with about 8% more visitors reporting they planned a year or more before their visit during PTES than 2021.

Table 7. Frequency comparisons between 2021 and 2022 samples for timing of decision to visit Arches National Park.

Timing Category	2021	2022
A year or more before the visit	9% (n = 74)	17% (n = 156)
More than 6 months but less than a year before the visit	6% (n = 48)	9% (n = 85)
2 to 6 months before the visit	45% (n = 355)	43% (n = 402)
1 month before the visit	11% (n = 87)	9% (n = 82)
1–3 weeks before the visit	9% (n = 73)	6% (n = 60)
A week before the visit	6% (n = 46)	6% (n = 55)
A couple days before the visit	11% (n = 84)	10% (n = 92)
On the same day of the visit	3% (n = 22)	1% (n = 10)

χ^2 = 36.29, df = 7; p < 0.001. Cramer's v = 0.145.

Visitors were asked about their ethnicity and race. For ethnicity, visitors were asked to report if they identified as Hispanic or Latino. There were no significant differences identified for ethnicity (Table 8). For race, respondents could select as many races as they identified with in the survey. Visitors identifying as more than one race (n = 14 across both years) were recoded as multi-racial. A low number of respondents identified as several

races and could not be statistically compared. Where statistical comparisons could be made, there were no significant differences for any race between 2021 and 2022 (Table 9).

Table 8. Frequency comparisons between 2021 and 2022 samples for visitors identifying as Hispanic or Latino.

Year	No	Yes
2021	95% (n = 329)	5% (n = 17)
2022	95% (n = 422)	5% (n = 21)

$\chi^2 = 0.65$, $df = 1$; $p = 0.798$.

Table 9. Percentage of visitors identifying with race between 2021 and 2022 samples.

Race	2021	2022	p (χ^2, df)
American Indian or Alaska Native [1]	<1% (n = 3)	<1% (n = 3)	-
Asian	9% (n = 30)	8% (n = 36)	0.753 (0.099, 1)
Black or African American [1]	<1% (n = 2)	<1% (n = 2)	-
Native Hawaiian or other Pacific Islander [1]	0% (n = 0)	0% (n = 0)	-
White	90% (n = 300)	89% (n = 387)	0.937 (0.006, 1)
Multi-racial	3% (n = 9)	1% (n = 5)	0.128 (2.314, 1)

[1] Statistical comparisons could not be completed due to low numbers of respondents in each cell and the associated violation of expected count per cell assumption for χ^2 analysis.

Level of education and household income were measured using categorical variables Very few respondents reported having either some high school education or less than a high school education and were re-coded into the education level high school or less to allow for statistical testing. There were no significant differences for level of education (Table 10). There were also no significant differences for household income (Table 11).

Table 10. Frequency comparisons between 2021 and 2022 samples for education level.

Education Level	2021	2022
High school or less	6% (n = 22)	5% (n = 24)
Some college, business or trade school	14% (n = 47)	14% (n = 61)
College, business, or trade school graduate	41% (n = 142)	39% (n = 175)
Some graduate school	5% (n = 18)	5% (n = 24)
Master's, doctoral, or professional degree	33% (n = 114)	36% (n = 162)

$\chi^2 = 1.115$, $df = 4$; $p = 0.892$.

Table 11. Frequency comparisons between 2021 and 2022 samples for household income.

Household Income	2021	2022
Less than $24,999	4% (n = 14)	3% (n = 12)
$25,000-$34,999	3% (n = 10)	2% (n = 8)
$35,000–$49,999	6% (n = 18)	2% (n = 10)
$50,000–$74,999	13% (n = 42)	15% (n = 62)
$75,000–$99,999	17% (n = 56)	14% (n = 60)
$100,000–$149,999	24% (n = 79)	25% (n = 106)
$150,000–$199,999	14% (n = 46)	15% (n = 63)
$200,000 or more	19% (n = 62)	24% (n = 99)

χ^2= 10.323, df = 7; p = 0.171.

3.3. Visitor Support for Management Practices

Visitor support for management practices was measured through Likert-type questions (Table 12). There were significant differences for four of the seven variables. Visitors during PTES were significantly more likely to oppose expanding parking at key attractions to allow more visitors access to trails (small-medium effect), implement site specific timed-entry permits (small effect), and implement temporary closures of congested parking areas (small effect). Visitors during PTES were significantly more likely to support advanced timed-entry reservations. There was a medium-large effect for this variable.

Table 12. Mean [1] comparison between 2021 and 2022 samples for visitor support or opposition to management practices.

Variable	2021 Mean (SD; N)	2022 Mean (SD; N)	p-Value [2]	Effect size (Hedges' g)
Expand parking areas at key attraction sites, allowing for more visitors on the related trails	2.56 (1.23; 346)	3.04 (1.22; 431)	<0.001	Small-Med 0.392
Continue advanced timed entry reservations to the park to reduce crowding during the peak season [3]	2.50 (1.14; 336)	1.75 (0.96; 436)	<0.001	Med-Large 0.720
Expand trail network in the park to provide additional recreation opportunities	2.29 (0.93; 339)	2.19 (0.93; 432)	0.139	-
Implement advanced timed entry reservation to visit specific areas of the park (i.e., site-specific permits)	3.03 (1.16; 341)	3.30 (1.21; 432)	0.002	Small 0.167
Implement mandatory shuttle system to reduce traffic congestions	3.34 (1.21; 339)	3.45 (1.20; 431)	0.212	-
Implement voluntary shuttle system to increase modes of access	2.26 (0.90; 342)	2.27 (0.96; 433)	0.903	-
Temporarily close congested parking areas	3.09 (1.00; 334)	3.30 (1.09; 416)	0.005	Small 0.198

[1] Variables were measured on a scale where 1 = strongly support, 3 = neither support nor oppose, and 5 = strongly oppose. [2] p-values are interpreted using Levene's test for equality of variances. [3] The phrasing of this statement was changed in 2022 since the park was implementing a timed-entry system. In 2021, the statement read "Implement advanced timed entry reservations to the park to reduce crowding during the peak season".

4. Discussion

The PTES at ARCH provided a unique ability to understand changes in visitor experiences, characteristics, and support for management actions using a quasi-experimental design. Overall, visitors reported improved experiences during PTES when compared to the year prior with no PTES. At parkwide levels, visitors perceived less crowding, higher levels of safety, and better protection of historic and cultural resources. While hiking, visitors reported all around improvement in the quality of their experience during PTES. This included more positive evaluation of the number of people on trails. Critically, the change in perceptions among visitors toward higher quality experiences aligns with the on-the-ground conditions during the PTES [18]. Monitoring data from other studies comparing pre-PTES data and data during PTES shows parking was less congested, visitor access was more predictable, and visitor use conditions on the trails and at key geologic features were more likely to provide higher quality experiences [18]. Collectively, this data suggests that the PTES not only changed the on-the-ground conditions at the park [18], but that the changes were noticed by visitors and evaluated as more positive when compared to previous conditions.

Visitors showed subtle changes in characteristics during the PTES compared to the previous year. Longer planning horizons during PTES were confirmed in this study with a shift towards planning more than 6 months in advance for a trip to ARCH. This is the first empirical finding that shows visitor planning behavioral shifts under a managed access system and aligns with calls from some groups to provide more flexibility for longer planning horizons [24]. The reason for this shift is unknown, but it may be related to visitors wanting more certainty in their travel planning. However, the plurality of visitors during PTES still planned their trip between 2 and 6 months before their visit, which was the same for the year prior to PTES.

Visitors also re-entered the park less frequently during PTES than the year prior. This is an unexpected finding. Visitors were allowed same-day re-entry to ARCH during PTES if they validated their reservation during their timeslot, and it was anticipated that people may re-enter more frequently during PTES. The reason for fewer re-entries during PTES is unknown, but it may be that visitors are altering their spatial and/or temporal behaviors during PTES. This may include spending different amounts of time in the park, visiting different areas, or a variety of other aspects related to visitor use patterns. Additionally, greater availability of parking, reduced congestion during PTES, and higher quality visitor experiences [18] may reduce the need for visitors to return to the park at a later time to access desired areas. Further research is warranted to understand potential changes.

Perhaps most striking was the lack of differences in visitor characteristics before and during PTES. Interpretation of a few of these key findings is warranted. PTES at ARCH was managing the number of vehicles that entered the park, not people. There were some assumptions that the number of people per vehicle might increase because of this, but that was not the case. Additionally, although recent research casts doubt on the utility of mobility data to accurately identify race and income among national park visitors [25], some researchers claimed exclusionary effects of reservation systems in national parks—specifically for race and income at campgrounds—using mobility data [26,27]. This current study uses robust, on-the-ground survey methods to collect sociodemographic data and found no differences for race, ethnicity, income, local residency, or education level when comparing visitors before and during PTES. Substantively, no exclusionary effects were identified during ARCH PTES. The collective summary of the visitor characteristic results suggest that although visitors may be planning their trips further in advance and re-entering the park less during the PTES, the sociodemographic characteristics of the people visiting was unchanged.

Lastly, the largest effect size in the study was found in visitors becoming more supportive of timed entry during the PTES than before at ARCH. This finding aligns with other findings that once visitors experience improved quality of social conditions, like crowding, they generally become more supportive of the management actions that maintain those

conditions—even if those conditions are direct forms of management [3,28]. It is also worth noting that a timed entry system became the management action that was most strongly supported during PTES, which was also a change from before PTES. Visitors also were less supportive of other actions that could increase visitor access and crowding to areas, like expanding parking.

4.1. Limitations

This survey was administered following the principles outlined by Dillman's Tailored Design Method [19]. As with any survey research this study is subject to limitations that need to be considered. First, respondents completed the mail-back survey after completion of their trip to ARCH. It is possible the amount of time between their trip and response may have affected respondent recall to some degree, and responses may not be fully reflective of their behavior during their trip to ARCH. Second, these data were collected from 27 May–6 June 2022 and represent a sample of visitors during this period of time. As such, results do not necessarily represent visitor groups throughout the rest of the year. Third, a non-response bias check of the 2022 survey identified differences between mail-back respondents and non-respondents regarding the number of adults in group and their visit to ARCH as the primary purpose of their trip. Lastly, this research only intercepted visitors who were on-site and does not include the non-visiting public.

4.2. Conclusions

The purpose of this study was to identify any changes related to visitor experiences, characteristics, and support for management actions before and during the PTES at ARCH. Overall, visitor experiences parkwide and while hiking improved during PTES. Visitor characteristics were largely unchanged, though visitors were planning further in advance for their trip to ARCH and re-entering the park less. Additionally, no exclusionary effects for race, ethnicity, age, income, education level, or local residency were identified. Visitors became more supportive of timed entry during PTES, and timed entry became the most supported management action during PTES. These robust data from a unique quasi-experimental study can help parks considering managed access as a strategy for sustainable visitor use management evaluate potential changes to visitor experience quality, visitor characteristics, and visitor support for management actions.

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