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Regular Paper

Perceived Health Outcomes of Mountain Bikers: A National Demographic Inquiry

Eddie Hill
Edwin Gómez

Executive Summary

Given the International Mountain Bike Association's growing membership, mountain biking popularity, and industry growth, it is important to explore perceived health benefits and outcomes derived from the sport of mountain biking. Mountain biking is currently one of the fastest growing recreational activities in the world, but empirical documentation regarding outcomes from participation is limited. The purpose of this study was to explore the perceived health outcomes of mountain biking as they relate to different demographic groups in the United States. Data were collected using the Perceived Health Outcomes of Recreation Scale, which measured recreation outcomes in terms of prevention, improvement, and psychological benefits from recreation participation in mountain biking. Results from this national study explored differences according to gender, age, membership, and regions. Findings suggest that women perceived higher psychological health outcomes, and men perceived higher health outcomes related to prevention. Older riders significantly perceived prevention-based health outcomes from mountain biking than their younger counterparts. No differences were found between prevention, psychological, and improvement outcomes related to membership. Regional analysis revealed a homogenous view of health outcomes from mountain bikers across the U.S. Land managers, outdoor advocacy groups, and commercial outfitters could use this research to promote the health benefits of moun-

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tain biking. Interestingly, and noteworthy from a public health perspective, mountain bikers who ride twice monthly, or every day, perceived similar outcomes. This provides support for the notion that mountain biking, even when participating with less frequency, bodes well as a possible recreation activity to address some of the challenges our society faces regarding unhealthy lifestyles. Recreation professionals could advocate for an alternative form of physical activity by introducing mountain biking to new audiences, while articulating the possible health benefits achieved from participation. This study may be useful to outdoor recreation programmers and public land use managers to better understand participants on park trails; and to allow for better recognition of benefits resulting from mountain biking on trails.

Keywords

Perceived health outcomes, recreation benefits, mountain biking

Introduction

The growth of the mountain biking (MTB) industry continues its upward trajectory both in the United States (U.S.) and globally. In the U.S., the National Bicycle Dealers Association (NBDA, 2015) reported a stable bicycle industry since 2003, with mountain bikes representing approximately 25% of the total bicycle market. According to Research and Markets (2017), the global compounded annual growth rate for the MTB market is expected to be 9.84% from 2017-2021, and the mountain biking tourism trend will continue to be an aspect of this global growth. In the U.S., Barber (2015) noted: (a) mountain bikers take two MTB vacations each year; (b) they bring their bikes on two additional trips each year; (c) 62% of mountain bikers travel to experience/ride new trails, with an average of 566 miles traveled from their home; (d) mountain bikers spend an average of \$382, and (e) more than half of MTB trips last two days or less. The top MTB destination in the U.S. is Moab, Utah (Barber, 2015).

An obvious aspect of MTB is the extent to which participants are physically active for extended periods of time. Barber (2015) reported MTB tourists averaged 55.5 mi (89.3 km) per trip and spent four hours and forty-five minutes riding each day during their trip. Current recommendations for general health and well-being stress the importance of being physically active. Although several studies on MTB exist, none have focused on the perceived health benefits from MTB. Hardiman and Burgin (2013) noted that more detailed information is needed related to motivations, demographics, and perceptions of MTB participants.

Pinch and Bijker (1984) introduced a social constructionist approach to the development of technologies related to the bicycle. The basic argument they made was that the success of a technological artefact (e.g., a mountain bike) is socially constructed. Critical to Pinch and Bijker's social construction of technology (SCOT) approach was the identification of "relevant social groups" (RSG), which they defined as:

... institutions and organizations (such as the military or some specific industrial company), as well as organized or unorganized groups of individuals. The key requirement is that all members of a certain social group share the same set of meanings, attached to a specific artefact. (p. 414)

Pinch and Bijker identified three primary groups that influenced technological innovation: (a) women, (b) older men, and (c) racing cyclists. As such, the purpose of this study was to explore the perceived health outcomes of mountain biking as they relate to the different MTB demographic groups in the U.S. The following research question will be addressed: Using the Perceived Health Outcomes of Recreation Scale, do the three dimensions of benefits (realization of a psychological experience; prevention of a worse condition; and improved condition) vary among gender, age, rider type, MTB membership, or regional location?

Literature Review

Outdoor Recreation and Physical Health Benefits

The International Mountain Bikers Association (IMBA) is the largest mountain bike advocacy group in the world, with over 40,000 members representing 205 chapters (IMBA, 2015). Given IMBA's growing membership, the promotion of healthy exercise alternatives in the U.S., and MTB's popularity and industry growth, it is important to explore perceived health benefits and outcomes derived from the sport of mountain biking. The U.S. Department of Health & Human Services (DHHS, 2008) has recommended at least 150 minutes of moderate physical activity, or 75 minutes of vigorous physical activity, per week to meet physical activity goals. Mountain biking in natural settings could be a vehicle for meeting physical activity goals.

Although empirical studies on the effect physical activity in natural settings has on one's overall health are nascent, there is evidence that parks and other natural areas have been linked to physical activity health benefits (Bedimo-Rung, Mowen, & Cohen, 2005; Kaczynski & Henderson, 2007; Kaczynski et al., 2011; Wilhelm Stanis et al., 2009). According to Giles-Corti et al. (2005), users of public outdoor recreation spaces are three times more likely to meet recommended physical activity levels. Additionally, evidence supports improved physical health from being in green spaces (Maller, Henderson-Wilson, & Townsend, 2009). More specific to MTB, Pretty et al. (2007) measured the effects of "green exercise" (i.e., adopting physical activities while at the same time being directly exposed to nature) in four regions of the United Kingdom (U.K.). Of the activity-based green exercises (e.g., mountain biking, boating, woodland activities, horse riding, walking, and fishing), mountain biking used the most calories overall, thereby leading to greater weight loss, and presumably better physical health. In the absence of more studies, or more precise measurements of physical health, it is important to ask participants in green exercise the extent to which they perceive receiving health benefits (outcomes) from participating in any given recreation activity in natural environments.

The Outcomes-Based Movement (formerly Benefits Movement) implored recreation professionals to not assume that recreation is inherently rewarding, but instead to identify and measure the beneficial outcomes (Allen & Cooper, 2003; Driver, Brown, & Peterson, 1991; Moore & Driver 2005). Leisure professionals must understand what the measurable outcomes are to promote and convey the "magnitude, pervasiveness, and social significance of particular types of benefits" to public agencies, related social service professionals, and those responsible for the provision of leisure services in the private sector (Driver, 1998, p. 26). Empirical evidence of health benefits is instrumental in positioning and promoting recreation and parks as vehicles that could address

current public issues, especially those related to health and quality of life (Gómez & Hill, 2016). Research demonstrating objective and measurable benefits is needed to justify funding, advocate for and guide the development of new facilities, improve best practices for management and programming, and increase participation in outdoor recreation activities (Gómez & Hill, 2016). Research has been conducted on the perceived health outcomes from hiking on trails and visiting state parks (Gómez & Hill, 2016; Gómez et al., 2016; Wu, Liu, & Cox, 2018), rock climbing (Hill et al., 2018), and participation in triathlons (Hill, Morgan, & Hopper, 2018); however, there is a dearth of information detailing the perception of health outcomes derived from participation in MTB (Outdoor Foundation, 2016).

Given the growth of the MTB industry, there has been a similar growth in the number of research articles devoted to MTB, culminating in a special issue in the *Journal of Outdoor Recreation and Tourism (JORT)* in 2016 (Pickering & Leung, 2016). The *JORT* special issue articles covered the history and popularity of MTB, as well as research spanning the globe (e.g., Scotland, Australia, U.S., New Zealand, Portugal, and Austria, among others), with qualitative (e.g., phenomenological) and quantitative (e.g., GIS and surveys) methodological approaches. Our goal here is not to be exhaustive of previous research, but to contextualize where the current research “fits,” with respect to previous studies on MTB. Previous studies on MTB have generally focused on two broad themes: management concerns and motivations/affect for mountain biking, not health outcomes. Of note are studies alluding to the importance of exploring demographic variables such as gender, age, and user type.

Gender

Huybers-Withers and Livingston (2010) noted that mountain biking is a lifestyle sport that has had women as a recognizable subcultural and emerging market since the 1990s. In an examination of female/male images, female-specific products, and advertisements targeted at women, they also found that advertisers in a prominent MTB niche magazine reinforced gender identity as “a narrow picture of masculinity, a masculinity similar to the physically dominant form found in mainstream sport” (Huybers-Withers & Livingston, 2010, p. 1214). As a lifestyle sport, mountain biking should be gender neutral and inclusive. However, studies have consistently shown that MTB is a male-dominated sport (Carothers, Vaske, & Donnelly, 2001; Chiu & Kriwoken, 2003; Pickering & Rossi, 2016), with male ridership representing 86% in the U.S., 97% in the U.K., and 86% in Australia (Hardiman & Burgin, 2013). Although male-dominated, in 60 intensive semi-structured interviews (35% of whom were women), McCormack (2017) found that many male respondents considered gender unimportant, and that the focus on gender for men shifted to skills, which men found more important than gender. McCormack reported that women felt supported as riders by the mountain biking community, but that they are often assumed to be beginners, must prove themselves to be fully accepted by men (reinforcing what men said about skills being more important than one’s gender), and some may seek out women-only group rides.

Age

Most mountain bikers on trails tend to be in their 30s and 40s (Chiu & Kriwoken, 2003). Trends show that extreme derivations of mountain biking (i.e., freestyle, downhill) are growing in both the Generation Y and Z demographic and skewed towards

young males seeking thrills as the ultimate experience (Carothers et al., 2001; Hardiman & Burgin, 2013). Hill, Wygant, Smith, and Gómez (2017) also found significant differences in younger versus older riders as it related to health perceptions. As trails, parks, and other mountain biking venues cater to a diversity of ages, future studies should be conducted. Young riders are becoming more prevalent in the sport with the rise of mountain biking as a competitive high school sport. The National Interscholastic Cycling Association (NICA), which develops mountain biking leagues for teenage students in the United States, had a 51% increase in participation in mountain biking events from 2014 to 2015 (NICA, 2016).

MTB Recreational Riders and Racers

Although no mountain biker typology exists, leisure pursuits can be distinguishable between those that are purely recreational riders or “less serious” riders (e.g., informal MTB outings) vs. those that are “more serious” MTB racers (e.g., competition participants, membership involvement, and trail builders/maintenance volunteers). Taylor (2010) noted that serious riders would demonstrate “perseverance, personal effort, and a strong identification with mountain biking and its social scene” than would recreational mountain bikers (p. 263). This suggests that more serious mountain bikers may be more likely to be formal members of organizations or associations and are more likely to follow prescribed ethical codes of conduct, such as IMBA’s “Rules of the Trail” (IMBA, n.d.). Ostensibly, these rules are recognized internationally as the official code of conduct for mountain bikers (Hardiman & Burgin, 2013).

Theoretical Framework

Efforts to justify the need for recreation experiences led to the Benefits Movement (Allen & Cooper, 2003); the Benefits Movement refers to the “ongoing process of leisure service providers to identify desirable individual, social, economic and environmental benefits derived from recreational experiences” (Allen & Cooper, 2003, p. 30). The Benefits Movement implores professionals not to assume that recreation is inherently rewarding, but rather to identify and measure associated outcomes (Allen & Cooper, 2003; Driver, Brown, & Peterson, 1991). The theoretical framework for this study is derived from recreation benefits theory. A recreation benefit, as defined by Driver (1998), has the following characteristics: (a) an outcome that causes a change resulting in a more desirable condition than the preexisting state, (b) the continuance of a desired condition in order to prevent an undesired condition from occurring, or (c) the realization of a satisfying experience resulting from recreation (Moore & Driver, 2005; O’Sullivan, 2006).

More specifically, in the 1990s and early 2000s, Driver and his colleagues conceptualized benefits or outcomes from recreation participation along three primary areas: (a) benefits related to the realization of a psychological (PSYC) experience (e.g., connecting with others, oneself, nature, relaxation and spirituality), (b) outcomes related to the prevention (PREV) of a worse condition (e.g., maintenance of good physical health and level of life satisfaction), and (c) outcomes related to an improved (IMPV) condition (e.g., improving skills or health, increased sense of community or familial bonding) (Driver et al., 1991; Moore & Driver, 2005). Kil et al. (2012) noted that improvement and prevention outcomes “accrue from both resource management and/or participation,” and includes longer-term outcomes, while realizing psychological expe-

riences “derives from engagement in recreation,” and has more immediate outcomes (p. 371). Outcomes are distinguished from motivations in that they are conceptualized as perceived outcomes resulting from participation, whereas motivations are preconceived notions that push one to participate in MTB.

Gómez et al. (2016) dubbed Driver’s three-dimensional conceptualization as Driver’s Typology of Leisure Benefits and operationalized its three dimensions in the Perceived Health Outcomes of Recreation Scale (PHORS). Gómez and Hill (2016) used PHORS at a U.S. state park on multi-use trail users. Their findings indicated no differences between men and women on prevention, improvement or psychological experience, indicating both genders similarly perceived health outcomes from trail usage. Gómez and Hill found age differences between older and younger users, where older users perceived prevention-related outcomes differently from younger users. Additionally, age was a significant predictor of trail use. The current study used the PHORS and applied it to the specific context of mountain biking to determine the perceived health outcomes of users.

Methods

Participants and Study Area

Data were collected in the U.S. via a self-administered online survey with help from IMBA as they announced the survey to its listserv and posted the link to the survey on their website. The survey link was available from mid-May to mid-August of 2015. In terms of gender, respondents were 80.2% male and 19.8% female. The average age was 42 ($M=41.92$, $SD=10.68$), and the median age was 42, indicating a normal age distribution (ages ranged from 15–77). The original race/ethnicity variable had six self-identification categories, including “other.” The majority of the study population was non-Hispanic whites (92.2%). The highest education category was a bachelor’s degree (37.6%), and the largest income category was \$100,000+ (40.1%).

A response rate was not easily attainable because IMBA only posted the link to their website, and the researchers did not track how many people visited the website directly for the test, nor how many who started the survey, completed it. There was no additional follow-up or tracking beyond the initial post. Researchers also failed to include a question of how respondents found out about the survey to see the effectiveness of the listserv post. Although researchers were not privy to the breakdown of the IMBA membership to test for representativeness, IMBA’s seven regions were represented in the sample: (a) Atlantic, (b) Southeast, (c) Great Lakes, (d) Midwest, (e) Southwest/South Central, (f) Pacific NW and CO+WY, and (g) The Pacific 3.

Survey Instrument

The PHORS was assessed for reliability, discriminant validity, and convergent reliability—all tests reflected a very sound instrument. Gómez et al. (2016) tested the PHORS instrument at three different sites (two national trails and one state park) and time periods and found the scale valid and reliable across all three sites and time periods (i.e., measurement invariance supported the three-structure model). The results indicated that the hypothesized three-factor model was an appropriate model, and that the 13 items and three dimensions were valid and reliable for measuring the PSYC, PREV and IMPV benefits (Table 1). For the purposes of this study, the word “hike” in the Perceived Health Outcomes of Recreation Scale was substituted with the

word “mountain biking” in the online questionnaire to reflect MTB activity related to trail use (Table 1). Changing the wording to fit the recreation context when using the PHORS was a recommendation given by Gómez et al. Additional information on the questionnaire was asked related to demographics, membership and mountain biking participation.

Table 1

Three Factor Analysis of Perceived Health Outcomes of Recreation Scale (PHORS), Maximum Likelihood Extraction, Promax Rotation on IMBA a Data (N=1231)

Items ^b I mountain bike ^c on trails because this activity ...	<i>M</i>	<i>SD</i>	λ^2	λ		
				PREV	IMPV	PSYC
<i>Psyc1</i> – causes me to appreciate life more	6.47	0.87	.565	.777	-.066	-.011
<i>Psyc3</i> – gives me a sense of self-reliance	5.81	1.31	.471	.598	.104	.087
<i>Psyc4</i> – gives me a sense of higher self-esteem	5.76	1.39	.486	.631	.128	.023
<i>Psyc5</i> – makes me more aware of who I am	5.79	1.39	.577	.774	.028	-.061
<i>Psyc6</i> – is connected to other positive aspects of my life	6.38	0.92	.333	.579	-.019	.012
<i>Psyc7</i> – causes me to be more satisfied with my life	6.53	0.75	.538	.767	-.120	-.001
<i>Prev1</i> – reduces my chances of developing diabetes	3.85	2.10	.633	.042	.826	-.116
<i>Prev3</i> – reduces my chances of having a heart attack	4.85	1.95	.839	-.102	.952	-.013
<i>Prev4</i> – reduces my chances of premature death	5.11	1.90	.664	-.040	.807	.047
<i>Prev5</i> – reduces my number of illnesses	5.27	1.73	.622	.118	.682	.106
<i>Impv1</i> – improves my overall fitness	6.76	0.52	.786	-.057	-.034	.923
<i>Impv2</i> – improves my overall health	6.75	0.56	.712	-.018	.014	.845
<i>Impv3</i> – improves my muscle strength	6.50	0.87	.368	.136	.003	.535
Eigenvalue				5.013	2.234	1.465
% of Variance				38.561	17.183	11.269
Cronbach's α				0.833	0.888	0.787

^a – IMBA = International Mountain Biking Association
^b – items on a 7-point scale from Likert-type scale where 1=never like me, 2=very much not like me, 3=moderately not like me, 4=somewhat not like me, 5=somewhat like me, 6=moderately like me, and 7=very much like me
^c – the word “hike/hiking” on the original scale replaced by “mountain bike” to adapt scale to mountain biking
 λ^2 = communalities; λ = factor loadings; factor loadings > .40 are in boldface.
 PSYC = Psychological Outcomes Factor; PREV = Prevention Outcomes Factor; IMPV = Improvement Outcomes Factor

Results

Data Analysis

Data were collected using Qualtrics and analyzed using IBM SPSS Statistics, v24. All analyses were performed at the $p < .05$ level. The initial database consisted of 1,319 cases. Data were assessed for non-normality by screening for univariate (i.e., individual item skewness and kurtosis) outliers in each of the databases following suggestions by Osborne (2012). For multivariate outliers, data were assessed with the Mahalanobis distance test. Based on the univariate and multivariate tests, 88 outliers were removed from the database, and all remaining items were within acceptable skewness and kurtosis metrics. After deleting problematic outliers, the data were then assessed for missing data (Tabacknick & Fidell, 2007). No items were missing more than 1% of data. Missing data were then handled using multiple imputation with maximum likelihood estimation. The final amount of useable surveys collected via online method was $N=1231$.

Descriptive Statistics

Just over half (50.6%) of the respondents were IMBA members. Respondents reported contributing an average of \$192.75 annually to IMBA, with a low of \$5 and a high of \$10,000. On average, respondents go mountain biking 11.66 times a month

($SD=6.62$), or nearly 3 times a week, with as low as one time a month, and as high as every day. About three fourths (76.5%) of respondents drive to their biking trail, and they travel approximately 16 miles away on average ($M=16.24$ mi., $SD=16.2$). Respondents were asked what features they would like to see added to mountain bike trails. The top three responses were (a) flow (i.e., the rhythm and fluidity of the trail; 76.1%), (b) long route options (58.9%) and (c) technical features (i.e., the challenge of obstacles, roots, turns, jumps, trees, etc., that deviates from straight or flat terrain; 57.7%). When asked what features or attributes they would like to see taken away, respondents' top three replies were (a) use restrictions (22.7%), (b) multi-use trails (12.4%) and (c) steep climbs (9.3%).

Inferential Statistics

The next set of analyses report differences in perceptions between subgroups for the purposes of data exploration. The following sections compare groups on perceived health outcomes using *t*-tests and ANOVA analyses. The three sections reflect Pinch and Bijkers' (1984) primary demographics: gender, age, rider type (recreational or racing cyclists).

Gender and MTB benefits. Women had significantly higher scores on PSYC (realization of a psychological experience) than men (Table 2). Men had significantly higher scores on PREV (prevention of a worse condition) than women. However, women and men did not differ significantly on IMPV (improvement of a current condition).

Table 2

Demographic t-test Analyses on Perceived Health Outcomes of Recreation Scale Dimensions

Variables	Realization of a Psychological Outcome				Prevention of a Condition				Improvement of a Condition			
	<i>M</i> ^a (<i>SD</i>)	<i>n</i>	<i>t</i> (<i>df</i>)	<i>p</i>	<i>M</i> (<i>SD</i>)	<i>n</i>	<i>t</i> (<i>df</i>)	<i>p</i>	<i>M</i> (<i>SD</i>)	<i>n</i>	<i>t</i> (<i>df</i>)	<i>p</i>
Gender												
Women	6.41 (0.67)	980	-6.12 (1220)	.0001	4.51 (1.72)	980	2.67 (1220)	.008	6.71 (0.50)	242	-1.56 (1220)	.120
Men	6.05 (0.86)	242			4.81 (1.65)	242			6.66 (0.51)	980		
IMBA ^b												
Member	6.16 (0.82)	603	-0.40 (249)	.069	4.81 (1.66)	603	-0.33 (249)	.280	6.69 (0.48)	603	-0.33 (249)	.082
Non-Member	6.08 (0.85)	588			4.71 (1.68)	588			6.64 (0.53)	588		

Age and MTB Benefits

The age variable was open-ended. Based on its distribution ($M=41.92$, $Mdn=42$), age was converted to an ordinal scale using the following categories: < 35 years old (26%), 35-40 years old (20%), 41-50 years old (32.2%), and > 50 years old (21.8%). A one-way, between subjects ANOVA was performed on the four age levels and mountain biking benefits. The results were significant for PREV, but no differences found on the PSYC and IMPV dimensions. For PREV, $F(3, 1221) = 7.31$, $p = .0001$, the Tukey HSD test revealed that the means differed significantly between the following groups: (a) < 35 years ($M=4.53$) and > 50 years ($M=5.11$), and (b) 35-40 years ($M=4.59$) and > 50 years ($M=5.11$). There were no differences found between the two younger categories.

ries, and no differences between the two older categories. Thus, a dichotomy was found where older bikers (> 50 years old) had a generally higher affinity towards PREV than did the younger bikers (< 40 years old).

IMBA Membership and Mountain Biking Benefits

The “commitment level to the sport” between riders was operationalized in terms of IMBA membership—assuming those who are IMBA members are more committed to the sport of mountain biking, and those who are not IMBA members are not as committed to the sport. This dichotomy was used as a proxy for Taylor’s (2010) notion of “serious” and “less serious” MTB participants. IMBA membership was about evenly split between members/serious (50.6%) and non-members/less serious (49.4%) participants. There were no differences between IMBA/non-IMBA members and PSYC, PREV or IMPV (Table 2).

Regions and biking benefits. In the U.S., IMBA has seven distinct regions: (a) Atlantic, (b) Southeast, (c) Great Lakes, (d) Midwest, (e) Southwest/South Central, (f) Pacific NW and CO+WY, and (g) The Pacific 3 (see Table 3 footnotes for state breakdown). We received responses from people in Washington, DC and all U.S. states, except North Dakota, Kansas and Delaware. The individual state with the highest representation was California (20%). When the IMBA regions are aggregated to the eastern states, central states, and western states in the U.S., there is a similar number of respondents per geographic region (Table 3) in the U.S. There were no differences between any of the seven regions and PSYC, PREV or IMPV.

Table 3
IMBA and U.S. Geographic Regions (N=1186)

	Regions	<i>n</i>	%
IMBA Regions			
	Atlantic ^a	181	15.3
	Southeast ^b	198	16.7
	Great Lakes ^c	191	16.1
	Midwest ^d	105	8.8
	Southwest & South Central ^e	115	9.7
	Pacific NW & CO+WY ^f	159	13.4
	The Pacific 3 ^g	237	20.0
Geographic Regions of the U.S.			
	Eastern States ^h	379	32.0
	Central States ⁱ	411	34.6
	Western States ^j	396	33.4

^a – Atlantic Region = CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV

^b – Southeast = AL, FL, GA, MS, NC, SC, TN

^c – Great Lakes = IL, IN, KY, MI, OH

^d – Midwest = IA, MN, NE, ND, SD, WI

^e – Southwest and South Central = AR, AZ, KS, LA, MO, NM, NV, OK, TX, UT

^f – Pacific NW and CO+WY = CO, ID, MT, OR, WA, WY

^g – AK, CA and HI

^h – Atlantic + Southeast

ⁱ – Great Lakes + Midwest + Southwest & South Central

^j – Pacific NW & CO+WY + The Pacific 3

Discussion

This study provides insight into the perceived health benefits of mountain bikers in the U.S. Similar to previous studies (Chiu & Kriwoken, 2003; Hardiman & Burgin, 2013), our findings indicate that mountain bikers in the U.S. tend to be wealthy, white males in their early 40s. Additionally, the sample is highly educated, reflecting prior studies (Carothers et al., 2001). The discussion is organized around Pinch and Brijker's (1984) recommended demographics and augmented (where applicable) by additional information. Following the recommended demographics, other demographics are presented, followed by limitations of the study.

Given that mountain biking continues to be a male-dominated sport, gender is a critical demographic variable. Our findings indicate that women perceive the realization of a psychological experience derived from MTB much more strongly than men do. In fact, gender was the only demographic variable where PSYC health outcomes were found to be different in this study. Given the items that make up PSYC outcomes from mountain biking (e.g., self-reliance, self-esteem, life satisfaction), our findings relate to previous findings noting that biking on a trail and the PSYC outcomes resulting from MTB could translate into other areas of life for women (McCormack, 2017). With respect to prevention, Huybers-Withers and Livingston (2010) noted that "it is natural for male athletes to play hurt and risk their long-term health ... paying the price through bodily health provides them with many privileges ... [and] traditional hegemonic ideals of masculinity" (p. 1215). Counter to this viewpoint, the results of our study found men to be higher than women in their perception of preventing a future condition (illness) as a benefit of MTB participation—indicating support for mountain biking as a "lifestyle" sport. Men and women perceived improvement benefits similarly. It might be of value to consider the marketing and educational components when recruiting and offering mountain bike programs for females. Many bicycling retail stores have started hosting clinics and rides for females only. In 2018, IMBA recognized the needs of women participants by organizing its first ever "IMBA UPRISING"—a women's summit led by female trail builders, chapter presidents, ride leaders, coaches and advocates (Blick, 2017). Out of this summit, IMBA announced May 5, 2018 as the inaugural International Women's Mountain Biking Day (Blick, 2018).

Age was one of two variables that was associated with participating in MTB to prevent a future condition. Similar to findings from Gómez and Hill (2016), the "50 and over" age group scored significantly higher on prevention as a reason for remaining physically active than any of the other groups under age 50. Gómez and Hill surmised that the difference between younger and older trail-hiking participants may have been due to a propensity for older people to want to naturally prevent the onset of a condition due to their age and sense of mortality. Another key finding with respect to age is that respondents under 35 years of age are more welcoming of multi-use trails than their older counterparts. This reinforces findings on younger walkers' more positive attitude toward bikers than their older counterparts (Hardiman & Burgin, 2013), and less conflict perceived between hikers and mountain bikers, especially in younger generations (Brown, 2016).

Regional variations were explored to see if MTB participants from different geographic regions differed in their perceptions of prevention, improvement and psychological benefits. We found no differences between any of the perceived benefits (PREV,

IMPV or PSYC) and regional affiliation. We echo Gómez and Hill's (2016) assertion that we are heartened by these nonsignificant findings, as they indicate that the perception of health benefits derived from MTB, generally speaking, are being perceived similarly throughout different parts of the U.S.

Management Implications

These results provide land managers evidence-based findings to address conflicts/challenges that might exist in their park, given the challenges of managing potential hiker-MTB conflict (Brown, 2016; Pickering & Rossi, 2016). Knowing that younger riders are more open to multi-use trails, managers could partner with local mountain biking IMBA chapters or clubs, or attend NICA-supported teenage MTB leagues, specifically targeting younger ridership. Representatives from the clubs or MTB leagues could host brief informative talks or set up tables at the trailhead. The partnership could foster positive relationships while sharing the workload for educating on responsible trail use (e.g., waiting until trails dry before riding). The partnership between parks and mountain biking clubs could also serve as an educational tool for hikers who might have challenges with multi-use trails, and sharing what practices MTB should employ (e.g., yielding to hikers).

Other findings meaningful to administrators are drawn from the responses about trail changes. When asked what features or attributes they would like to see taken away, almost 25% said use restrictions. It is possible users do not have the same lens land managers must use to impose restriction. It could be tied to city/state/federal finances, land acquisitions, policies, or stakeholders. Land managers might need to do even more when it comes to educating their users. Similarly, over 10% of respondents said they wanted multi-use trails removed. Riders who are unaware/uninformed of the above-mentioned managers' lens (e.g., managing for multi-users), might limit their understanding of the rationale for multi-use trails.

Limitations

A limitation of the study is the sampling framework. We assumed "less committed riders" based on IMBA membership. A note of caution is warranted because we surveyed people that visited the IMBA website, regardless of whether they are IMBA or non-IMBA members, and the self-selection process may not accurately reflect the less serious riders, as less serious riders might not visit the IMBA website. Another limitation is the representativeness of the sample. While we managed to have diverse regional representation, the researchers were unable to access IMBA's regional breakdown to more adequately compare our sample to the population. As such, the study could be viewed as a large convenience sample.

Future studies should aim to access mountain bikers who are not associated with IMBA or do not visit the organization's webpage. Future studies might also consider small focus groups or follow-up with individuals interested in expanding their responses. Adding a qualitative component might better tell the story of why women had significantly higher scores on the PSYC (realization of a psychological experience) outcome than men or why older mountain bikers (> 50 years old) had a generally higher affinity towards the PREV (prevention of a worse condition) benefit than did the younger bikers (< 40 years old). Gómez and Hill (2016) found the PSYC factor to have a significant impact on park use; however, we did not find support for any of the benefit dimensions' impact on use/visitation to mountain biking trails. We posit whether

the difference could be related to the nature of the participation. In Gómez and Hill's earlier study, hiking and park visits/usage were passive in nature, whereas the current study's mountain biking and trail visits/usage are much more active in nature. Future studies looking to explore the role of perceived health outcomes and recreation usage should consider the nature of the activity as an intermediary aspect of the relationship between benefits and usage.

Conclusion

The purpose of this study was to explore perceived health outcomes of MTB as they relate to different demographic groups. This research supports Gómez et al.'s (2016) factor structure of the PHORS, thus increasing the versatility of the newly developed scale to be used in a variety of recreation settings with desired health outcomes. This study may be useful to outdoor recreation programmers and public land use managers to better understand the "participants" while on park trails; and to allow for better recognition of benefits of mountain biking on trails or urban areas. For example, trail administrators could market the benefits of biking trails differently to women by focusing on the psychological benefits, and could focus on prevention benefits, particularly to older men. Outdoor advocacy groups could also use this research to promote the positive health outcomes of mountain biking, as well as to inform their marketing and recruitment strategies. Interestingly, and noteworthy from a public health perspective, mountain bikers who ride twice monthly, or every day, perceived similar outcomes. This provides support for the notion that mountain biking, even when participating with less frequency, bodes well as a possible recreation activity to address some of the challenges our society faces regarding unhealthy lifestyles. As recreation professionals we could be advocates for an alternative form of physical activity by introducing activities like mountain biking to new audiences, while articulating the possible health benefits achieved from participation.

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