SELF-REPORTED PRECAUTIONARY COVID-19 MEASURES TAKEN BY HIKERS, MOUNTAIN BIKERS, AND TRAIL RUNNERS IN CALIFORNIA DURING SPRING 2020

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ABSTRACT: Introduction. To slow COVID-19's progress in California, Governor Newsom issued an executive order on March 19, 2020, closing exercise facilities and implementing a stay-at-home order. This study sought to describe and compare social distancing habits and the use of personal protective equipment (PPE) by people participating in outdoor sports in California's public open spaces during the pandemic.

Methods. From April 29 to May 20, 2020, an online LimeSurvey questionnaire was distributed to over 40 outdoor organizations across California. Data was analyzed via descriptive statistics and compared using Pearson Chi-squared test ($P<0.05$). The target population included hikers, mountain bikers, and trail runners using California's public open space following Governor Newsom's March 19, 2020, order.

Results. Of all the respondents (n=822), 87% (n=712) reported distancing of greater than 1.8 m (6 ft) around others on trails. Further, 56% of mountain bikers (n=223), 48% of trail runners (n=100), and 35% of hikers (n=499) reported not wearing a facial covering during outdoor exercise. Additionally, 71% (n=584) did not worry about COVID-19 exposure while outdoors and 59% (n=487) of respondents did not think it is important to wear PPE while participating in either hiking, mountain biking, or trail running.

Conclusions. Responding trail users reported adhering to physical distancing guidelines while on trail systems. However, respondents reported not wearing personal protective equipment while exercising outdoors.

Keywords. Wilderness medicine, outdoor exercise, social distancing

Introduction

SARS-CoV-2, the virus causing COVID-19, surged across the world in 2020, triggering an ongoing global health crisis. Seven months after the first case was reported in the United States in January 2020, 4,388,566 cases and 150,054 deaths were documented by the World Health Organization (Holshue et al, 2020; World Health Organization, 2020). According to the Center for Disease Control (CDC), as of July 13, 2020, California reported over 300,000 cases. This number has since increased. COVID-19 most likely spreads by a combination of a droplet and airborne infectious agents (Setti, et al, 2020). In order to decrease communicable transmission, the CDC set forth guidelines urging all citizens to practice six feet of social distancing, avoid gatherings, and wear masks until medical research provides further recommendations (Chaney, 2020).

Understanding what it means to be safe from COVID-19 infection while in an outdoor environment is still developing. This study was conducted in California, where it was estimated 14 million people utilize unpaved trail systems at least once per month prior to the pandemic ("Survey of Public Opinions and Attitudes on Outdoor Recreation in California," 2014). The purpose of this research project was to determine whether California's exercising

public subscribes to the CDC's COVID-19 prevention guidelines while participating in hiking, mountain biking, and trail running in public open spaces. This can help inform public health guidelines in the management of future pandemics. This research project provides quantitative measures of a sample of the California public's self-reported behavior regarding trail system conduct in the first wave of the COVID-19 pandemic. Additionally, this study compared the different social distancing practices between the three sports, respondents' change in habits, and concern for contracting COVID-19 from other trail users.

Methods

This cross-sectional study was derived from an anonymous online survey of Californians exercising outdoors and participating in three specific sports, following the issuance of the governor's stay-at-home order on March 19, 2020. The specified sports were hiking, mountain biking, and trail running in public open space. Public open spaces were not strictly defined because each individual has their own idea of wilderness (Townes, 2002). For the purposes of this study, the term "trail users" both encompassed and was limited to describing responding hikers, mountain bikers, and trail runners, which were the three sports examined.

Study Design and Data Collection

An invitational email was distributed to over 40 outdoor organizations, corporations, associations, and clubs across California. Participating organizations then distributed the survey via a link to its members. The field period was April 29, 2020, through May 20, 2020. The survey included information on demographics, sporting experience and frequency, COVID-19 beliefs, and utilization of PPE. For this study, PPE was defined as any form of facial covering. Classification of respondents being at high-risk of developing complications from COVID-19 was based upon a positive response regarding such conditions as exceeding 65 years of age, history of smoking, diabetes, cardiovascular disease, chronic respiratory problems, hypertension, and/or obesity. The methodology and the 23-question survey was approved by University of Washington's institutional review board. It was distributed via *LimeSurvey*. After programming, the survey was pilot tested with several remote participants. Though the pilot test did not uncover any technical problems, the wording on some questions was slightly modified due to the pilot testers' input.

Inclusion criteria were as follows: 18 years old or older, residing in California, literate in English or Spanish, and participated in specified outdoor activities after March 19, 2020. Exclusion criteria were failure to complete mandatory answers or breaking anonymity. The survey was designed so that upon completion, respondents were provided a random numerical code in order to withdraw their responses upon request.

Statistical Analysis

Collected data was generated via *LimeSurvey* and was completely anonymous. *LimeSurvey* was programmed not to record IP addresses in order to ensure the anonymity of the survey. Respondents' data was analyzed in SPSS 26.0 courtesy of SPSS Inc, Chicago, IL. Baseline characteristics were determined using descriptive statistics. Data was compared using Pearson Chi-squared test. A p-value of <0.05 was considered statistically significant. Data was presented as mean±SD or percentages rounded to the nearest integer, as appropriate. The population was estimated to be 14 million people, with a sample size of 822 respondents there was an associated conservative 5% margin of error (n=384 or larger).

Results

Of the 1,050 respondents who opened the online survey, 78.3% (n=822) completed the mandatory questions and did not break anonymity; 225 responses were incomplete and three respondents' broke anonymity by

Table 1
Demographics

	%	(n)
Age (y)		
18 – 30	25	(208)
31- 40	21	(174)
41 – 50	20	(167)
51 – 64	23	(189)
>65	10	(84)
Sex		
Female	56	(457)
Male	44	(360)
Other	1	(5)
Region of California		
North	31	(256)
Central	21	(170)
South	48	(396)
High risk for complications		
Yes	22	(183)
No	78	(639)
Level of education		
No Education	1	(4)
High School/GED	18	(145)
College	47	(389)
Graduate/Doctorate	34	(284)
Sex by sport		
Hikers		
Female	41	(338)
Male	19	(156)
Other	1	(5)
Mountain Bikers		
Female	7	(55)
Male	20	(168)
Trail Runners		
Female	8	(64)
Male	4	(36)

providing personal information coupled with the randomly generated numerical code via email and were thus excluded.

Table 1 indicates respondent demographics. There were 819 English speakers and three Spanish speakers, with 56% (n=457) being of female sex. The age of all respondents was 43.4 years ±15.6. Most of the respondents, 78% (n=639), did not categorize themselves as falling into the high-risk population of developing complications from COVID-19 due to pre-existing conditions. Additional data showed that 26% of hikers, 11% of trail runners, and 19% of mountain bikers considered themselves in the high-risk category for developing severe complications from COVID-19 infection.

Table 2 reflects data specifically pertaining to COVID-19 infection prevention. The vast majority, 85% (n=695) of trail users reported the stay-at-home order changed where they normally exercise with 26% (n=217) stating that they spent more time exercising outdoors. Further, Table 2 compares data between the specified outdoor sports and compliance with social distancing guidelines. Among the three specified sports, most respondents routinely maintained 1.8 m (6

Table 2
Comparison of outdoor sports and social distancing guidelines

	Total n=822		Hikers n=499		Trail Runners n=100		Mountain Bikers n=223	
	%	(n)	%	(n)	%	(n)	%	(n)
Distance between persons of differing households								
<6ft	13	(110)	10	(48)	22	(22)	18	(40)
≥6ft	67	(553)	73	(363)	65	(65)	56	(125)
At least 12 feet	19	(159)	18	(88)	13	(13)	26	(58)
Time exercising outside after Stay-At-Home								
Less	46	(376)	51	(253)	37	(37)	39	(87)
Same Amount	28	(229)	23	(113)	27	(27)	27	(61)
More	26	(217)	27	(133)	36	(36)	34	(75)
Worried about contracting COVID-19 during outdoor exercise								
Yes	29	(238)	30	(147)	27	(27)	29	(64)
No	71	(584)	71	(352)	73	(73)	71	(159)
Believe it is important to wear PPE exercising outside								
Yes	41	(335)	44	(217)	38	(38)	36	(80)
No	59	(487)	57	(282)	62	(62)	64	(143)
Should others use PPE while exercising outdoors								
Yes	49	(404)	53	(262)	46	(46)	43	(96)
No	51	(418)	48	(237)	54	(54)	57	(127)
Use PPE while exercising outside								
Yes	52	(425)	65	(275)	52	(52)	44	(98)
No	48	(397)	35	(224)	48	(48)	56	(125)

ft) or greater distance between themselves and others not of the same household. Hikers were most likely to maintain at least 1.8 m (6 ft) of distancing on trails. There was no statistically significant difference between respondents in different sports reporting being worried about contracting COVID-19 while participating in their respective outdoor sport (P=0.881). Of the total respondents: 44% (n=361) reported their physical fitness decreased due to social distancing regulations. Specifically, 49% of hikers reported their physical fitness decreased; 35% of trail runners reported their physical fitness decreased; 37% of mountain bikers reported their physical fitness decreased as well.

Overall, the use of a facial covering while exercising outside was not a unanimous practice; 48% of respondents reported not wearing PPE while exercising outside. There was no statistically significant difference between the three sports and thinking it was important to wear PPE while exercising should they be asymptomatic for COVID-19 (P=0.051). In the 18–30-year-old age group, 15% reported wearing PPE while exercising outside. Of the total population surveyed, 10% (n=84) reported being over the age of 65 years old. Only 8% of those over the age of 65 years reported wearing PPE while exercising outside.

Almost 60% of the sample population did not believe it is important to wear PPE while exercising outside; further, educational level did not influence belief in PPE utilization (P=0.132). Of the respondents who attained a college or graduate degree (n=673), 50% reported that during outdoor exercise people should wear PPE. Statistically significant differences were reported between wearing PPE and educational level (P=0.015) where 55% of respondents with a college or graduate degree (n=370) wore PPE while exercising outside; only 11% of those with a GED or no schooling (n=149) wore PPE. Finally, different sexes did not report statistically significant differences (P=0.299) of worrying about contracting COVID-19 while exercising outside.

Limitations

The nature of this study, being a self-reported survey, relies on respondents being honest; therefore, the accuracy of the data is questionable. A respondent who chose to participate in this survey introduced selection bias. An individual more interested in COVID-19 and overall social distancing practices was more likely to respond to the invitation to complete the survey. The highly educated population in this study may be due to survey bias. The sample included individuals associated with an outdoor organization, indicating a sample bias, whereas some individuals may use trail systems without associating themselves with an outdoor organization. The survey was also distributed via the internet, thus not all hikers, mountain bikers, and trail runners in California had equal opportunity to respond. There was a current lack of recent data describing the California population that utilized trail systems for exercise in the midst of the pandemic, so the target population may be greater or less than 14 million people7. It should be noted trail runners made up only 12% of the sample size, which induces bias.

Discussion

Results indicated the SARS-CoV-2 pandemic caused trail users to change where they normally exercised, sending 26% of the respondents outdoors more frequently than normal. Over 80% of the respondents held at least a college degree and over one-fifth of respondents reported being in a high-risk category for complications of COVID-19. Results further indicated that most trail users attempted to maintain 1.8 m (6 ft) of distance between each other, but most did not believe it is important to utilize PPE while participating in their outdoor sport. Regardless of education level, 71% of respondents do not worry about contracting COVID-19 in the outdoor environment.

Of the three sports, hikers tended to be the most cautious with the majority maintaining at least 1.8 m (6 ft) of distance from others. While hikers reported spending less time exercising outside after Governor Newsom's executive order compared to the two other sports, hikers tended to maintain the most distance between others outside their household and reported higher rates of utilizing PPE. Trail runners and mountain bikers, possibly due to their aerobic sport, were least likely to wear PPE. While mountain bikers were least likely to wear PPE, they reported the highest rate (26%) of maintaining more than 3.7 m (12 ft) of distance between others.

These results suggest an expansive frontier for future research studies exploring COVID-19 in the wilderness as well as the broader impacts of SARS-CoV-2 as it may apply to future pandemics. Specifically, future research into the contractibility of COVID-19 in an outdoor environment is needed in order to advise trail users regarding protection of personal and communal health. Another aspect of future research is determining how the small size of the SARS-CoV-2 virion affects its mobility, particularly when factoring in such variables as wind, trail dust, and a person's increased

respiratory efforts as well as its overall ability to cause a clinical syndrome. As 44% of respondents reported a decrease in their level of physical fitness, the long-term impacts to the health of the individual and society as a whole merits investigation. Such future studies would lead to more efficient management of future pandemics, including how best to create public health guidelines for outdoor contexts and communicating these guidelines to the public.

Conclusion

This study suggests the majority of trail users in California did not have concerns regarding contraction of COVID-19 while participating in outdoor recreation and nearly half of trail users did not wear PPE while exercising outdoors. However, trail users reported adherence to physical distancing guidelines of 1.8 m (6 ft). It is important to consider this data was self-reported and may not be accurate to as how the public is behaving on California trail systems. This data can help formulate public education material regarding COVID-19 avoidance measures while exercising outdoors, particularly when coupled with further research on the mobility of SARS-CoV-2 virions in outdoor environments. This data can also help public health officials implement realistic behavioral guidelines in the management of future pandemics. Another avenue for future research would be to compare the publics' conduct on trail systems in the spring of 2021 compared to this research project which analyzed the spring of 2020. It would be interesting to learn if a year or more after the initial introduction of COVID-19 to California if the public remains not concerned about contracting COVID-19 while participating in outdoor recreational activities. When conducting future research, it would also be best to design a study in which the methodology was independent of self-reported information.

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