

ORIGINAL SCIENTIFIC PAPER

Cycling as Transportation & COVID-19: Advantages of Shared Bicycles during Epidemics

Vahid Saatchian¹, Amin Azimkhani², Mutlu Türkmen³ and Dorri Dolatkahh Laein⁴

¹Imam Reza International University, Sports Management Department, Mashhad, Iran, ²Imam Reza International University, Sports Science Department, Mashhad, Iran, ³Bayburt University, Physical Education and Sports College, Bayburt, Turkey, ⁴Imam Reza International University, Sports Management Department, Mashhad, Iran

Abstract

In addition to the environmental problems that have plagued human life in recent decades, the outbreak of the coronavirus epidemic has endangered people's health and adversely affected their lives in other ways. Therefore, the present study aimed to investigate the advantage of using shared bicycles (SB) during the outbreak of epidemics. For this purpose, 310 male subscribers of an SB system were examined. The research tool was a questionnaire taken from studies. The results showed that the environmental and health advantages were favourable, but the place advantage indicated a relatively unfavourable situation. The results of the structural equation model also showed that the advantages of using an SB based on the highest impact are the motivational advantage, health advantage, environmental advantage, social advantage, financial advantage and place advantage. These results can provide useful solutions for governments to reduce environmental risks and maintain health and physical activity during epidemics.

Keywords: *shared bike, bicycle advantage, epidemics, COVID-19*

Introduction

The world is dealing environmental pollution issues caused by exhaust emissions, including hydrocarbons, nitrogen oxides, carbon monoxide, and particulate matter from vehicles using traditional fuels, such as gasoline and diesel, and these were expected to significantly increase by 2020 (Pielecha, Merkisz, Jasiński, & Gis, 2015). In recent decades, the emphasis of urban transport policies has been placed on developing sustainable transportation strategies in a way that protects the interests of future generations. Civil society organizations are considering sustainable low-carbon transportation options and measures to increase non-motorized transportation modes (such as cycling and walking) (Agarwal, Ziemke, & Nagel, 2019). Today, due to various transportation problems and various environmental pollutants; as an active and sustainable means of transportation, bicycles play an essential role in the development of multilateral transportation systems (Rybarczyk & Wu, 2010).

Therefore, doing sports activities in accordance with the principles of health can also improve people's physical and mental health during epidemics.

Physical activity (PA) also plays a significant role in mental health and cognitive function because exercise has positive effects on preventing and reducing depressive symptoms, reducing anxiety, improving learning, and is useful for cognitive function in the elderly. In addition to promoting PA, participation in sports allows the participant to progress psychosocially, become a member of a community, and create a social network. With limited social activities due to mandated restrictions, organized sports activities are greatly reduced during the virus outbreak. In this regard, it is imperative to continue physical activity (PA) in order to maintain good physical and mental health while facing the current challenges imposed by COVID-19 (Jakobsson, Malm, Furberg, Ekelund, & Svensson, 2020). As the world has struggled with COVID-19, sports faced an unprecedented



Correspondence:

A. Azimkhani

Imam Reza International University, Sports Science Department, Razavi Khorasan Province, Mashhad, Sanabaad, Daneshgah Avenue, Iran Mashhad, Iran

Email: amin.azimkhani@imamreza.ac.ir

crisis. Tournaments have been cancelled and postponed, and quarantined athletes lead to adverse decisions about sports activities (Gallego, Nishiura, Sah, & Rodriguez-Morales, 2020).

However, the use of personal transport compared to public transport can have different benefits during epidemics. By providing numerous benefits for traffic, health and cost, cycling has led to rapid growth as an important transportation mode in many countries (Saplıoğlu & Aydın, 2018). Cycling can help reduce pollution and traffic congestion. Bicycles consume less energy and bring health to their users. They can also provide quick, affordable access to parts of cities that are more difficult to reach by public transport or large vehicles (Karanikola, Panagopoulos, Tampakis, & Tsantopoulos, 2018). Cycling is also a good source of PA at a time in which physical activity is declining, and obesity is relatively widespread (Killingsworth, 2003). Cycling is a type of physical activity that offers multiple benefits to its users. In addition to satisfaction (De Hartog, Boogaard, Nijland, & Hoek, 2010), cycling provides significant flexibility over other modes of transportation (Akar & Clifton, 2009) while simultaneously making travel affordable, thereby increasing social cohesion (Gatersleben & Appleton, 2007). Bicycles are also beneficial for health and longevity (Reynolds, Winters, Ries, & Gouge, 2010), and have significant health effects, especially for groups with low or moderate levels of exercise (Börjesson & Eliasson, 2012).

Pucher and Boehler's (2008) study showed that cities with high levels of cycling and adequate safety tend to have extensive infrastructure as well as pro-cycling policies and programs. The research of Que & He (2018) suggests that SB can play an essential role in the development of urban transportation and provide useful information for urban transportation policies. Also, Legros (2019) shows that only a small amount of intervention from the operator, such as changing the location of the bikes, prioritizing the nearest and most active stations, can significantly increase the quality of bicycle services. Dill (2009) has also demonstrated that cycling can be used for transportation by adults to follow the recommendations for daily PA. De Hartog et al. (2010) indicate that due to the health benefits of increasing PA, there are significant social benefits for cycling. The findings of R. Wu, Z. Wu, Wen, Cai, and Li (2019) show that in the relationship between perceived usefulness and usage intention, perceived ease of use and facilitating conditions played moderating roles. However, concerning the effect of enjoyment on usage intention, the moderating effects of perceived ease of use and facilitating conditions were not significant. Handy and Xing (2011) provide empirical evidence of the impact of physical and social environmental factors on cycling, although individual attitudes and limitations are the most critical determinants of cycling. Akar & Clifton (2009) have stated that people who consider walking and cycling to be a form of exercise and identify flexibility of departure time as an essential factor in their mode choice are more likely to use bicycles.

Maintaining regular PA during self-isolation (quarantine) due to a sedentary lifestyle is essential in preventing chronic health conditions in the future. During crises, applied medical care and community service are of paramount importance. To prevent physical and mental distress, governments, public health officials, and the public themselves

need to be vigilant in maintaining PA during the COVID-19 pandemic (Jakobsson et al., 2020). Physical inactivity is a growing problem that exists both individually and socially. The World Health Organization (WHO) has concluded that physical inactivity and overweight/obesity are the fourth and fifth most dangerous risk factors for non-communicable diseases, respectively (Raustorp & Koglin, 2019). Sports activities that bring communities together are also intricately linked to particularly significant human health problems (Memish et al., 2019). In the current pandemic, in which the infection increasingly global and interdependent in almost every corner of the globe and has the potential to transcend psychological and economic boundaries, many important sporting events have either been cancelled or postponed to a definite or uncertain future date (Gilat & Cole, 2020; Brown & Horton, 2020). The severity of the situation could also lead to austerity measures by governments in various countries to prevent the spread of the disease (Corsini, Bisciotti, Eirale, & Volpi, 2020).

Concerned about changing world conditions, cities around the world have begun to implement policies to promote cycling (Karanikola et al., 2018). In this regard, the emergence of bike-sharing is closely related to its social and environmental benefits (Qiu & He, 2018) and is a good option for solving environmental problems related to the use of automobiles in major European cities (Zuurbier, Willems, Schaap, Van der Zee, & Hoek, 2019). These bikes can reduce the emission of hazardous particles and gaseous pollutants (MacNaughton, Melly, Vallarino, Adamkiewicz, & Spengler, 2014), and also reduce traffic congestion (Legros, 2019) and reduce noise pollution (Caulfield, O'Mahony, Brazil, & Weldon, 2017). Therefore, the present study seeks to provide valuable results in this regard by examining the benefits of using SB services in comparison with public transport (bus and taxi) during the outbreak of epidemic diseases. Thus, it is imperative to conduct this study in terms of the conditions under review and the current environment in countries affected by coronavirus epidemic, especially in Iran, which has been one of the high-risk countries for this epidemic. However, only limited research has directly or indirectly investigated SB and epidemics.

Methods

Participants

The statistical population of the study included all male registrants in the SB system of the city of Mashhad who regularly used SB (N=310). According to the statistical population type, the sample size was calculated to be 170 using the Morgan table. Table 1 shows the general characteristics of the Participants.

Research tool

To measure the behaviour of SB users, a questionnaire containing 24 questions was used, which was classified into five components: environmental advantage, financial advantage, place advantage, health advantage, social advantage, and motivational advantage. This tool has been adapted from previous research studies (Huang, 1998; Lim, 2006) on the use of shared bicycles. The main components and contents of the questionnaire are given in Table 2.

The questionnaire was measured on a five-point Likert scale.

Table 1. Demographic Details of the Participants

	Characteristic	Frequency	Percentage
Age	-20	2	1.2
	21-30	44	25.9
	31-40	51	30
	+41	73	42.9
Marital status	Single	33	19.4
	Married	137	80.6
Education	Diploma & less	37	21.8
	College degree	38	22.4
	Bachelor	72	42.4
	Master & more	23	13.5
job	Self-employment	50	29.4
	Employee	76	44.7
	Student	15	8.8
	Retired	29	17.1

Table 2. Questionnaire Configuration

Factor	Item	Number of Items
Environmental advantage	Bicycle usefulness for environment	4
	Energy efficiency	
	Environmentally friendly production process	
	Less environmental pollution	
Social advantage	Correct Informing	5
	Attract specific contacts	
	Increase environment awareness	
	Enough city advertising	
Financial advantage	Creating environmental attitude	3
	Fair cost	
	Good money value	
Place advantage	Save time and money	4
	Appropriate station distances installation	
	Stations access in residential areas	
Health advantage	Stations' suitable number	4
	Proper station schedule	
	Reducing stress	
	Relaxation	
Motivational advantage	health and fitness	4
	Keep fitness	
	Belonging to SB system	
	Commitment to SB system	
	Continuous use of SB	4
	Introducing the SB to others	

Validity test

A factor analysis was conducted to guarantee the validity, and as shown in Table 3, the questionnaire about the use of SB includes five factors: environmental advantage, financial advantage, place advantage, health advantage, social advantage, and motivational advantage. Factors accounted for about 62% of the

total variance, and the reliability coefficient of the questionnaire was all over 0.8 ($\alpha = 0.820$) in total, thus proving reliability.

Data processing

After the inappropriate data were deleted, the collected data were subjected to extensive analysis and performance anal-

Table 3. Factor Analysis of advantages of shared bike

Item		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Motivational advantage	BBS	0.643					
	CBS	0.526					
	CUB	0.645					
	IBO	0.580					
Place advantage	ASDI		0.505				
	SARA		0.642				
	SSN		0.589				
	PSS		0.362				
Social advantage	CI			0.791			
	ASP			0.617			
	IEA			0.621			
	ECA			0.761			
	CEA			0.551			
Financial advantage	FC				0.845		
	GMV				0.851		
	STM				0.682		
Environmental advantage	BUE					0.784	
	EE					0.613	
	FEPP					0.608	
	LEP					0.706	
Health advantage	RS						0.874
	R						0.838
	HF						0.372
	KF						0.458
Eigenvalue		3.146	2.736	2.576	2.248	2.100	2.027
% of Variance		13.108	11.399	10.732	9.365	8.750	8.444
Cumulative %		13.108	24.506	35.238	44.603	53.354	61.798
Cronbach's α		0.749	0.802	0.750	0.780	0.641	0.769

Legend: BBS-Belonging to SB system; CBS-Commitment to SB system; CUB-Continuous use of shared bike; IBO-Introducing the SB to others; ASDI-Appropriate station distances installation; SARA-Stations access in residential areas; SSN-Stations' suitable number; PSS-Proper station schedule; CI-Correct Informing; ASP-Attract specific contacts; IEA-Increase environment awareness; ECA-Enough city's advertising; CEA-Creating environmental attitude; FC-Fair cost; GMV-Good money value; STM-Save time and money; BUE-Bicycle usefulness for environment; EE-Energy efficiency; FEPP-Friendly environmentally production process; LEP-Less environmental pollution; RS-Reducing stress; R-Relaxation; HF-health and fitness; KF-Keep fitness

ysis of the importance of the components. First, a frequency analysis was conducted to examine the demographic characteristics of the subjects. Then, exploratory factor analysis was conducted to validate the components of the advantage of using a shared bike, including the environmental, financial, place, social, health, and motivational advantages. Data reliability was also confirmed by Cronbach's alpha coefficient,

which measures internal consistency between the items.

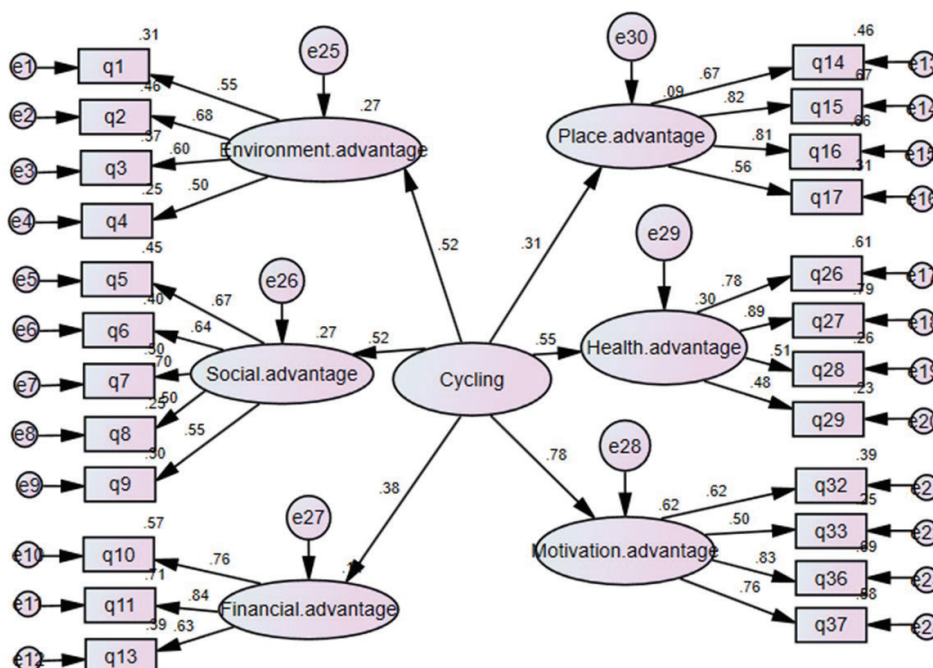
Finally, performance analysis of item importance was performed based on SB users, using SPSS 24. Also, the structural equation model of the relationship between cycling and its components is illustrated using AMOS software in Figure 1. The output results of the structural equation model are shown in Tables 4 and 5.

Table 4. Output results of the structural equation model

Variable	Variable	Estimate	S.E.	C.R.	P	Standard regression weight
Environment advantage	<--- Cycling	1.000				0.516
Financial advantage	<--- Cycling	2.028	0.751	2.702	0.007	0.378
Motivation advantage	<--- Cycling	3.719	1.133	3.281	0.001	0.785
Place advantage	<--- Cycling	2.212	0.922	2.399	0.016	0.307
Social advantage	<--- Cycling	3.638	1.189	3.060	0.002	0.517
Health advantage	<--- Cycling	3.192	0.986	3.238	0.001	0.579

Table 5. Model fit indicators

Fit indicators	CMIN/DF	P	GFI	IFI	CFI	RMSEA
Amount	1.996	0.0001	0.814	0.819	0.815	0.077

**FIGURE 1.** Structural Equation Model

Results

One-sample t-test was used to investigate the role and

importance of research components. The output results are shown in Tables 6.

Table 6. One-sample statistics

Variable	Mean±Std. Dev.	Std. Error Mean
Environment advantage	4.68±0.369	0.028
Social advantage	3.20±0.720	0.055
Financial advantage	4.26±0.596	0.045
Place advantage	2.90±0.922	0.070
Health advantage	4.27±0.524	0.040
Motivation advantage	4.18±0.595	0.045

The average score of the environmental advantages item (4.68) indicates a favourable situation, in which the usefulness of the SB for the environment and the lower environmental pollution have a higher average. Also, the average score of the health advantages item (4.27) indicates the favourable situation that health and well-being and maintaining the fit of the bicycle have a higher average. The average score of the financial advantages item (4.26) also indicates the favourable situation that the fair cost of using an SB has a higher average. The average score of the motivational advantages item (4.18) indicates a favourable situation, which means that the continuation of using SB and the introduction of the SB system to others have a higher average. The average score of the social advantages item (3.20) indicates a relatively favourable situation, which is a higher average than the increase in awareness of the environment and the creation of an ecological environment. However, the average score of the place advantages item (2.90) indicates the relatively unfavourable situation in which the appropriate number of stations and the appropriate schedule of the sta-

tions have the lowest average. Also, according to the coefficients of the path explained in the structural equation model, the motivational advantage (0.78), health advantage (0.55), environmental advantage (0.52), social advantage (0.52), and financial advantage (0.38) and spatial advantage (0.62) have the highest impact.

Discussion

In general, assessing the outbreak of COVID-19 throughout the world requires a comprehensive and systematic understanding. In addition, the focus of the effects of this crisis on countries' sports industry sports services, especially people's physical activities. Therefore, one of the topics that can be examined in this period is to perform healthy activities with respect to social distance, because of the use of shared bicycles is considered as a suitable temporary solution. Therefore, one of the topics that can be examined in this period is to perform healthy activities regard to social distance, which because of the use of SB is considered as a suitable temporary solution.

However, attention to the issue of home quarantine has always been a complex challenge for politicians. As a result, the present study seeks to identify the advantages of using anSB. According to the research findings, the advantages of cycling are of great importance, and each has significant effects on its own. This finding is consistent with those of Mueller et al. (2015), Gatersleben and Appletonet (2007), Sapliogluand Aydin (2018), Karanikola et al. (2018). Willis, Manaugh, and El-Geneidy (2015) state that these factors, especially understanding the advantages of cycling, reflect the attitude towards cycling and other modes of transportation. The following are an analysis of each of the advantages of the shared bike:

Motivational advantage

The importance and high impact of motivational advantage reflect the value of SB use among its users. A commitment to SB systems leads to the continued use of shared bikes. Users of these systems are extremely interested in introducing SB to other citizens for transportation in the city. Analysing the research of Handy and Jing (2011) reveals that individual attitudes and limitations are the most critical determinants of cycling. This can be considered the most critical factor for users of this device compared to public transportation during the outbreak of COVID-19. As a result, paying attention to the motivational needs of users against the use of this device is one of the essential priorities of decision-makers.

Health advantage

The importance and impact of health benefits reflect the high value of SB use among its users. Cycling can meet the health expectations of its users. The use of SB is effective in improving the health and well-being of citizens and aids in relaxing and reducing stress, especially during the COVID-19 outbreak, while also helping them to maintain fitness and improve their physical fitness during quarantine. Mueller et al. (2015) stated that the effect of increasing physical activity had the highest estimate on the health advantages, which far exceeded the harmful effects of traffic accidents and air pollution on health. Therefore, paying attention to this aspect of advantage compared to public transportation during the outbreak of COVID-19 can improve the immune system of users, in addition to aiding in controlling the widespread outbreak of this disease.

Environmental advantage

The importance and impact of environmental advantages also show the high value of SB use among its users. Cycling, as a means of transportation, seems to be useful for the environment compared to the public transportation; it is very efficient in terms of energy consumption and can minimize environmental pollution through an environmentally friendly production process. In their research, Qiu and He (2018) showed that

Acknowledgements

There are no acknowledgments

Conflict of Interest

The authors declare that there are no conflicts of interest.

Received: 14 June 2020 | **Accepted:** 03 August 2020 | **Published:** 01 February 2021

Reference

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bicycle sharing significantly reduced traffic, reduced energy consumption, reduced emissions, and overall environmental protection. Because the use of public transportation causes environmental pollution and is a significant factor in the spread of the disease, to the use of SB is a crucial factor in this issue.

Social advantage

The relatively moderate importance and impact of social advantage suggest that by informing and raising awareness about the environment, as well as safe transportation methods during the outbreak of epidemics, more users can be encouraged to use SB. Attracting specific audiences and creating environmental and personal health attitudes in them can lead to an increase in SB users. Handy and Xing (2011) stated that the social environment and the development of bicycle use policies and programs are effective in increasing the rate of cycling. However, during this period, social constraints have made this issue of moderate importance.

Financial advantage

The importance and impact of financial advantages reflect the value of using anSB to its users. The fair cost of using SB and the association of good value for money is vital for general bike users. Cycling also saves time and money, which is valuable for users. In this regard, Börjesson and Eliasson (2012) stated that with the development of bicycles and increasing their speed and comfort, the use of bicycles for users will be affordable. As a result, the development of bicycle-based networks in the city can provide better support to users during the outbreak of epidemics.

Place advantage

The low importance and impact of place advantages suggest that creating and deploying the right number of bike stations in residential areas and easy access to them, as well as creating the right schedule for stations, increases the number of SB users during the outbreak of epidemics. Branion, et al. (2019) state that the greater availability of bicycle infrastructure, especially SB stations and bicycle lanes, is associated with a greater chance for cycling in the city. As a result, it is suggested that while developing available places for users, attention should be paid to maintaining control over the outbreak of epidemics to use public transportation.

Maintaining regular PA during self-isolation (quarantine) is essential for preventing future chronic health conditions due to sedentary lifestyles. In times of crisis, functional medical care and community service are of the highest priority. To prevent physical and mental distress, governments, public health officials, and the public itself should also care for maintaining PA during the COVID-19 epidemics (Jakobsson et al., 2020). Therefore, targeted studies on community transportation can improve health and thus increase life expectancy during the epidemic.

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