A seemingly unrelated regression model of the impact of COVID-19 risk perception on urban leisure place choices

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Abstract: Due to the prolonged COVID-19 pandemic and various restrictions, peoples' leisure activity patterns significantly change. Thus, it is necessary to understand how people's travel and leisure behaviors have changed during the COVID-19 pandemic. However, there is still a lack of empirical evidence on how individuals' COVID-19 risk perception influences their leisure destination choice behavior. This empirical study aims to confirm the relationship between risk perception of COVID-19 and choice of leisure destination and to explore any differences between them related to demographic characteristics. A total of 537 valid samples were used for SUR model analysis by conducting an online survey targeting citizens of the Seoul metropolitan area, Korea. Our findings show that the risk perception of COVID-19 has a significant effect on the choice of leisure places. In particular, the risk perception of COVID-19 has a positive effect on the choice of natural places, disinfected areas, and socially distanced spaces while negatively influencing the choice of crowded leisure places. In addition, age and gender are more effective factors than other control variables in COVID-19 risk perception and leisure destination choices. Furthermore, this study also provides several implications for urban leisure place planners and service providers to respond to the changing leisure activity patterns caused by COVID-19.

1.   INTRODUCTION

Leisure places play an important role in improving the quality of urban life (Jiao et al., 2015). However, these places are more vulnerable to the spread of various infectious diseases caused by a lot of human activities. Specifically, location premises for eating and drinking, sports facilities, and entertainment facilities are conducive to epidemic spread (World Health Organization, 2020). Therefore, to prevent the spread of COVID-19, each country began to implement restrictions or bans on the uses of urban leisure places. Due to the current situation, the tourism and hospitality sectors face "an existential crisis" with numerous jobs and income losses (Donthu & Gustafsson, 2020).

In South Korea, for example, overall tourism and leisure expenditure decreased to around 21,981 billion won (from January to August 2020) compared to the previous year (Korea Culture and Tourism Institute, 2021).

Meanwhile, the changes in consumer leisure activities after the COVID-19 outbreak showed the largest decline in domestic travel (-72%), sports activities (-67%), shopping mall visits (-61%), religious activity (-47%), respectively (Korea Economic Research Institute, 2020). Under this situation, it is important for travel and leisure marketers and service providers to better understand the changes in people's leisure behavior due to the COVID-19 pandemic (Honey-Rosés et al., 2020).

Previous studies have already demonstrated that risk perception for infectious diseases such as SARS, H1N1, Ebola, and MERS is an important factor influencing individual behaviors and decision-making processes (Anshul & Jeetesh, 2017; Lepp & Gibson, 2008; Oh, Paek, & Hove, 2015; Pine & McKercher, 2004). Meanwhile, some recent literature on COVID-19 risk perception has examined that the impact of COVID-19 risk perception on preventive health behavior, tourism satisfaction, mental health, leisure activities, and travel behavior intention (Abdelrahman, 2020; Bae & Chang, 2021; Ding et al., 2020; Wise et al., 2020; Zhu & Deng, 2020)

In particular, a few studies have found that the COVID-19 risk perception has positive effects on health-protective behavior (Wise et al., 2020); negative effects on international travel intention (Han et al., 2020); and negative effects on leisure activities (Parady, Taniguchi, & Takami, 2020). Overall, these studies on COVID-19 risk perception and behavior have provided important insights to date; however, additional research is still needed for a more comprehensive understanding, as follows:

(1) Regarding the spatial scope, most of these related studies dealt with international and/or national level for destination scope setting (Han et al., 2020; Karl, Muskat, & Ritchie, 2020; Neuburger & Egger, 2021). However, during this pandemic, where cross-border movement due to COVID-19 is restricted, people are more likely to spend their leisure activities close to home. Therefore, it has not yet been investigated how risk perception of COVID-19 affects the choice of leisure destinations at the urban level. (2) As regards the measurements, existing studies did not consider the characteristics of each leisure place when measuring the factor of risk perception of COVID-19 (Abdelrahman, 2020; Bae & Chang, 2021). In order to prevent the spread of COVID-19, it would be necessary to examine how the risk perception of COVID-19 impacts each leisure place.

(3) Finally, in terms of analysis methods, most recent studies (Honey-Rosés et al., 2020; Karl, Muskat, & Ritchie, 2020) have employed the qualitative approach due to the lack of capable empirical data resources to analyze. Therefore, this study aims to empirically verify the effect of the urban residents' COVID-19 risk perception on their choice of destinations for leisure activities and explore any differences among them related to demographic characteristics.

2.   METHOD

2.1   Research design

Previous research has demonstrated the impact of risk perception on people's decision and behavior (Li & Tang, 2019; Reisinger & Mavondo, 2005). The destination choice behavior is also related to risk perception (Han et al., 2020; Sinha & Nair, 2021). Besides, some studies have pointed out that the effect of risk perception on destination choice behavior can vary

depending on personal characteristics (Karl, Muskat, & Ritchie, 2020; Sönmez & Graefe, 1998; Ramkissoon & Nunkoo, 2010).

Based on such existing literature, this study predicts that the risk perception of COVID-19 may significantly affect the choice of leisure places and these relations may differ depending on demographic characteristics. In all, this study proposes the following hypotheses:

(1) Hypothesis 1: The risk perception of COVID-19 is associated with the choice of leisure places
(2) Hypothesis 2: The influence of COVID-19 risk perception on the choices of leisure places varies among the space characteristics.
(3) Hypothesis 3: The relationship between risk perception of COVID-19 and choice of leisure place differs depending on the demographic characteristics.

2.2   Study area and data collection

This work's study area is the Seoul metropolitan area, including Seoul, Incheon, and Gyeonggi province in South Korea. Over half of the population (nearly 51%) lives in the Seoul metropolitan area (Korea National Statistical Office, 2021). The first confirmed case of COVID-19 occurred in the Seoul metropolitan area on January 24, 2020. As of March 14, 2021, the number of confirmed cases in the Seoul metropolitan area is 60,653, 63.4% of the total confirmed cases (95,635) in Korea (Korea Disease Control and Prevention Agency, 2021).

The survey was conducted by an online survey agency (http://www.entrustsurvey.com/) using residents (over 19 years) in the Seoul metropolitan area from September 23 to October 7, 2020. A total of 537 voluntary responses were collected from residents who are willing to join the survey. A quota sampling method was chosen to collect data based on residence address (66 boroughs in three metropolitan cities), age, and gender. *Table 1* shows the demographic characteristics of the participants. Of the 537 respondents, there were more women (50.7%) than men (49.3%). The majority of participants are within the age range of 20–49 years. The largest proportion of respondents held bachelor's degrees (74.7%) and reported their monthly average family income within the range of 2,000,000–4,999,999 KRW (46.7%).

Table 1. Demographic characteristics (n=537)

	f	%		f	%
Gender			Monthly income (KRW)		
Male	265	49.3	2 M or less	36	6.7
Female	272	50.7	2-4.99 M	251	46.7
Age			5-7.99 M	173	32.2
20s	109	20.3	8-9.99 M	53	9.9
30s	184	34.3	10M or higher	24	4.5
40s	186	34.6	Occupation		
50s	46	8.6	Manager/director	35	6.5
60s and over	12	2.2	Professional	42	7.8
Education			Office worker	241	44.9
High school or less	101	18.8	Service/sales	39	7.3
University/College	401	74.7	Elementary workers	20	3.7
Postgraduate	35	6.5	Student	39	7.3
Marital Status			Housemaker	48	8.9
Married	254	47.3	Unemployed	37	6.9
Single	283	52.7	Others	36	6.7

2.3 Measures and methods

Table 2 shows the indicator variables for analysis. The questionnaire was composed of three parts: risk perception of COVID-19, choice of leisure destinations and personal characteristics. Specifically, the independent variable, risk perception of COVID-19, is the degree to which a respondent subjectively perceives the risk of the disease (Bae & Chang, 2021; Neuburger & Egger, 2021), and it was measured with twelve items.

RP1 and RP3 were measured on an 11-point Likert scale (-5 = not at all; +5 = very concerned). RP2, RP4, and RP5 were recorded on a 5-points Likert scale (1= not agree at all; 5 = very agree). Besides, responses to the questions regarding risk perception of COVID-19 infection on urban spaces (RP6 – RP12) were measured on an 11-point Likert scale (-5 = worse than before COVID-19 outbreak; +5 = better than before COVID-19 outbreak).

Meanwhile, the dependent variable, choice of leisure destinations, was based on previous studies (Han et al., 2020; Kim & Kang, 2021; Xie et al., 2020) and consisted of five items, considering the characteristics of leisure places. The measured scale of dependent variables was an 11-point Likert scale (−5 = not preferable at all; +5 = most preferable). Finally, we used five items of demographic characteristics—gender and age—as control variables. All the measured values were changed into standardized values to be used in the analysis. This study also verified the reliability of the input variables using Cronbach's alpha whose value was 0.623, indicating an acceptable level of reliability.

This study used the seemingly unrelated regression (SUR) model to examine the hypotheses. Ordinary Least Squares (OLS) regression in which two or more dependent variables can be interrelated may have a bias in the estimates and their standard errors (Bassil, Saleh, & Anwar, 2019). That is, when one visits leisure destinations, the selection of a specific destination is correlated with the choice of other destinations. SUR model allows for the consideration of multiple models of correlations between variables (Choe, Kim, & Joun, 2019; Zellner, 1962). Considering such simultaneous relations, the SUR model is more valid in presuming other destinations' selections than the OLS regression model. Therefore, this study used the SUR model to assume that the error terms in the separate equations are correlated with a bivariate normal distribution with the same variance across equations.

Table 2. Measurement items

Variables	Item code	Description	Mix	Max	Mean	SD
Dependent variable Leisure destination choice	Natural places	Nature-based destinations (national park, beach area, etc.)	-5	5	0.79	2.896
	Crowded places	Popular leisure spots (place with a high number of visitors)	-5	5	-3.07	2.378
	Disinfected areas	Safe and sanitary leisure places (i.e., facilities with good hygiene)	-5	5	1.87	2.822
	Socially distanced spaces	Unfamiliar leisure areas (place with a low number of visitors)	-5	5	0.81	2.578
	Commercial places	Facility-based leisure spaces (shopping center, department store, etc.)	-5	5	-2.14	2.715
Independent variables risk perception of COVID-19	RP1	Worried about the infection of COVID-19	-5	5	3.61	1.491
	RP2	Perception of safety from COVID-19	1	4	2.48	.868
	RP3	COVID-19 impacts on daily life	-1	5	3.84	1.170
	RP4	COVID-19 impacts on daily activities	1	5	4.31	0.709
	RP5	COVID-19 impacts on physical activity	1	5	3.90	.929

	RP6	COVID-19 infection (high population density)	-5	5	-3.30	2.647
	RP7	Risk perception of COVID-19 infection (shopping malls)	-5	5	-2.95	2.355
	RP8	Risk perception of COVID-19 infection (entertainment facilities)	-5	5	-3.71	2.495
	RP9	Risk perception of COVID-19 infection (sanitation facilities i.e., Sauna)	-5	5	-3.49	2.410
	RP10	Risk perception of COVID-19 infection (religious facilities)	-5	5	-3.77	2.542
	RP11	Risk perception of COVID-19 infection (open leisure spaces)	-5	5	-.67	2.263
	RP12	Risk perception of COVID-19 infection (natural areas)	-5	5	.07	2.303
Demographics variables	Con1	Age				
	Con2	Income				
	Con3	Gender (1: man, 2: women)				
	Con4	Marital status 2 (1: married, 2: single)				
	Con5	Education level (1: Middle school, 2: High school, 3: University/College, 4: Postgraduate)				

3.　　　RESULTS AND DISCUSSIONS

This study applied OLS and SUR model to examine the risk perception of COVID-19 on the choice of leisure destinations (see *Table 3*). *Table 3* shows the results of the OLS model. Also, the present study confirmed the multicollinearity between independent variables using the variance inflation factor (VIF). The VIF values were low at 1.08~4.54.

Table 3. OLS regression results

Variable	Standard coefficient				
	Natural places	Crowded places	Disinfected areas	Socially distanced spaces	Commercial places
RP1	0.04	0.02	0.01	-0.04	-0.04
RP2	0.07 *	0.05	0.10 **	0.07	0.01
RP3	-0.04	-0.14 ***	-0.03	0.01	-0.06
RP4	0.09 *	0.05	0.08 *	0.06	0.04
RP5	-0.07	0.003	-0.01	-0.03	-0.02
RP6	0.05	0.07	-0.09	-0.21 ***	0.06
RP7	-0.09	0.0004	-0.001	0.01	0.09
RP8	0.10	0.04	0.02	0.010	0.02
RP9	-0.02	0.19 **	-0.08	-0.09	-0.02
RP10	-0.03	0.06	-0.09	0.06	0.09
RP11	0.08	-0.13 *	0.12 *	0.09	-0.06
RP12	0.23 ***	0.10	0.13 *	0.13 *	0.07
Con1	-0.03	-0.11 **	-0.04	-0.04	-0.13 **
Con2	-0.01	-0.01	-0.03	-0.05	-0.02
Con3	-0.09	-0.13	-0.03	-0.06	-0.07
Con4	-0.02	-0.07	0.02	0.07	-0.15
Con5-1	0.66	0.26	-1.02	0.23	-0.19
Con5-2	0.70	0.18	-1.07	0.29	-0.26
Con5-3	0.83	0.07	-0.92	0.24	-0.40
_cons	-0.65	-0.08	1.05	-0.27	0.36
R-squared	0.10	0.16	0.10	0.08	0.10
n	537				

*: p <0.1, **: p<0.05, ***: p<0.01

This study argues in the measures and methods sections that a SUR model would be applied for this analysis. To examine the validity of applying the SUR model, this study conducted the Breusch-Pagan independence test. The results of the Breusch-Pagan independence test confirmed that applying the SUR model, which allows for simultaneous analysis rather than ordinary least squares regression (OLS), is a suitable method in this study (see *Table 4*). Also, this result showed a correlation between all residual terms (χ^2 (45) = 685.96, Pr = 0.00).

Table 4 shows the SUR model analysis results. The results showed that the risk perception of COVID-19 has some significant effect on the choice of leisure places. First, "the perception of safety from COVID-19," "COVID-19 impacts on daily activities," and "risk perception of COVID-19 infection (open leisure spaces and natural areas)" were positively associated with natural places, disinfected areas, and socially distanced spaces. Specifically, among the independent variables, "risk perception of COVID-19 infection (natural areas +0.23)," and "COVID-19 impact on daily activities (+0.09)" had significantly positive impacts on the choice of natural places. These results provided additional support for expanding findings from the related studies; Zhu and Deng (2020) found that risk perception had a positive influence on the intention to visit rural destinations; Venter et al. (2020) found that visits to urban green spaces increased during the pandemic, suggesting that people have a positive perception of urban green spaces in Oslo, Norway; and Xie et al. (2020) confirmed that visiting parks increased Chinese residents' overall health condition and social interaction needs.

Moreover, "risk perception of COVID-19 infection (open leisure spaces +0.12 and natural areas +0.13)," "COVID-19 impact on daily activities (+0.08)," and "perception of safety from COVID-19 (+0.10)" had a positive impact on the choice of disinfected places. In comparison, "risk perception of COVID-19 infection (natural areas +0.13)" and "perception of safety from COVID-19 (+0.07)" were positively associated with the choice of socially distanced spaces. These results are in line with the findings of Han et al. (2020) and Bae and Chang (2021). Our results imply that people who perceive they are safe from COVID-19 in open spaces and natural spaces are more likely to visit natural places, disinfected areas, and socially distanced spaces for leisure purposes. This is probably because people believe that they are less likely to be infected by COVID-19 in natural places since they can distance themselves from others.

Second, "perception of safety from COVID-19 (-0.13)," "risk perception of COVID-19 infection (high population density -0.02)," and "risk perception of COVID-19 infection (open leisure spaces -0.13)" were negatively associated with crowded leisure places. These results support the findings of previous studies (Han et al., 2020; Kim & Kang, 2021). Meanwhile, "COVID-19 impacts on physical activity (-0.08)" had a negative effect on the choice of natural places. Thus, people who used to be active in the outdoors are more likely to refrain from physical activities due to COVID-19, which causes fewer visits to natural places.

Contrary to the expectations, among the risk perception factors, "risk perception of COVID-19 infection (sanitation facilities)" was correlated negatively with socially distanced spaces, whereas positively with crowded leisure places. It can be inferred that people who believe they will be not infected or become less ill are more likely to visit places with greater exposure to the COVID-19 virus. Besides, when considering the simultaneous

correlation of destination selections, more choices of crowded leisure places probably result in fewer choices of socially distanced spaces.

"COVID-19 impacts on daily life" was negatively correlated with crowded leisure places [although not significant, all other places showed negative (-) coefficients]. This implies that people who perceive that they are highly vulnerable to COVID-19 in their daily lives tend to reduce outdoor activities. In contrast, "COVID-19 impacts on daily activities" was positively correlated with choices of natural places and disinfected areas. This means that people who are keen on preventive behavior in their daily activities may prefer visiting areas with a low risk of COVID-19 infection. Other places such as crowded leisure places were not significant, but they all had positive (+) values. This appears to have resulted from social distancing measures in Korea, which did not completely close public places, so people did not feel uncomfortable in their daily routines.

Overall, the results showed that the independent variables were only marginally significant. This could be due to Korea implementing "social distancing" measures instead of a nationwide lockdown to prevent the spread of COVID-19. As a result, risk perception has a low influence on leisure spaces because people's use of space was not strictly restricted in Korea.

Lastly, among the demographic characteristics, age and gender had a significant impact on the choice of commercial leisure places and crowded leisure places, while other demographic factors were not significant. Specifically, men are less likely to visit crowded leisure places than women. Also, age was found to negatively influence the selection of "commercial leisure places" increased with age. This result may be related to the mortality of COVID-19 that the older people were much higher than younger people.

These results are consistent with previous studies suggesting that the influence relationship between risk perception and behavior varies according to personal characteristics such as gender and age (Kim & Kang, 2021; Ramkissoon & Nunkoo, 2010; Sönmez & Graefe, 1998; Reisinger & Mavondo, 2005). Other control variables did not show any significant effect, unlike the prediction of this study. However, the reason why income, education level, and marital status were not significant in this study is thought to be because the COVID-19 infection rate and mortality rate have a higher correlation with age and gender than other control variables.

Table 4. SUR model results

Variable	Standard coefficient				
	Natural places	Crowded places	Disinfected areas	Socially distanced spaces	Commercial places
RP1	0.06	0.02	0.01	-0.02	0.01
RP2	0.06	0.05	0.10 **	0.07 *	0.02
RP3	-0.03	-0.13 **	-0.03	0.00	-0.08
RP4	0.09 *	0.05	0.08 *	0.06	0.03
RP5	-0.08 **	0.02	-0.01	-0.02	-0.02
RP6	0.05	0.07	-0.09	-0.02 ***	0.05
RP7	-0.09	0.00	0.00	0.02	0.10
RP8	0.02	0.05	0.02	0.09	0.01
RP9	-0.02	0.19 **	-0.08	-0.09 **	-0.02
RP10	-0.04	0.05	-0.09	0.06	0.09
RP11	0.08	-0.13 *	0.12 *	0.09	-0.06
RP12	0.23 ***	0.10	0.13 *	0.13 *	0.08
Con1	-0.03	-0.11 **	-0.04	-0.05	-0.13 **

Con2	-0.01	-0.01	-0.03	-0.04	-0.02
Con3	-0.09	-0.14 *	-0.03	-0.06	-0.07
Con4	0.01	0.07	-0.02	-0.06	0.16
Con5-1	0.64	0.25	-1.03	0.27	-0.14
Con5-2	0.69	0.16	-1.08	0.31	-0.21
Con5-3	0.81	0.06	-0.93	0.27	-0.34
_cons	-0.64	-0.14	1.08	-0.24	0.16
N	537				
R-squared	0.10	0.16	0.10	0.08	0.10
RMSE	0.95	0.92	0.95	0.96	0.95
Chi2	61.86	102.58	59.72	47.88	59.82

Breusch-Pagan test of independence: χ^2 (45) = 685.96, Pr = 0.00

*: p <0.1, **: p<0.05, ***: p<0.01

4. CONCLUSIONS

Undoubtedly, the prolonged COVID-19 pandemic is bringing significant changes to people's leisure patterns. It is important to understand how leisure destination choice behavior has changed during the COVID-19 pandemic. Therefore, this study examined the relationship between risk perception of COVID-19 and choice of leisure place.

The following are the highlights of our findings: First, the risk perception of COVID-19 has a significant effect on the choice of leisure places. Second, the risk perception of COVID-19 was positively associated with the choice of natural places, disinfected areas, and socially distanced spaces, negatively associated with the choice of crowded leisure places, and not significantly associated with the choice of commercial leisure places. In addition, people's risk perception of COVID-19 infection (concerning their visits to sanitation facilities and open leisure spaces) has both positive and negative impacts on leisure places. Finally, age and gender are more significant variables than other demographic factors in COVID-19 risk perception and leisure destination choices.

This study provides several implications for leisure service providers and marketers to respond to the changing leisure activity patterns caused by COVID-19. First, people's perception of COVID-19 risk has increased the choice of outdoor leisure spaces such as urban green areas and parks and leisure places with good hygiene and stability. Based on these results, we suggest that visits to outdoor spaces for leisure activities are expected to increase significantly. However, people perceive that outdoor spaces are relatively safe compared to indoor facilities. In other words, they are less likely to follow the quarantine rules. Hence, we need to measure to control visits and reinforce the quarantine rules.

On the other hand, people's risk perception of COVID-19 has decreased the choice of crowded leisure places. The findings of this study imply that it is important for the related practitioners to lower people's perception of COVID-19 infection risk and raise safety awareness when attracting visitors. Particularly, indoor leisure businesses that are crowded with people, such as movie theatres or restaurants, are facing the COVID-19 crisis. Target marketing can be considered for some optimistic groups for promoting visiting. In addition, there must be a balance of two contradicting response strategies between attracting visitors and reinforcing sanitation and hygiene.

Finally, our research suggests that it is important to consider the visitors' COVID-19 risk perception as well as the characteristics of each urban leisure place when setting the level of control and restriction measures for visiting urban leisure spaces.

The contributions of this study are twofold. As for the academic contributions, this study can be differentiated from previous studies in that it has analyzed the relationship between risk perception of COVID-19 and choice of leisure places at the urban level. In addition, it contributes to diversifying and expanding the existing research approach in that this research used the SUR analysis method to consider multiple models of correlations between variables. Practically, this study contributes to establishing management and marketing strategies to control or attract urban residents' leisure behaviors during the COVID-19 pandemic.

The limitations of this study and future research recommendations are as follows. First, the survey respondents were residents of the Seoul metropolitan area in South Korea. Therefore, the sample may not be representative of the entire population of South Korea or other countries. Furthermore, the survey was conducted during the social distancing to level 2 for the Seoul Metropolitan area, so the results may differ when the other stages of lockdown or social distancing measures. Future studies can address these limitations by extending the temporal and spatial range of the survey with more representative samples.

Second, the results showed that risk perception factors have a low effect on the choice of leisure, which may limit our findings' generalizability to other issues. Further research may provide significant implications by considering various variables, such as social, cultural, and geographical factors, which are closely related to the public's perception of COVID-19. Finally, the current study only focused on the relationship between risk perception of COVID-19 and leisure place choices. For further research, we will analyze whether there are differences in risk perception of COVID-19 and leisure behavior among the three metropolitan areas based on the participants' location information.

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