



# A Comparative Study of Leisure Constraints in Outdoor Leisure Activities Depending on Recognition of the Level of Particulate Matter (PM<sub>10</sub>): Focused on Golf Participants in the Republic of Korea

## Authors' contribution:

- A) conception and design of the study
- B) acquisition of data
- C) analysis and interpretation of data
- D) manuscript preparation
- E) obtaining funding

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## ABSTRACT

Particulate matter, one of the most recent social problems in Korea, not only poses a threat to people's health, but is also emerging as a constraint to discourage outdoor leisure activities. Golf, a leisure sport played outdoors for hours, is not free from such a threat, and now is time to analyze golfers' recognition of particulate matter. To examine whether particulate matter, among other constraints for golfers, had a significant effect as well as how golfers recognized particulate matter, we used 324 collected questionnaires in this study. After exploratory factor analysis and reliability analysis through SPSS 23.0, we divided questionnaire participants into recognition and non-recognition groups based on whether they checked and recognized atmospheric conditions, including particulate matter, before playing golf, and used multivariate analysis of variance (MANOVA) to compare and analyze leisure constraints. Respondents in the recognition group who recognized particulate matter in advance experienced participation constraints in weather and health factors, while those in the non-recognition group experienced participation constraints in skill and confidence factors. In other words, respondents participated in outdoor leisure activities even though they recognized the level of hazardous particulate matter in the air beforehand, and particulate matter worked as a participation constraint for them; this finding confirmed that it will be necessary in the future to take preventative action more actively against the danger of particulate matter.

## KEYWORDS

Fine dust, golf, particulate matter (PM<sub>10</sub>), leisure constraints, public health

## Introduction

The Korean golf industry has continued to grow, not just qualitatively but also in terms of scale, since the early 2000s (Lim & Yoo, 2015). Enormous achievements made by Korean golfers who compete at home and abroad also serve as a catalyst for such growth (Kim & Seo, 2018). Furthermore, the advent of screen golf, which allows people to enjoy playing golf indoors through a virtual reality simulator, also exponentially increased the number of people playing golf and is leading the popularization of the golf industry overall (Lyu, 2015). This

starkly contrasts the situation in Japan and the US where the golf population is declining due to the perception that golf is generally expensive, time-consuming, and difficult (Mullin, Hardy, & Sutton, 2014). According to the Korean Golf Association (KGA) (2017), not only has the population of golfers in Korea increased by 3.84 million to 6.36 million in the last decade, but the potential golf population who want to learn how to play stands at 9.36 million. In the meantime, particulate matter, one of the most serious social issues in recent years, has a negative impact on participation in outdoor leisure activities (Zhang & Choi, 2018), and this situation cannot be overlooked in golf, one of the most popular outdoor leisure activities in Korea.

Particulate matter generally refers to particulate matter (PM)  $10\mu\text{m}$  or less in diameter (WHO, 2018). Depending on the level of particulate matter in the air, the atmospheric condition is forecast in 4 grades (good:  $0-3\mu\text{m}/\text{m}^3$ , normal:  $31-80\mu\text{m}/\text{m}^3$ , bad:  $81-150\mu\text{m}/\text{m}^3$ , and very bad:  $150\mu\text{m}/\text{m}^3$  or higher), and if a person is exposed for a long time to particulate matter, which is classified as a Group 1 carcinogen, not only does it cause respiratory or cardiovascular diseases but it can also be life-threatening (Ministry of Environment, 2018). Due to pollutants emitted from factories as a result of industrialization, car exhaust released from countless vehicles, and the inflow of air pollutants from neighboring countries, the amount of particulate matter in the air is at a dangerous level all around the world (WHO, 2018). The government is preparing measures such as replacing outdated vehicles, regulating industrial sites, and coordinating environmental regulations with neighboring countries, as well as promoting personal precautions such as washing hands and wearing masks (Ministry of Environment, 2018). However, in reality, many people are partaking in outdoor activities without wearing masks even when the level of particulate matter is very severe; therefore, it seems that there is still a lack in people's recognition or preparation for particulate matter.

However, despite recent negative environmental factors, such as fine dust, previous studies have found that physical activities bring physical, psychological, and social benefits to people. There seems little doubt that physical leisure participation has various significant benefits physically for all individual participants (Kemperman & Timmermans, 2008). From previous research on participation in physical activities, there was significant empirical evidence that physical activity participation could improve quality of life by reducing the risk of diseases (e.g., high cholesterol, obesity, high blood pressure, and diabetes) that could damage health (Dishman, 2003).

In addition to the physical risks of inactive lifestyles, mental diseases are also an emerging global concern. Modest leisure activity participation has been an alternative method to reduce those kinds of risks and a way to enjoy active living (Henderson & Bialeschki, 2008). Previous studies regarding work stress have long focused on the significance of leisure as a way coping with stress, and a lot of attention is being paid to the investigation of coping strategies (Trenberth & Dewe, 2002). Tsai and Coleman (2009) also indicated that participation in recreational activities is positively associated with promoting self-efficacy and personal control.

Along with physical and mental benefits from leisure participation, the social benefits have also been highlighted in that social problems, such as social isolation, are an emerging concern in modern society. An individual who participates in a certain leisure activity might form new social relationships with other participants, and these new relations could allow being a more connected member of society. Further, through recreational leisure activities, people might have more opportunities to spend time with family or friends (Ingen & Eijck, 2009).

Despite the many advantages mentioned above for outdoor leisure activities, it is necessary to think carefully whether to do outdoor activities, such as golf, for a long time amid particulate matter. Ironically, however, it is true that many people are still exercising outdoors without such awareness. In addition, it calls into question the judgment and choices of those who do outdoor leisure activities which could have potentially more disadvantages than advantages, even though they check and recognize that the level of particulate matter in the air is hazardous. The concept of leisure constraints has been defined as factors "which affect individuals' formation of leisure preferences for particular activities and limit their ability to participate in the activities"

(Lyu & Oh, 2014, p. 480). The fine dust of air pollution could and should be one of the strongest leisure constraints factors in recent times.

Previous research on leisure constraints have investigated diverse factors limiting individuals' leisure participation (Samdahl & Jekubovich, 1997) to understand rapidly changing leisure preferences and find variations in leisure choices (Jackson, 1990a; 1990b). Initial research on leisure constraints focused on the significance of individual social and psychological factors, arguing the fact that people were social animals (Iso-Ahola & Mannell, 1985). Crawford and Godbey (1987) suggested the three types of constraints: (a) Intrapersonal, "individual psychological states and attributes which interact with leisure preferences rather than intervening between preferences and participation" (p.122); (b) Interpersonal, "the result of interpersonal interaction or the relationship between individuals' characteristics" (p. 123); and (c) Structural, "intervening factors between leisure preference and participation" (p.124) (e.g., financial status, lifestyle, climate, and work time). Based on the leisure constraints, Crawford and Godbey (1987) proposed three relationship models of leisure constraints with preference and participation (Figure 1).

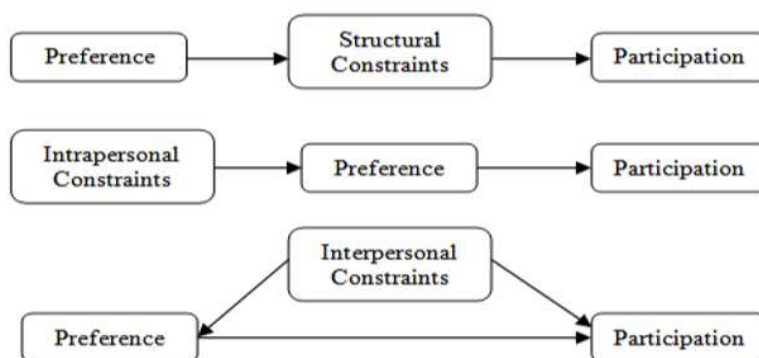


Figure 1. Three relationship models of leisure constraints with preference and participation  
Source: Crawford & Godbey, 1987.

Crawford, Jackson, and Godbey (1991) developed a sequential hierarchical model of constraints, assuming that an individual's decision-making process in leisure participation might be more complicated than we think. Also, they stated that leisure participants might encounter continual constraints although the initial leisure constraints were successfully negotiated in a sequential order (Figure 2). While previous research found leisure constraints causing individuals' nonparticipation, Crawford et al. (1991) stated that leisure constraints were a negotiable concept. Also, Godbey, Crawford, and Shen (2010) modified the previous leisure constraint model and argued that constraints may both inhibit and enable leisure participation. When facing a constraint, an individual can negotiate the constraint in various ways, which might lead to subsequent participation or nonparticipation in leisure activities (Crawford & Godbey, 1987; Crawford et al., 1991).

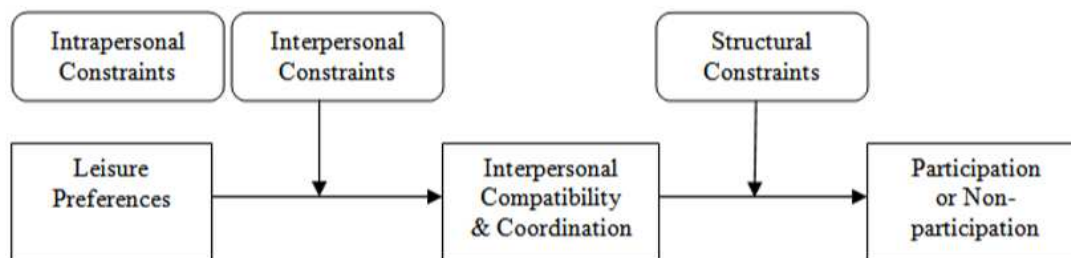


Figure 2. The hierarchical model of leisure constraints  
Source: Crawford et al., 1991.

As mentioned above, people do outdoor leisure activities for physical, mental, and social benefits, and sometimes internal and external leisure constraints limit their physical activities. The level of particulate matter in the air, which has been discussed recently as a social issue, poses another powerful threat to people's leisure activities. It seems necessary to examine the reality where people do outdoor activities although they recognize the danger of particulate matter. In this regard, the purpose of this study is to compare and analyze what significant difference people's recognition of air pollution related to particulate matter makes in leisure constraints for golf. Based on this study's results, it would be possible to identify the level of people's recognition or awareness about particulate matter in overall outdoor leisure activities, as well as golf. In this context, this study set the following research question: What are the differences in participation constraints of outdoor leisure activities (golf) depending on air pollution (fine dust)?

## Method

### *Participants*

To investigate differences in leisure participation constraints in golf depending on individuals' recognition of fine dust concentration, this study conducted a survey on people who practiced golf on a driving range and played golf at golf courses on days where fine dust was at a dangerous level. To begin with, we divided the participants into the recognition and non-recognition groups based on their answer to the question "Do you check the day's level of particulate matter from the weather forecast before you decided to play or practice golf and recognize that the atmospheric condition is dangerous?" This data collection was performed at a driving range and three golf courses, two public and one private, located in the Republic of Korea from September 1<sup>st</sup> to November 30<sup>th</sup>, 2018. Specifically, we chose September 7, 8, 9, and 25; October 15 and 22; and November 3, 6, 7, 25, 27, and 28, (a total of 12 days) when the atmospheric condition in regard to particulate matter was announced to be "bad" or worse ( $PM_{10} 81\mu m^3$  or higher) by the Korea Meteorological Administration. It took approximately 15 minutes to complete the paper-based survey, and all respondents voluntarily filled out the survey using a self-administration method. A total of 460 surveys were distributed, and 343 were collected (approximately 74.6% response rate). After excluding 19 incomplete surveys, 324 surveys were utilized in the current study. Based on the individuals' recognition, this study divided survey respondents into two groups: (a) recognition ( $n = 133$ , 41.0%) and (b) non-recognition ( $n = 191$ , 59.0%).

### *Measures*

To measure the participation constraints, the scale used by Jun and Kyle (2011) was modified and applied in this study. The instrument showed acceptable reliability scores (Cronbach's alpha level of 0.76 to 0.92) in the previous study. Specifically, there were seven subfactors, (a) social (three items: "My friends have different interests"), (b) health (three items: "I'm not fit enough"), (c) skill (three items: "I'm too inexperienced"), (d) confidence (four items: "I am lacking in confidence"), (e) cost (three items: "Cost of the activity is too expensive"), (f) weather (three items: "I hate playing in bad weather"), and (g) time (three items: "The activity takes too long to enjoy"). The scale (a total of 22 items) was measured on a 7-point Likert scale, ranging from 1 ("Strongly disagree") to 7 ("Strongly agree").

### *Data Analysis*

To test the factor structure of the instrument, an exploratory factor analysis (EFA) using a principal component analysis (PCA) with orthogonal rotation (Varimax) was applied in the current study. A multivariate analysis of variance (MANOVA) was performed to compare and analyze the differences in participation constraints based on individuals' recognition about atmospheric fine dust concentration. MANOVA is a statistical technique to investigate group differences on more than one dependent variable (Field, 2009).

## Results

### Descriptive statistics

The first group (recognition group) consisted of 77 (57.9%) males and 56 (42.1%) females. In terms of age, 27.8% ( $n = 37$ ) were in their 50s, followed by over 60s ( $n = 33$ , 24.8%), 30s ( $n = 32$ , 24.1%), 40s ( $n = 22$ , 16.5), and 20s ( $n = 9$ , 6.8%). The second group (non-recognition group) consisted of 90 (47.1%) males and 101 (52.9%) females. In respect to age, 25.1% ( $n = 48$ ) were in their 50s, followed by 30s ( $n = 48$ , 23.6%), over 60s ( $n = 41$ , 21.5%), 40s ( $n = 30$ , 15.7%), and 20s ( $n = 27$ , 14.1). Additionally, all respondents were asked questions regarding golf (i.e., frequency of participation and average score in golf). Detailed information is described in Table 1.

Table 1. Descriptive statistics of the sample

Variables		Recognition group n (%)	Non-recognition group n (%)
Gender	Male	77 (57.9)	90 (47.1)
	Female	56 (42.1)	101 (52.9)
Age	20s	9 (6.8)	27 (14.1)
	30s	32 (24.1)	48 (23.6)
	40s	22 (16.5)	30 (15.7)
	50s	37 (27.8)	48 (25.1)
	60s+	33 (24.8)	41 (21.5)
	Rarely	6 (4.5)	31 (16.2)
Frequency of participation	Sometimes	15 (11.2)	46 (24.1)
	Often	27 (20.3)	64 (33.5)
	Frequently	43 (32.3)	23 (12.0)
	Very often	42 (31.6)	27 (12.6)
Average score in golf	Less than 81	8 (6.0)	4 (2.1)
	82 – 90	47 (35.3)	34 (17.8)
	91 – 99	53 (39.8)	45 (23.6)
	Greater than 100	14 (10.5)	66 (34.6)
	I don't know	11 (8.3)	42 (21.9)
Total		133 (41.0)	191 (59.0)

Source: own study.

### Scale validity & reliability

An exploratory factor analysis using the PCA with Varimax of participation constraints (7 factors, 22 items) was performed. In the constraints, the Kaiser Meyer-Olkin measure identified the sample adequacy for the analysis,  $KMO = .720$  (Field, 2009). Barlett's test of sphericity ( $\chi^2 = 4609.184$ ,  $df = 231$ ,  $p = .000$ ) was statistically significant. Seven extracted factors (confidence, skill, weather, social, health, cost, and time/commitment) accounted for 80.27% of the total variance. All extracted factors had eigenvalues greater than 1 and factor structure coefficients greater than .40. All Cronbach's alphas showed excellent internal consistency for reliability based on the .70 cutoff (Nunnally & Bernstein, 1994): (a) confidence,  $\alpha = .930$ ; (b) skill,  $\alpha = .897$ ; (c) weather,  $\alpha = .894$ ; (d) social,  $\alpha = .894$ ; (e) health,  $\alpha = .874$ ; (f) cost,  $\alpha = .815$ ; and (g) time/commitment,  $\alpha = .814$  (Table 2).

Table 2. Factor structure matrix for participation constraints in outdoor leisure activities

Constraints	1	2	3	4	5	6	7
I am lacking in confidence	.934						
My performance is inadequate with others	.930						
I believe I'm not good at the activity	.900						
I am not very good at enjoying golf	.839						
The activity is too difficult		.946					
I'm too inexperienced		.901					
My performance is too inconsistent		.876					
I only like to enjoy golf in nice weather without fine dust			.929				
I hate playing in poor air quality cause by fine dust			.918				
I want to enjoy golf with clean air quality			.846				
My family/friends don't want me to enjoy golf				.920			
I don't have friends to enjoy golf with				.918			
My friends have different interests				.870			
I have health problems					.923		
I don't have the energy to enjoy golf					.914		
I'm not fit enough					.831		
I don't have enough money to enjoy golf						.903	
Equipment is too expensive						.893	
Cost of the activity is too expensive						.747	
The activity takes too long to enjoy golf							.921
Time commitments to friends and family							.868
It is difficult to find the time to enjoy golf							.768
E-value	3.86	2.92	2.58	2.42	2.15	1.90	1.82
Variance (%)	17.6	13.3	11.7	10.9	9.77	8.65	8.29
Cronbach's alpha	.930	.897	.894	.894	.874	.815	.814

Source: own study.

### Multivariate Analysis of Variance (MANOVA)

The multivariate test revealed statistically significant differences of participation constraints based on the individuals' recognition about atmospheric fine dust: [Wilks' lambda = .788,  $F(7, 316) = 12.164$ ,  $p = 0.00$ , partial  $\eta^2 = .212$ ]. To find statistical results, an adjusted alpha level using the Bonferroni correction ( $P = 0.05/7 = .007$ ) was applied. As a result, (a) health, (b) skill, (c) confidence, and (d) weather were statistically significant (Table 3). Mean scores of each factor based on groups were shown in Table 4.

Table 3. Differences in participation constraints by groups

Source	DV	df	F	p	$\eta^2$
Constraints	Health	1	9.674	.002*	.029
	Skill	1	14.222	.000*	.042
	Confidence	1	42.860	.000*	.117
	Weather	1	23.159	.000*	.067

Note. \* $p < 0.007$ .

Source: own study.



Table 4. Mean Scores of Constraints Factors Between Groups

	1	2	3	4	5	6	7
G1	3.461	<b>4.326</b>	<b>3.632</b>	<b>3.432</b>	3.090	<b>4.602</b>	3.504
G2	3.625	<b>3.815</b>	<b>4.264</b>	<b>4.459</b>	3.354	<b>3.820</b>	3.490

*Note.* G1 = outdoor physical activity with fine dust pollution, G2 = outdoor physical activity without fine dust pollution; 1 = Social, 2 = Health, 3 = Skill, 4 = Confidence, 5 = Cost, 6 = Weather, 7 = Time; Statistically significant higher mean scores between groups in bold.

Source: own study.

## Discussion

This study looked into people's recognition of particulate matter in the air, which is becoming a social issue lately, in terms of golf, a popular outdoor leisure activity. More specifically, we compared and analyzed the participation constraints of those who enjoyed playing golf even though they recognized the danger of particulate matter and those who played golf without recognizing the danger. Such a study could serve as an opportunity to discover the seriousness of this matter and establish preventive measures by analyzing people's recognition of particulate matter. The questionnaire results revealed that, ironically, many of those who said they played golf often were included in the recognition group that already recognized the dangers of the atmospheric condition. This could suggest that they continued to participate in leisure activities even though they recognized the level of particulate matter was serious. It seems that they take part in leisure activities even though they recognize or are well aware of the seriousness of particulate matter. It raises questions whether campaigns or measures carried out by the government are successful in changing people's recognition and behavior.

A comparison of participation constraints between the two groups showed that respondents in the recognition group who recognized the danger of particulate matter said they experienced stronger constraints in weather and health factors than those in the other group. As stated above, this is a very noteworthy finding as it proves that those who play golf more often do outdoor leisure activities even though they are not only more sensitive to their health but also actually experience psychological constraints from the danger of particulate matter. In the end, it means they went ahead with playing golf, although they all checked the overall atmospheric condition, including particulate matter before they went out, recognized the dangerous level of particulate matter, and experienced participation constraints.

These results can be related to the concept of leisure constraint negotiation where leisure constraints do not necessarily mean non-participation but can be fully negotiable, as suggested by Crawford et al. (1991). It can be inferred that participants in this study also decided to participate through such a negotiation process. However, it is indispensable to recognize that the threat of particulate matter, which can have a negative impact on individuals' health, unlike other leisure constraints, is a dangerous factor that cannot be negotiated. Considering that one can decide to participate when leisure constraints are successfully negotiated and they can be negotiated anytime even though they were not previously (Crawford et al., 1991), each individual must precisely recognize the danger of particulate matter. Particulate matter is not simply a factor that can be negotiated by individuals, but a serious issue related to public health that calls for management and action at the government level.

On the contrary, the non-recognition group who did not recognize particulate matter when participating in golf showed higher scores for participation constraints in confidence and skill constraints. These results mean that a low level of golf skill and a psychologically low level of confidence worked as significant constraints to enjoying golf. As mentioned above, it is believed that respondents in this group experienced the general participation constraint factors that golf beginners might feel as they had a low frequency of participation in golf and their skill was also low. The perception that golf is a difficult sport to learn for ordinary people, as suggested by Mullin et al. (2014), still seems to exist in the Korean golf industry, which has gained more

popularity than before. Additionally, considering the fact that this group did not recognize the dangerous level of particulate matter beforehand, it is believed that apart from perceptions about golf as a sport, it is essential to check the weather forecast on particulate matter and prepare thoroughly before leisure activities.

## Conclusions

This study produced significant results and attempted to examine particulate matter, which has been becoming an issue in recent years. It is true, however, that this study has some limitations. For starters, this study divided respondents based on whether they recognized particulate matter, analyzed their participation constraints, and found that particulate matter was a significant factor, but it has a limitation in identifying how strong an impact it has on people's recognition. In other words, particulate matter was statistically significant in relative terms in a comparison between the two groups, but further studies would need to be conducted for its absolute effect with additional factors, such as participants' intention for continued participation.

Next, although this study collected data for three months on the atmospheric environment that fit this study's condition, three months could be seen as a relatively short period to examine people's recognition of particulate matter. In the future, it would be necessary to accumulate data for at least one year considering seasonal changes and apply longitudinal research design to investigate people's psychology in more detail.

Last, as seen in this study's results, it calls for an additional study on the finding that people chose to do outdoor leisure activities even though they checked for the existence of particulate matter. In particular, it would be very significant to examine how people successfully negotiated particulate matter, a relatively strong leisure constraint. If leisure participation motives and other factors are added to examine correlations between different factors, it would be possible to identify people's decision-making processes in leisure participation.

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