

# A Temporal Analysis of Leisure Activity Variety and Social Capital Before and During the COVID-19 Pandemic

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## SHORT SUMMARY

The extraordinary disruption caused by the spread of COVID-19 has prompted the need to better understand the changes in people's activity and mobility behavior. Reduced leisure activity space due to public health interventions has changed people's ability to participate in different activities. This paper examines the temporal influence of social capital, mobility, personalities, and demographics on leisure variety using samples collected in 2019 and 2020. Social capital constructs, specifically instrumental support, have substantial and significant effects on increasing leisure activity variety and remain temporally stable. This result supports the robustness and importance of social capital in activity variety, which further provides evidence for the valuable resources offered by one's social network under drastic changes and restrictions. Age, household size, and extraversion are among the factors that exhibit temporal instability. Model inference shows negative impact of the pandemic on activity variety, especially for people aged 60 or older.

**Keywords:** activity diversity modeling, instrumental support, social network, social support, temporal instability

## 1. INTRODUCTION

Being of a voluntary and often social nature, leisure activities and their induced travel are dynamically impacted by major changes in the activity space and social contacts. In addition to growing interest in transportation literature for leisure activity behavior modeling, recent studies have focused on exploring the global pandemic impacts on various aspects of leisure activity.

Diverse leisure activity engagement was examined in several countries. Liu et al., (2021) observed the self-report changes in different types of leisure activities before and during the pandemic varied by age and income. Their survey noted that US residents had reduced participation in all types of leisure activities with the strongest decline in social, then outdoor, and physical activities. With the nationwide shelter-in-place policy in China, Zhou and Zacharias (2020) examined the effects of out-of-home leisure before quarantine and in-home leisure during quarantine on overall, mental, and social well-being while accounting for living environment and demographics. Their analysis suggested that young people who were active before quarantine improved their social well-being by exploring new things. Variety seeking was an important trait of experienced travelers who would choose diverse activities during their travel despite the perceived threat of COVID-19 (Kim et al., 2021). COVID-19 risk and crowding concerns in different leisure activity spaces had an indirect influence on South Koreans' activity participation with cultural and artistic activities having the highest perceived risk (Kim and Kang, 2021) or crowded leisure places (Bayrsaikhan et al., 2021). These studies have not considered the influence of one's social network on their activity decision-making.

As leisure activities are often informed by, motivated by, and performed with social connections, leisure activity participation was greatly influenced by many public health restrictions, such as social distance and quarantine in 2020 to curve the spread of COVID-19 disease. Several studies have analyzed the effects of social support or social relationships on seniors' leisure participation. Being enhanced by physical activities, social support helped reduce

aging anxiety among 55-65 year-old Koreans (Oh et al., 2020). Sasaki et al. found that participation in a community exercise program before the pandemic helped adults aged 65 or more maintain their physical activity during the pandemic (2021). From a qualitative analysis of 126 interviews, Sweeney and Zorotovich (2021) realized that retirees who had major disruption on their recreation and leisure activities due to COVID-19 experienced negative impacts on their friendships, while those who had no or minimal changes in activities preserved the quality of their friendships. These studies have focused on physical activity instead of a broad spectrum of different leisure types, and only for seniors instead of the general population.

The authors' research work has developed and tested Maness's (2017) social capital theory of leisure activity behavior using two social capital constructs: instrumental support and expressive support. Mannering et al. (2019) documented the significant impacts of instrumental support on increasing leisure variety. In addition to finding support for social capital measures as significant predictors for increased leisure activity variety, this paper has distinct contributions to the literature on leisure activity participation influenced by the global pandemic by examining the influence of social capital, mobility, personalities, and demographics using a comprehensive list of leisure activities of 3,775 participants collected in November and December of 2019 and 2020.

This study examines a sample's access to social capital and its association with the temporal aspects of activity variety outcome between 2019 and 2020. This research proposes four research questions to test this social capital theory of leisure activity behavior:

1. Is leisure variety behavior (i.e., participating in a variety of leisure activities) temporally stable before and during the pandemic?
2. How much is leisure variety impacted before and during the pandemic?
3. How temporally stable are social capital constructs before and during the pandemic?
4. How temporally stable are sociodemographic, mobility, personality factors in predicting leisure variety before and during the pandemic?

This study aims to answer those questions using insights gathered from a self-administered web-based survey to test differences in social capital and its relevance in a leisure activity context.

## 2. METHODOLOGY

### *Data collection*

A cross-sectional survey was designed to better understand social factors influencing leisure activity participation. This same survey design was distributed to nonprobability-based samples with different compositions across three web-based survey panels: Amazon Mechanical Turk (MTurk), Prolific, and Qualtrics for 2019 and 2020. Descriptive statistics of the survey respondents are provided in Table 1. While there might be some repeated respondents in each panel, there was no tracking of returning respondents for the 2019 and 2020 samples. The questionnaire consisted of questions on leisure activity participation, social capital, mobility, accessibility, and individual and household characteristics. Respondents reported their leisure activity variety by choosing from a list of 86 unique activity types – mostly adopted from Tinsley and Eldredge (1995). Social capital was measured through three instruments: (1) position generator, (2) resource generator, and (3) generalized name generator. A list of 22 occupations used in the 2009 Pew Internet Personal Networks and Community Survey (Hampton et al., 2009) was used as the position generator in both years' surveys. A list of 14 accessible resources proposed by Joye and colleagues (2019) was used as the resource generator in the surveys. The generalized name generator—measuring the number of strong ties an individual has—was a generalized version of Burt's name generator in the General Social Survey (Burt 1984).

### *Social capital measures*

As Lin (2001) posits that social capital can be classified in terms of instrumental and expressive resources, this study utilized two refined metrics to quantify the influence of instrumental and expressive support on leisure activity variety (Mannering et al., 2019). The raw data of social

capital questions for both years were combined before applying further factor analysis to derive the instrumental and expressive support constructs.

Using principal component analysis, the instrumental support—resources that can help a person attain wealth, power, and status—was computed as follows: Instrumental support = 0.392 \* network occupational volume + 0.495 \* network occupational highest reach + 0.681 \* network occupational range + 0.372 \* instrumental resource volume.

Expressive support—resources that can help strengthen a person's mental wellbeing, physical health, and life satisfaction—was defined using the following resources:

Practical support:

- a. Help you for a household or a garden job that you can't do yourself
- b. Help you around the house if you were sick and had to stay in bed for a few days
- c. Look after you if you were seriously ill

Emotional support:

- d. Be there if you felt a bit down or depressed and wanted to talk about it
- e. Give you advice on family problems
- f. Make you feel appreciated for who you really are
- g. Be there if you just wanted to talk about your day

Results from the confirmatory factor analysis of expressive support are as follows:

$$\text{Practical} = 1.00a + 1.14b + 1.21c$$

$$\text{Emotional} = 1.00d + 1.12e + 1.20f + 0.99g$$

$$\text{Composite} = 1.00 * \text{Practical} + 1.24 * \text{Emotional} + 0.99 * \text{Strong tie}$$

### ***Model formulation***

Activity variety is defined as the number of different leisure activities that survey respondents had participated in over the last three months. The model is specified through the following mathematical expectation with the temporal distinction using the year 2020 indicator:

$$E(y_n | x_n, s_n, p_n, r_n) = \exp[(\alpha + \alpha^*T) + (\beta + \beta^*T)x_n + (\gamma + \gamma^*T)I_n + (\delta + \delta^*T)E_n] \quad (1)$$

where

$y_n$  = activity variety for individual  $n$ ,

$x_n$  = personal and household characteristics for individual  $n$ ,

$I_n$  = instrumental support measure for individual  $n$ ,

$E_n$  = expressive support measure for individual  $n$ , and

$T$  = indicator for the year 2020

$\alpha, \beta, \gamma, \delta$  = model parameters

$\alpha^*, \beta^*, \gamma^*, \delta^*$  = temporally varying model parameters.

To account for possible overdispersion, a negative binomial regression is used. An individual's probability of participating in  $y_n$  different activities,  $P(y_n)$ , is defined as follows:

$$P(y_n) = \frac{\Gamma(1/\alpha + y_n)}{\Gamma(1/\alpha)y_n!} \left(\frac{1/\alpha}{(1/\alpha) + \lambda_n}\right)^{1/\alpha} \left(\frac{y_n}{(1/\alpha) + \lambda_n}\right)^{y_n} \quad (2)$$

where  $\Gamma(\cdot)$  is the gamma function,  $\lambda_n = \exp(\beta(x_n + I_n + sE_n) + \varepsilon_i)$ , and  $\exp(\varepsilon_n)$  is a Gamma-distributed disturbance term with unit mean and variance given by the dispersion parameter  $\alpha$ . Model parameters were estimated using quasi-maximum likelihood estimation using the *MASS* package in R.

### ***Hypotheses***

To test the temporal stability or lack thereof, this research examines the following hypotheses:

H1: Leisure variety behavior is not temporally stable before and during the pandemic

H2: Social capital constructs, including instrumental and expressive support, remain temporally stable before and during the pandemic

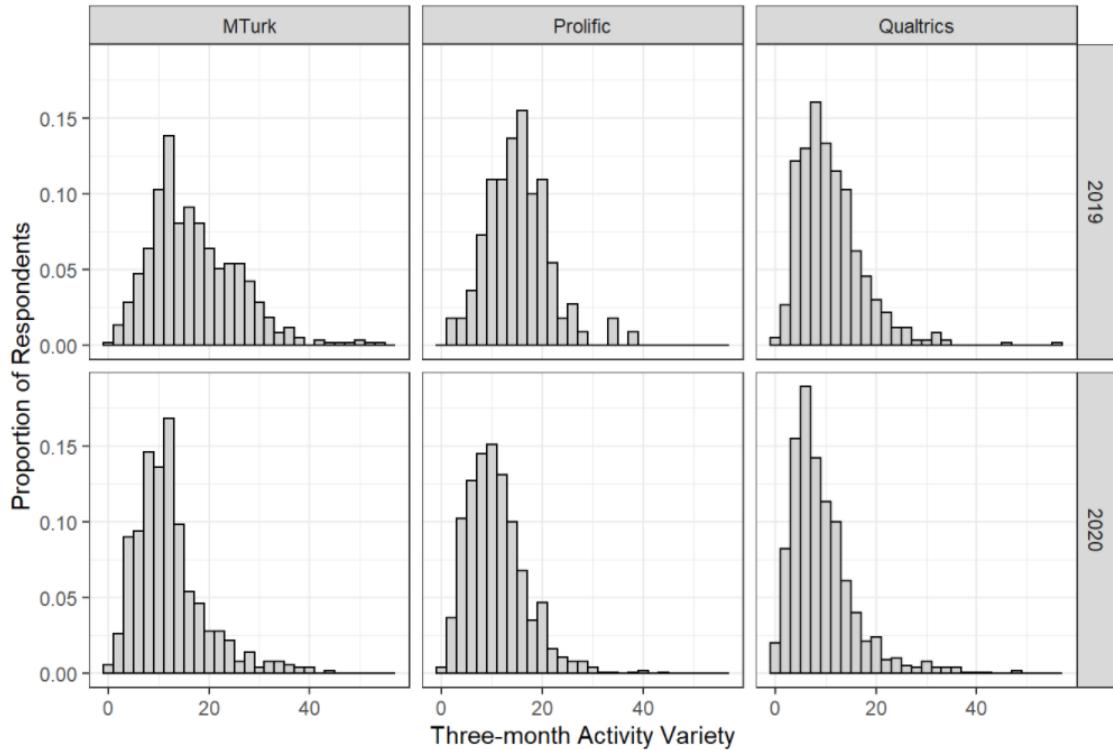
**Table 1: Two-year Sample Descriptive Statistics**

<b>Variable</b>	<b>Description</b>	<b>2019</b>	<b>2020</b>
Age	Mean	46.9	47.4
	Median	44.0	45.0
	Standard deviation	16.9	17.7
Education	Less than high school	0.7%	1.6%
	High school graduate	12.2%	15.4%
	Some college, no degree	18.4%	21.1%
	Associate degree	9.5%	9.0%
	Bachelor's degree	35.4%	33.2%
	Graduate degree	19.6%	16.4%
Employment	Full-time	57.0%	40.9%
	Part-time	12.7%	12.9%
	Retired	15.9%	22.1%
	Student (not employed for pay)	1.9%	3.7%
	Disabled (not employed for pay)	2.9%	4.4%
	Not employed for pay	6.7%	12.2%
Gender	Female	50.3%	49.2%
	Male	49.2%	50.8%
Household income (in US dollars)	Under \$15,000	5.5%	10.2%
	\$15,000–\$24,999	9.6%	10.6%
	\$25,000–\$34,999	10.6%	10.4%
	\$35,000–\$49,999	16.0%	14.4%
	\$50,000–\$74,999	22.3%	19.4%
	\$75,000–\$99,999	14.1%	15.3%
	\$100,000–\$149,999	12.5%	12.3%
	\$150,000–\$199,999	4.9%	4.4%
	\$200,000–\$249,999	2.2%	1.2%
	\$250,000 or more	2.0%	1.9%
Household size	One person	22.2%	19.8%
	Two people	38.2%	36.9%
	Three or more people	39.6%	43.2%
Marital status	Married/domestic partnership	48.1%	47.5%
	Widowed	4.0%	3.0%
	Divorced	9.6%	9.0%
	Living with a partner	7.2%	8.6%
	Never been married	29.8%	30.6%
Race	Asian	6.9%	6.4%
	Black or African American	9.7%	9.8%
	White	82.0%	81.2%
	Other race	4.0%	4.3%
Household vehicle	No vehicle	7.8%	8.3%
	One	37.2%	35.4%
	Two	39.1%	36.4%
	Three or more	15.7%	19.8%
Sampling source	MTurk	46.4%	20%
	Prolific	8.6%	40%
	Qualtrics	45%	40%
Number of valid responses		1,275	2,500

### 3. RESULTS AND DISCUSSION

#### *Leisure Activity Variety Summary*

Survey respondents reported reduced participation in different activity types over the last three months of 2019 and 2020. The 2019 respondents reported a mean of 14.6 unique activities and a standard deviation of 8.1 unique activities, while the 2020 sample averaged 11.0 unique activities with a standard deviation of 6.5 unique activities. Figure 1 presents the distributions of the number of unique activities across three sampling sources for 2019 and 2020. The distributions of activity variety across all three panels were skewed towards the left for 2020 indicating the reduction of activities the respondents participated.



**Figure 1: Activity variety distribution for two-year samples.**

#### *Leisure Activity Variety Temporal Model Results*

Using the two-year data, the negative binomial model estimation results of the 18 factors significantly correlated with the number of different leisure activities over the last three months are provided in Table 2. Some common variables that were tested but were not significant predictors of activity variety were household income, presence of children in the household, employment status, working hours, other race groups, and other personality traits. All variables were also tested on their specific changes for the year 2020 and whether they have statistically significant effects on activity variety. Columns [3] and [4] report the parameter estimates and t-statistics for eight variables with statistically significant effects for the year 2020. All else being equal, an individual would participate in 31% fewer activity types in 2020 compared to 2019.

#### *Temporal Stability Test for Activity Variety*

To test Hypothesis 1 on whether activity variety was temporally stable across the two-year data, a likelihood ratio test between a restricted pooled model assuming temporally stable parameters and an unrestricted pooled model with temporally varying parameters was conducted. The likelihood ratio test statistic of 282.02 for eight additional degrees of freedom ( $p\text{-value} < 0.001$ ) demonstrates clear temporal instability in leisure activity variety behavior during the pandemic.

**Table 2: Negative Binomial Model Estimation Results of Activity Variety**

Variable	Overall PE	t-stat	For 2020 PE	t-stat
[0]	[1]	[2]	[3]	[4]
Intercept	<b>1.811</b>	<b>27.1</b>	<b>-0.495</b>	<b>-7.4</b>
Instrumental support	<b>0.786</b>	<b>21.0</b>	—	—
Expressive support	<b>0.108</b>	<b>2.8</b>	—	—
Household size	-0.006	-0.6	<b>0.041</b>	<b>3.5</b>
Age between 18 and 35 years	<b>-0.003</b>	<b>-2.2</b>	-0.002	-1.5
Age between 35 and 60 years	<b>-0.002</b>	<b>-3.2</b>	—	—
Age of 60 years or more	0.001	0.4	<b>-0.009</b>	<b>-2.5</b>
Licensed driver with vehicle availability in the household indicator	<b>0.112</b>	<b>4.9</b>	—	—
Having disability to travel indicator	<b>-0.062</b>	<b>-2.0</b>	—	—
Personality score for openness to experience	<b>0.052</b>	<b>8.4</b>	—	—
Personality score for extraversion	0.010	1.3	<b>0.018</b>	<b>1.9</b>
Pandemic impact score for 2020	n/a	n/a	<b>0.053</b>	<b>5.1</b>
Female respondent indicator	<b>-0.081</b>	<b>-4.9</b>	—	—
Weekly cooking and chores time [10h]	<b>0.086</b>	<b>5.3</b>	<b>-0.054</b>	<b>-3.0</b>
Having been divorced indicator	<b>0.052</b>	<b>1.9</b>	—	—
Having bachelor's degree or higher degree indicator	<b>0.035</b>	<b>2.2</b>	—	—
Identified as white indicator	<b>0.070</b>	<b>3.5</b>	—	—
Sampled from Prolific panel indicator	<b>-0.127</b>	<b>-2.7</b>	<b>0.103</b>	<b>1.9</b>
Sampled from Qualtrics panel indicator	<b>-0.298</b>	<b>-9.3</b>	<b>0.243</b>	<b>5.8</b>
Number of observations	3,775			
Log likelihood at convergence	-11469.8			

PE = parameter estimates, ME = marginal effects.

— = variables without significant interactions with the year 2020

Bolded values are statistically significant at 95% level or more.

#### *Temporal Stability Test for Social Capital Constructs*

Across all models with social capital, the effects of both instrumental and expressive social capital are strongly positive. While showing the largest increase in activity variety, instrumental support measure does not have significant effect separately for 2020. Similarly, the expressive support measure does not exhibit temporally varying effects in 2020, thus supporting Hypothesis 2 that social capital constructs are stable before and during the pandemic.

#### *Temporal Stability Test for other Explanatory Factors*

The respondents' age was one of the main criteria for the changes across two years. Many combinations of the age groups were tested, and respondents aged 60 or older were significantly more likely to have reduced activity variety. Having access to a household vehicle is a significant factor across both years in increasing activity variety. While not being significant in the 2019 sample, more household members increase the number of unique activities for 2020 respondents which may show that respondents were more dependent on household members for leisure. Being extraverted was a more pronounced trait in 2020 to increase activity variety. Individuals with more serious concerns about COVID-19, measured by the pandemic impact questionnaire (Palsson et al., 2020), exhibited a higher likelihood of participating in different activities. Kim et al. (2021) also found that a greater perceived threat of COVID-19 induced greater variety-seeking behavior.

#### **4. CONCLUSIONS**

Independent samples for 2019 and 2020 collected from the same survey design allowed the test for temporal stability of leisure activity behavior. Model inference shows negative impacts of the pandemic on activity variety, especially for the vulnerable groups. Not only having substantial and significant effects on leisure activity variety, social capital constructs, specifically instrumental support, have remained temporally stable despite many changes due to the pandemic restrictions. Age, household size, and extraversion are among the factors that exhibit temporal instability. Although the findings would be more consistent in a longitudinal study with the same participants over time, this study's results support the robustness and importance of social capital constructs in increasing activity variety, which further provide evidence for the valuable resources offered by one's social network under drastic changes and restrictions. This study also provides a quantitative analysis of one's activity behavior change using actual activity count rather than subjective assessment as being prevalent in current study. Future efforts can be dedicated to examining activity frequency and unraveling the unobserved heterogeneity of the temporally unstable factors.

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#### **REFERENCES**

- Bayrsaikhan, T., Lee, J. and Kim, M.H., 2021. A seemingly unrelated regression model of the impact of COVID-19 risk perception on urban leisure place choices. *International Review for Spatial Planning and Sustainable Development*, 9(3), pp.30-40.
- Burt, R.S., 1984. Network items and the general social survey. *Social networks*, 6(4), pp.293-339.
- Hampton, K. N., L. Sessions, E. Her, and L. Rainie. Social Isolation and New Technology. 2009.
- Häuberer, J., 2011. Social capital theory. Towards a methodological foundation. *Wiesbaden: VS Verlag*.
- Joye, D., Sapin, M., Wolf, C., 2019. Measuring social networks & social resources: an exploratory ISSP survey around the world. *Köln: GESIS – Leibniz-Institut für Sozialwissenschaften*.
- Kim, J., Park, J., Kim, S., Lee, D.C. and Sigala, M., 2021. COVID-19 Restrictions and Variety Seeking in Travel Choices and Actions: The Moderating Effects of Previous Experience and Crowding. *Journal of Travel Research*, pp.1-18.
- Kim, Y.J. and Kang, S.W., 2021. Perceived crowding and risk perception according to leisure activity type during covid-19 using spatial proximity. *International Journal of Environmental Research and Public Health*, 18(2), pp.457.
- Lin, N., 2001. Building a network theory of social capital. In: N. Lin, K. Cook, R. Burt, eds. *Social capital: Theory and Research*. Transaction Publishers. pp.3-29.
- Liu, H., Lavender-Stott, E., Carotta, C., Garcia, A., 2021. Leisure experience and participation and its contribution to stress-related growth amid COVID-19 pandemic. *Leisure Studies*, pp.1-15.

Maness, M., 2017. A theory of strong ties, weak ties, and activity behavior: leisure activity variety and frequency. *Transportation research record*, 2665(1), pp.30-39.

Mannering, F., Maness, M., Pinjari, A., Zhang, Y., Alnawmasi, N., Balusu, S.K., Barbour, N., Behnood, A., Eluru, N., Luong, T. and Mishra, D., 2019. Emerging Econometric and Data Collection Methods for Capturing Attitudinal and Social Factors in Activity, Travel Behavior and Safety Modeling.

Oh, A., Kim, J., Yi, E. and Shin, J., 2020. Verification of the Mediating Effect of Social Support on Physical Activity and Aging Anxiety of Korean Pre-Older Adults. *International Journal of Environmental Research and Public Health*, 17(21), pp.8069.

Palsson, O., Ballou, S. and Gray, S., 2020. The US National Pandemic Emotional Impact Report.

Sasaki, S., Sato, A., Tanabe, Y., Matsuoka, S., Adachi, A., Kayano, T., Yamazaki, H., Matsuno, Y., Miyake, A. and Watanabe, T., 2021. Associations between socioeconomic status, social participation, and physical activity in older people during the COVID-19 pandemic: a cross-sectional study in a northern Japanese city. *International Journal of Environmental Research and Public Health*, 18(4), pp.1477.

Sweeney, T. and Zorotovich, J., 2021. Examining retirees perceptions of the effects of COVID-19 mitigation strategies on leisure participation and social relationships. *World Leisure Journal*, 63(3), pp.255-264.

Zhuo, K. and Zacharias, J., 2021. The impact of out-of-home leisure before quarantine and domestic leisure during quarantine on subjective well-being. *Leisure Studies*, 40(3), pp.321-337.