



Article

Variability in forest visit numbers in different regions and population segments before and during COVID-19 pandemic

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Abstract: In view of prevailing preferences for health and recreation revealed by previous studies as the main expected benefits of forest visits, the research presented herein focuses on whether such expectations would translate into a significant increase in number of forest visits (NFV) following pandemic outbreak. In this context, a Slovak nation-wide survey on forests was conducted with the main objective to cast light on possible changes in NFV as a coping mechanism or behavioral response to discomfort and severe restrictions stemming from COVID-19 and related measures. The survey was administered on a statistically representative sample after the first wave of the COVID-19 pandemic, after the pandemic’s 1st wave ebbed and restrictions were eased in the summer months of 2020. Collected data were assessed by ANOVA, whose results support importance of forests as places providing opportunities for restoration of mental and physical resources. Forest accessibility represented by forest coverage and settlement size emerged as paramount factors affecting NFV both before and during COVID-19 pandemic. The pandemic and its accompanying measures had effect on the relationship between NFV on the one hand, and average per capita income, type of employment, and—most importantly—age on the other hand, which highlights possible vulnerabilities and disadvantages in certain population segments.

Keywords: Forest recreation; forest coverage; settlement size; Covid-19 pandemic; lockdown restrictions; number of forest visits; forest visitor age

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1. Introduction

The social values of forest recreation deal mainly with intangible benefits such as aesthetic qualities as well as the enhancement of psychological and physical health [1]. The results of a considerable amount of research show that nature-based outdoor activities, forest visits and natural environment simulation promote both physical and mental health and wellbeing leading to more positive emotional self-reports, increased sustained attention, cognitive functions and processes of restoration. Further reported benefits include physiological stress reduction manifested by various indicators, e. g. heart-beat, heart-rate variability, blood pressure, stress hormone levels and others [2–6]. Since the 1990s, outdoor and forest recreation has been on the political agenda at the European level [7]. However, contradiction exists between the expressed political importance of outdoor recreation at the national level and the absence of binding commitments for action [8]. One reason for that can be that forest management role in contributing to “health bonus” in the form of human and public health benefits provided by forests is still poorly

investigated [9]. Professional forestry role may consist in appropriate tree species selection, supporting forest stand resilience, maintaining aesthetical forest values and in other activities.

Discussions and policies on forest recreation and management need to be reviewed in light of the multidimensional impact of Coronavirus Infectious Disease 19 (COVID-19) pandemic caused by a highly contagious virus that rapidly spreads and continuously evolves with new variants [10]. Uncertainty surrounding vaccine availability and uptake along with the fact that this virus rapidly circulates throughout the world and mutates has led to a strong focus on a variety of public health measures, e. g., quarantine, lockdowns and social distancing [11]. The coronavirus outbreak has also profoundly impacted the delivery of essential healthcare and management practices in core clinical settings across the globe, including health rationing, which affected many lives [12]. The overall cost of health risks due to the COVID-19 pandemic is exceptionally high [13]. Historical analogies reveal that such situations may lead to long-term issues in accessing healthcare and rising cost of medical treatments, in turn producing a growing demand for alternative ways of coping with health problems and lack of wellbeing [14]. Along similar lines, research with SARS-CoV-2 (hereinafter referred to as COVID-19) infection has shown that recovery is commonly affected by persistent fatigue, accompanied by anxiety or depression and other symptoms [15], thus pointing to multifaceted health repercussions and individuals' search for alternative methods of restoring mental and physical wellbeing.

Nature and forest visits feature various restorative effects on health including stress reduction, whereby the feelings of restoration, vitality and positive mood increases, with older forests showing significantly stronger effects compared to young forests [16,17]. Also, spending time in nature and forests appear to produce health benefits through enhanced immune functioning, promoted by various compound and microorganisms contained in forest air [5]. These findings make the *forests – public health* link profoundly relevant in the current pandemic situation. The complex consequences of the COVID-19 pandemic, along with its accompanying measures (e.g. limitations on accessing health services, lockdown, social distancing) and side-effects (e.g. loneliness, anxiety, depression, weight gain, increased alcohol consumption, reduced physical activity) are likely to last for an uncertain length of time into the future [18,19]. This necessitates public health initiatives and creative solutions to various wellbeing and social challenges as the global pandemic takes its heavy toll. Given the restorative effects mentioned above, our study aims to examine whether people seek relief from increased forest visits and recreation to cope with the difficulties and uncertainties of the pandemic. Our working hypothesis is that the number of forest visits (NFV) would increase during the COVID-19 pandemic as compared to the pre-pandemic period, and this would especially be the case with people having easy access to forests. The hypothesis drew on our 2018 survey that indicated high preference for forest recreation compared to some other forest ecosystem services, such as wood or biomass production [20]. We expected this tendency to be reinforced in face of the pandemic restrictions and so analyzed the number of forest visits in Slovakia – a country well-known for its collection of vast forests that cover approximately 40% of total area.

2. Materials and Methods

In order to establish the anticipated change in the number of forest visits during the early phase of COVID-19 pandemic, we conducted a nation-wide survey on a representative sample of respondents. Considering that population size for each stratum was known, the sample size for each stratum was determined using Krejcie and Morgan formula [21]. Required sample sizes along with the realized sample sizes are shown in Table 1. The realized sample size in most cases reached or exceeded the required sample size, except for respondents in the age category 16–29 and residents of Bratislava, capital of Slovakia.

Table 1. Determination of respondent sample size. Required sample size was calculated for 5 % margin and 90 % confidence interval. Realized sample size corresponded to the number of completed and returned questionnaires. Population size data were obtained from [22].

Variable	Stratum	Population size	Required sample size	Realized sample size	Margin of error (cl 90 %)
Sex	male	2 194 802	271	470	3.79
	female	2 345 447	271	530	3.57
	total	4 540 249	271	1000	2.60
Age	16–29	868 926	271	107	7.95
	30–44	1 302 786	271	280	4.91
	45–62	1 317 266	271	276	4.95
	>62	1 051 271	271	337	4.48
Residence area	Bratislava (capital)	669 592	271	114	7.70
	Eastern Slovakia	1 627 704	271	299	4.76
	Central Slovakia	1 336 785	271	249	5.21
	Western Slovakia	1 823 792	271	338	4.47

All results presented and discussed in this study were acquired through the survey that was conducted during summer 2020 following the first wave of the COVID-19 pandemic in Slovakia and when pandemic measures and restrictions were eased. The survey was distributed digitally throughout the whole of Slovakia to all age/sex/residence segments. The survey was carried out in collaboration with a market research agency Go4insight with expertise in qualitative and quantitative research and data collection methods. In this study respondents were divided into four age groups (16–29, 30–44, 45–62, and > 63 years of age) and the sex consisted of two categories (female and male). Among other aspects, the survey consisted of 19 questions, including two questions asking respondents to provide the average NFV per month before and during the COVID-19 pandemic. For the purpose of this study, we focused on 6 factors, i. e., sex, age, place of residence with regard to forest coverage (Figure 1), population size in place of residence, income category of respondents, and employment type. We then examined which factor had a more robust effect on NFV.



Figure 1. Forest coverage in geographical regions of Slovakia: Bratislava (3.7 %), Western Slovakia (19 %), Central Slovakia (42 %), and Eastern Slovakia (35.3 %).

Statistical analysis was performed using R Statistical Software (Foundation for Statistical Computing, Vienna, Austria). In the first step, descriptive statistics were used to explore the data. In the second step we analyzed the influence of sex, age, number of

citizens, education, employment, salary, place of residence and region on visiting of forests through ANOVA. Results were considered significant if $p \leq 0.05$.

3. Results and discussion

Average per capita NFV showed an increasing tendency from 5.39 before, to 5.87 after the introduction of pandemic measures (i. e. by 9 %, $p = 0.098$). However, the rate of change in NFV varied considerably in different population groups classified by geographical, socio-economic to demographic criteria.

3.1. Role of forest accessibility

The results of ANOVA pointed to strong regional influence on NFV, regardless of the pandemic's 1st wave (Figure 2). We attribute this significant effect to distinct forest coverage **and thus also settlement distance to the nearest forest in each region**. For example, the highest and the lowest average NFV differences occurred in the Central Slovakia and Bratislava regions, featuring the maximum and minimum forest coverage, respectively.

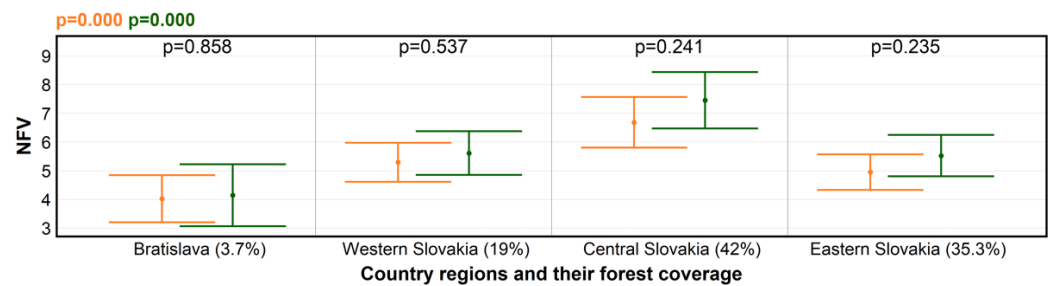


Figure 2. Levels of significance for differences in number of forest visits (NFV) per month according to regions characterized by forest coverage (%), before (orange) and during the COVID-19 pandemic (green) produced by ANOVA, and for NFV differences within groups (black) determined by t-test.

It is very likely that the trend in NFV and its changes during COVID-19 with regard to forest coverage among Slovak regions resulted from a direct link between forest coverage and distance to the nearest forest. Earlier studies conducted in some European countries showed that living closer to forest increases the likelihood of greater frequency of forest visits, also for example if children that grow up in the proximity of forests [23–25]. The closeness of forest was important as people were prepared to walk to close recreational forest if the distance was less than 1–2 km. Otherwise they were likely to drive, but not necessarily to nearest forest [26,27]. However, driving beyond one's own district limits was severely restricted during COVID-19 lock-down. Thus, the effect of distance to the nearest forest helps explain the highest NFV increase in settlements with less than 1000 inhabitants, followed by the category of towns up to 5000 inhabitants (Figure 3). Both settlement types typically offer direct access to forests without need to use motorized transport.

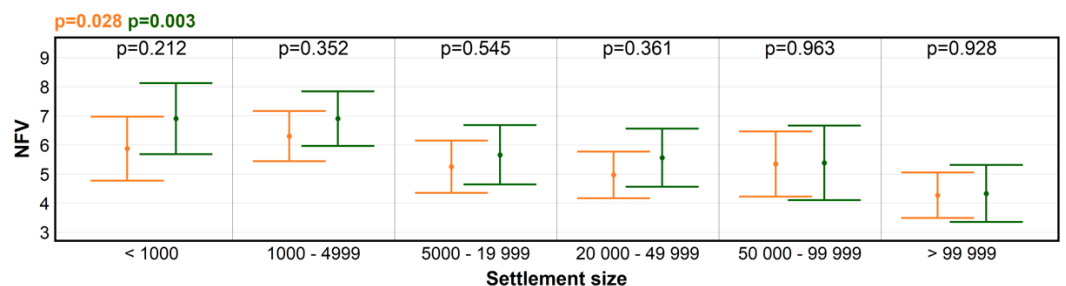


Figure 3. Levels of significance for differences in number of forest visits (NFV) per month according to settlement size, before (orange) and during the COVID-19 pandemic (green) produced by ANOVA, and for NFV differences within groups (black) determined by t-test.

Figure 3. Levels of significance for differences in number of forest visits (NFV) according to settle- 164
 ment size, before (orange) and during the COVID-19 pandemic (green) produced by ANOVA, and 165
 for NFV differences within groups (black) determined by t-test. 166
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On the contrary, respondents from the most urbanized areas depend on public or 168
 private means of transport to reach forests. According to major inventories, one-half (52 169
 %) of all national forest visits were made by motorised visitors living within 100 km of 170
 national forest boundaries [28]. Similar figures were reported from Lithuanian forests [27]. 171
 However, the use of both public and private transport was either restricted, discouraged 172
 by authorities, or reduced by owners to avoid crowded parking lots during lock-down. 173
 Thus, on average, inhabitants of large cities without abundant recreational forests in their 174
 vicinity had fewer convenient opportunities for more frequent forest visits. In contrast, 175
 NFV probably spiked in conveniently located urban or periurban forests. E. g., a two-fold 176
 increase in NFV was reported from a forest near Bonn shortly after the inception of 177
 COVID-19-related measures [29]. Unlike average changes in NFV before and during CO- 178
 VID-19 pandemic, such local or transient spikes were reported by Slovak media even in 179
 areas featuring low forest coverage such as Bratislava region. 180

3.2. Role of income and type of employment 181

Also, settlement size has been traditionally associated with average income, but this 182
 relationship appears to vary among countries [30,31]. Under normal circumstances, the 183
 share of various income groups among nature and forest visitors tends to be rather similar 184
 [32]. The local visitors are more likely to come from lower household income groups than 185
 non-local visitors. However, the size of settlements in Slovakia is not always a deciding 186
 factor affecting average income and there are many exceptions from the rule due to mul- 187
 tiple factors [33]. Irrespective of that, COVID – 19 related measures appear to have an 188
 equalizing effect on average income – NFV relationship by cutting down and pushing up 189
 NFV in the lowest and the highest income categories, respectively (Figure 4). It is possible 190
 that the former group partly overlapped with the retiree category (Figure 5), in which the 191
 decrease has not been significant either. It indicates that the drop was partly offset by the 192
 rise of forest visitors from settlements with < 1000 inhabitants (p=0.22) in rural areas. 193
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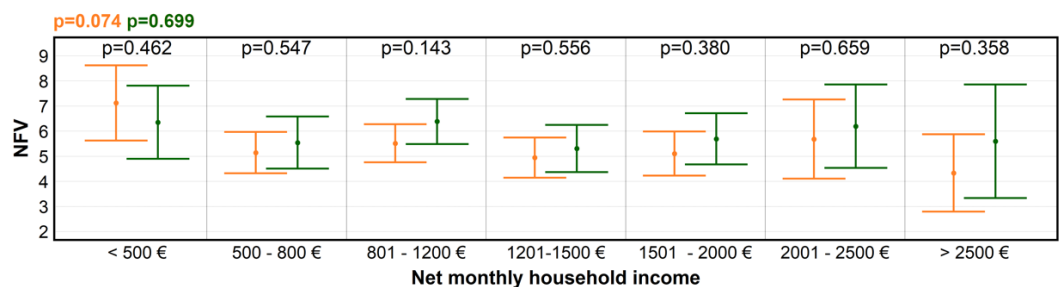


Figure 4. Levels of significance for differences in number of forest visits (NFV) among groups created 195
 according to net monthly household income, before (orange) and during the COVID-19 pandemic 196
 (green), produced by ANOVA, and for within-group NFV differences (black) determined by t-test. 197
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It also seems that flexible teleworking used by organizations to adapt to the global 201
 pandemic [34] enabled higher income categories to take advantage of increased flexibility 202
 to spend more time in nature, probably also with their children who did not attend schools 203
 at that time. 204

Average income generally depends on the type of employment, which in turn be- 205
 came a more important factor with regard to NFV during COVID-19 pandemic (p = 0.052). 206
 We deduce that the observed NFV increase in the majority of categories according to type 207
 of employment (Figure 5) resulted from the discovery of forests as environment providing 208
 opportunities for alternative leisure during wide-spread absence of established cultural 209

and entertainment opportunities, and for coping with stress, building resilience, and inducing positive mood states in a time of increased anxiety and confinement [35–37]. The clearest manifestation of NFV increasing tendency in some categories appeared in individuals on parental leave ($p = 0.11$). As for the “Other” category, the highest NFV variability reflects its composition including respondents from IT sector, services and state administration. While some individuals were placed on teleworking, others were included in the critical infrastructure and thus had less control over their working schedules.

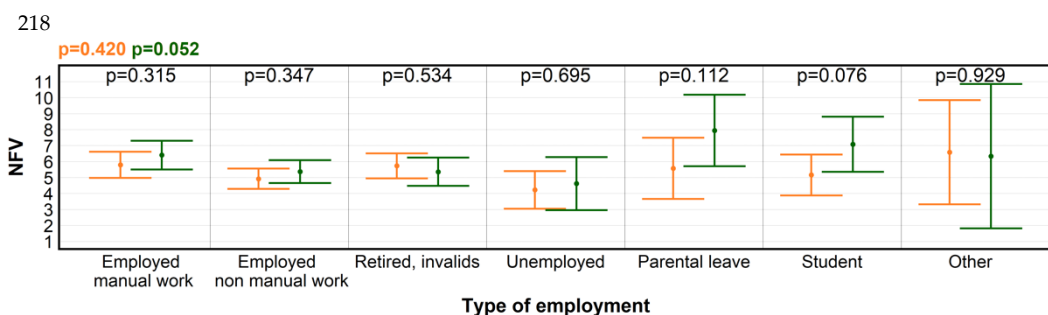


Figure 5. Levels of significance for differences in number of forest visits (NFV) according to type of employment, before (orange) and during the COVID-19 pandemic (green), produced by ANOVA, and for within-group NFV differences (black) determined by t-test.

The NFV rising tendency in parental leave group before and after COVID-19 pandemic was clearly recognizable but statistically non-significant. Neither did it lead to discernible NFV difference according to sex (Figure 6). While women still tend to stay home with little children despite ongoing transformation of sex roles in European families [38], traditional role distribution could have been partially perturbed by the unexpected outbreak of COVID-19. Besides, the respondent sample size did not specifically account for parental leave category.

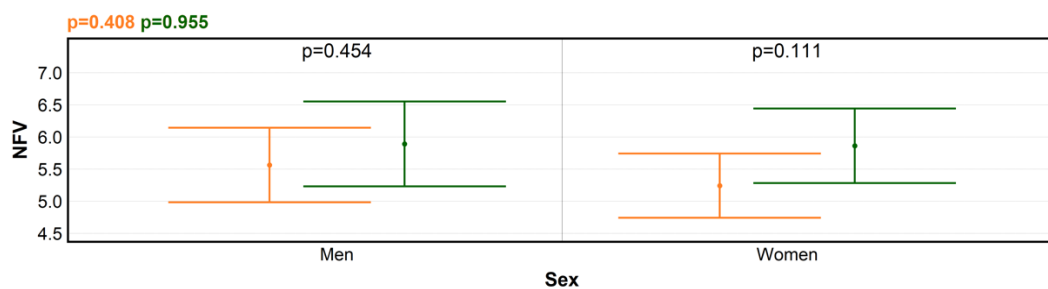


Figure 6. Levels of significance for differences in number of forest visits (NFV) between men and women, before (orange) and during the COVID-19 pandemic (green), produced by ANOVA, and for within-group NFV differences (black) determined by t-test.

3.3. Role of age

Finally, age as a factor explained a major part of the NFV variability (Figure 7). While there had been no detectable difference in the number of visits according to age prior to the COVID-19 ($p = 0.780$), highly significant differences emerged during the event ($p=0.001$). The biggest, approx. 20 % nominal increase in NFV occurred in the categories of young and younger middle-aged individuals. That increase was also statistically significant in the latter category. Contrary to that, there was a notable decrease in the group of elderly people during the COVID-19 compared to pre-COVID 19 level ($p = 0.160$), which corresponds with the nominal decrease in the “Retirees, invalids” category (Figure 3). Different results in various age categories indicate differentiated risk assessment. For instance, visiting forests with high concentration of visitors may have been perceived as a

risk due to increased probability of spreading or contracting COVID-19 infection. In particular, national and local governments around the world have declared emergencies, promoted safer-at-home orders, and required business closures to increase social distancing and reduce the risk of transmission [39]. In this context, it was suggested that people make generally less risky decisions after a disaster [40]. However, other studies [41,42] suggest a more nuanced and differentiated perspective, stressing that the risk attitudes of people who experience a disaster cannot be simply described as a general seeking or avoidance of risk, depending on whether information was gained by learning or experience, age, as well as their perception of low probability associated gain or loss. In our study, the main increase took place in young people and became less pronounced with increasing age, until there was a decrease in people older than 62 years. This corresponds well to theories implying that aging should be associated with reduced risk taking. In fact, primarily older people were encouraged to “stay home” and “keep safe” as a basic precautionary “shielding” measure promoted by health authorities and media outlets. The results also highlight possible vulnerabilities and disadvantages in certain population segments.

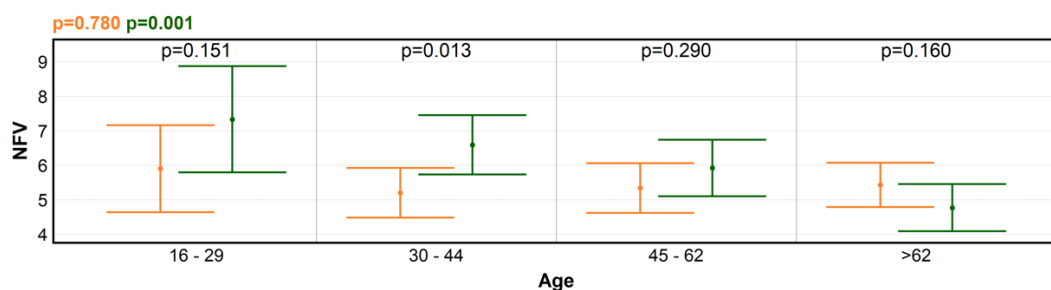


Figure 7. Levels of significance for differences in number of forest visits (NFV) according to age, before (orange) and during the COVID-19 pandemic (green), produced by ANOVA, and for within-group NFV differences (black) determined by t-test.

In fact, a plethora of factors and their interactions affect the number of visits during the COVID-19 pandemic, opening up avenues for further promising research. One question is whether the share of green urban space in municipalities affected NFV. We hypothesize that if people are aware of forest visit utility as documented by an array of research outcomes, demand for accessible forest areas would increase despite available green city infrastructure.

4. Conclusions

Results from a nation-wide survey among residents of Slovakia show that forest accessibility was a paramount factor affecting the number of forest visits in both pre-COVID-19 situation and during the pandemic. In terms of effect on NFV, settlement size was linked with forest accessibility through distance to the nearest forest, which is lowest in villages and towns with up to several thousand inhabitants. COVID-19 and its accompanying measures had an equalizing effect on average income–NFV relationship by alternatively diminishing and rising NFV in the lowest and the highest income categories, respectively. The observed pattern developed after massive introduction of working-from-home schemes during the COVID-19 pandemic and more flexible working schedules. Type of employment and age were revealed as additional crucial factor determining NFV. Also, there was a nominal increase in stated NFV by respondents on parental leave and students on the one hand, and NFV decrease in the retired people category, probably linked with risk avoidance behavioral patterns, on the other hand. It appears that COVID-19 triggered both conscious and unconscious responses by tapping into primordial and cultural connections between people, nature, and forests, discussed by Schama [43]. As a result, both intuitively and rationally propelled partial remedy to constraints and stress caused by COVID-19 pandemic emerged in the form of NFV increase. It follows that it is

crucial to maintain, adjust, and expand existing or design new opportunities for nature and forest recreation, especially in areas where such opportunities have been missing to date. Emphasis needs to be placed on protecting, enhancing, and building new potential for the restorative effects of nature and forests in particular, considering and building on central pathways mediating the effects of nature and forests on human health. At the same time, increase in NFV as a coping tool to handle health and wellbeing issues would not incur substantial public health care costs but could contribute significantly to enhanced public health. It is worth noting that the main challenges to enhancing wellbeing through forests are brought about by ecosystem and biodiversity degradation, deforestation, and climate change [4]. Findings from this paper imply that nudging for forest visits may be used as an effective tool to alleviate the wellbeing issues in the face of perceived health risks. Therefore, a dialogue among forest owners, regulators, public health administrators, policymakers, health officials and all stakeholders should be facilitated to ensure the pursuit of a closer-to-nature, multiple use – oriented land and forest management approach.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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