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The impact of the COVID-19 pandemic on the importance of urban green spaces to the public

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ABSTRACT

Green spaces provide people with countless intangible benefits, particularly important during crises. Restrictions imposed in many countries due to the COVID-19 pandemic forced people to maintain social distance, limit travels, and even refrain from visiting green spaces and stay at home at a certain point. The survey in one of the largest cities in Poland, Krakow, was intended to help understand the impact of the pandemic on the importance of urban green spaces to the public. The study focused on the first three stages of the pandemic in Poland, from March to November 2020. Nine weeks of the survey yielded over 1250 responses. Responses to spatial questions were analyzed with GIS tools and geoprocessing algorithms. The number of visitors to green spaces during the pandemic fell to 78.9% of the population, which is down 13.1% compared to before the pandemic. At the same time, the percentage of people refraining from the visits fell with each phase of the crisis. According to the study, residents believed green spaces to be important for their mental and physical health. Over 75% of the participants considered visits to green spaces as having a very big or big impact on stress level reduction. The work provides empirical proof of the importance of green spaces to residents, particularly during a crisis. The results can affect urban spatial policies and management of green spaces and can potentially be applied in other cities.

1. Introduction

1.1. The COVID-19 pandemic: spread and social restrictions

The new form of coronavirus (SARS-CoV-2) emerged in December 2019, in the Wuhan province of China, which causes coronavirus disease 2019 (COVID-19). It was declared an international public health emergency on 11 March 2020 by the World Health Organisation (WHO, 2020). Since then, the virus has been spreading globally and caused an increasing number of deaths worldwide (Angiello, 2020; Zhu et al., 2020). In many parts of the world, concerns about the COVID-19 pandemic and city quarantine policy have led to a general decline in residents’ physical and mental health due to insufficient social interaction (Doyle et al., 2021; Kavan, 2021; Xie et al., 2020a; White et al., 2020). The problems of the environmental and economic impact of COVID-19 on human activities and the environment call for a further investigation of this topic (Chernysh and Roubik, 2020). In an attempt to curb the COVID-19 pandemic, states have implemented various social restrictions. These measures varied among countries, but the most common ones included border and school closures, encouragement of teleworking, social distancing, and restrictions on mobility, including lockdowns (Karnon, 2020; Wilder-Smith and Freedman, 2020; Pouso et al., 2021). To prevent the spread of COVID-19, some types of public spaces, including urban green spaces, have been shut down (Benzell et al., 2020). Therefore, social, economic, and health consequences are inevitable (Mofijur et al., 2021; Douglas et al., 2020).

On 11 March 2020, the World Health Organisation (WHO) upgraded the status of the COVID-19 situation from epidemic to pandemic. The Polish Minister of Health reacted to this decision by imposing a state of epidemic emergency on 14 March 2020 due to SARS-CoV-2 infections
(The Minister of Health, 2020). Then, on 31 March 2020, specific restrictions and regulations were enforced due to the state of epidemic (REGULATION, 2020b). One of the measures was a mobility restriction. It was an unprecedented lockdown that was not imposed even during the First or Second World Wars or in the communist era. The government decided to close down public administration, schools, universities, shops (apart from grocery stores and pharmacies), churches, and state borders. Even the ongoing presidential campaign was brought to a halt, with candidates virtually ceasing promotional activities.

As of 1 April 2020, the public was barred from public beaches and green sites (REGULATION, 2020a). The ban involved parks, greens, promenades, embankments, botanic and zoological gardens, or special activity gardens for children and youth. These areas were believed to be social hubs with an increased chance of infection. Since 16 April, mouth and nose covering had been compulsory on the streets. On 20 April, some safety regulations changed. The lifting of the restrictions has been divided into four stages. The first limited restrictions (stage 1) were implemented on 20 April 2020 from which point forests, parks, and green squares could be used for recreation. The fourth stage of restriction loosening from 30 May 2020 annulled the obligation to cover the nose and mouth in open spaces.

Additionally, open-space gyms, playgrounds, and small forest infrastructure could be used again (REGULATION, 2020c). Despite strict controls and the reintroduction of the mouth and nose covering in October, green sites were not closed again (REGULATION, 2020d). The authors divided the period of the pandemic in Poland into three phases depending on government actions: phase I (March to May 2020), phase II (June to August 2020), and phase III (September to November 2020).

1.2. The role of urban green spaces in crises

Due to increasing urbanisation, the distribution of human settlement is changing, leading to a rapid decline of vegetation cover in cities and towns (Jayasinghe et al., 2021). Urbanisation tends to decrease the proportion of land that is dedicated to public green spaces. As the focal point of the urban natural ecosystem, urban green space is the primary source of the service functions of natural ecosystems for urban residents. Therefore, it has become a key measure of a city’s development, quality of life, and sustainable development capabilities (Zhu and Xu, 2021).

While the world is still struggling with the pandemic, there has been a lifestyle change in many countries and communities, which may have relatively longer socio-psychological and behavioural implications (Shaw et al., 2020). Mental and physical health problems have become one of the significant challenges faced by the global population (Jia et al., 2021). A growing number of studies suggests beneficial health effects of contact with urban green spaces (Engemann et al., 2019; van den Berg et al., 2015; Gascon et al., 2015; Zhang et al., 2020; Qin et al., 2021; Kabisch et al., 2021; Gao et al., 2020). Economically disadvantaged communities in neighbourhoods with poor access to green spaces are known to be burdened with health issues more, leading to intergenerational well-being problems (Sharifi et al., 2021). Researchers have proven that urban green spaces may improve human health and well-being and are meeting spaces for various socioeconomic classes, reducing segregation and multiplying opportunities for the psychological restoration of residents (Liotta et al., 2020; Aerts et al., 2021; Spencer et al., 2020; Bonilla-Bedoya et al., 2020). Living close to high-quality urban green spaces is associated with positive impacts on health, both physical and mental (Europe, 2016).

Urban research related to previous pandemics is mainly focused on issues such as inequalities that make poor and marginalised groups more vulnerable to pandemics (Wade, 2020). With many indoor recreational spaces closed due to COVID-19 restrictions, the role of public green spaces in promoting population health is amplified (Geary et al., 2021) and redefined.

1.3. Aim, research questions, and a new universal challenge

According to the literature review, new research continues to emerge on the use of urban green spaces, also in the pandemic (Felappi et al., 2020; Sharifi and Khavarian-Garmir, 2020; Gryzb et al., 2021; Ciupa and Suligowski, 2021). Nevertheless, to the best of the authors’ knowledge, the pandemic’s impact on the physical and mental needs of residents are rarely tackled. What is more, few researchers conduct surveys among urban residents who are directly affected by the situation. The present paper is our response to the existing research gap to address the issue with a survey study. First, it analyses the social aspect of intangible benefits of visits to urban green spaces. Second, we identify and map urban green spaces that the residents visited the most during mobility restrictions. Therefore, the purpose of the paper is to determine whether visits to green spaces by residents of Kraków help meet their intangible needs (mental and physical) exposed during the COVID-19 pandemic. The objective was to determine the reasons residents of Kraków visited or did not visit green spaces during the pandemic and to identify the most popular places. To this end, the authors posed the following research questions:

1. Has the pandemic affected how people perceive urban green spaces?
2. Has the importance to and for the public of the use of urban green spaces changed for residents of Kraków?
3. Do residents of Kraków believe that visits to urban green spaces during the COVID-19 pandemic affect their mental and physical health?
4. Which urban green spaces were the most visited by residents of Kraków during the pandemic?

Note the versatility of the study. The original survey questionnaire can be applied to cities worldwide because the COVID-19 pandemic is a global issue, and green areas are universally important. Hence, the present research can contribute to social and spatial comparative analyses in a broader international context. What is more, opinions of urban communities can help decision-makers and building developers better understand the relevance and universality of urban green spaces for satisfying human needs. They can further inspire rational planning of residential areas. Our results have been verified against the opinions of the largest building developers in Poland regarding changes in residential development planning brought by the pandemic. According to developers, they strive to provide residents with access to recreational areas and common green spaces (Infor, 2021).

For the purpose of the paper, ‘urban green spaces’ are larger green areas that provide various social and recreational functions (such as parks, playgrounds or greenways) in accordance with national regulations.

2. Methods

The present research was conducted in three stages as specified below (Fig. 1): (1) identification of the research problem and selection of the study area; (2) literature review and legal studies to define the purpose of the research; (3) acquisition of spatial data on green spaces in Kraków; (4) draft of a survey questionnaire; (5) revision of the questionnaire by experts in social sciences, engineering and technology, and natural sciences, including a statistician; (5) a pilot survey; (6) a survey proper and analysis of results; (7) spatial analyses of green spaces in Kraków using QGIS (and responses to survey questions); (9) conclusions.

2.1. Study area

The study area was the city of Kraków, a city in southern Poland (Fig. 2). Kraków is one of Poland’s largest cities (327 km²) with a population of 781 thousand (LDB, 2021) and about 150 thousand students. It used to be the capital of Poland and is now the capital of Małopolskie
Voivodeship, which affects its growth. Kraków is an interesting place to investigate for several reasons. The first one is that, according to Telega et al. (2021), it combines the historical developments of three towns, Kraków’s Old Town (established in 1257), Kazimierz (14th century), and Podgórze (18th century). The other reasons is its situation on the Vistula, which significantly affects its land cover (Kukulska-Koziel et al., 2019; Kwartnik-Pruc and Trembecka, 2021). Of importance is its ring-and-wedge layout with a green belt encompassing the Old Town sited in place of demolished town walls and green wedges providing connectivity between its environment and suburban green areas (forests around the city).

Urban green spaces are an important part of the Kraków’s spatial system (Kwartnik-Pruc and Trembecka, 2021). Parks, green squares, embankments, and other green spaces are important elements of the landscape in Kraków and affect its identity (Kukulska-Koziel et al., 2019). The spaces managed by Kraków’s Municipal Green Administration covers over 19 km², which is 6% of the total city area. Forests are the largest part of the urban green spaces. According to (Kwartnik-Pruc and Trembecka 2021), forests in Polish cities are normal. They complement the green fabric of the city. Street greenery, parks, and green squares also constitute a significant part of the urban green spaces. They are also popular venues for physical activity in the city.

2.2. Survey design and implementation

The authors designed and conducted an online survey to collect data from residents of Kraków who are the users of urban green spaces. It was impossible to carry out a traditional paper-and-pencil (PAP) survey due to the COVID-19 pandemic and restrictions such as official mobility and assembly bans. Moreover, online surveys have become a broadly employed method for quick and precise collection of responses from a relatively large population (Davidov and Depner, 2011). Online surveys are often used in interdisciplinary research on socioeconomic and, generally, cultural growth (Bernal et al., 2019; Chisika et al., 2020). The popularity of online tools is mostly due to their availability, cost-efficiency, multimedia capabilities, and versatility (Barrios et al., 2011). Data collection online can be faster, global, and cheaper (Krol and Hernik, 2020). It is why online surveys gradually replace traditional PAP surveys (Davidov and Depner, 2011).

The survey questionnaire for the study was designed in November 2020 and revised by various experts in social sciences, engineering and technology, and natural sciences, including a statistician. The anonymous survey was available for two months, from 4 December 2020–4 February 2021 and took about five minutes to fill in.

The questionnaire was divided into two parts with nine single or multiple answer questions. The first part included two questions about demographic data, the age interval and the district of Kraków where the respondent lived. The authors did not ask about sex for two reasons: (1) gender dimension (Magliozzi et al., 2016) and (2) promotion of gender equality (responses were treated equally regardless of the sex). The other part of the questionnaire consisted of seven questions about reasons for visiting or not visiting urban green spaces during the COVID-19 pandemic, most often visited green spaces, and how visits to green spaces helped meet respondents’ intangible needs (mental and physical) exposed during the COVID-19 pandemic.

The survey did not collect any data to identify the respondents, such as telephone numbers, e-mail addresses, or IP numbers of their devices to improve anonymity. The survey was broadly promoted to ensure as large as possible a sample and encourage potential respondents. Information about the survey was disseminated among residents of Kraków on social media (such as Facebook, Instagram, or LinkedIn) and among councillors of district councils. Heads of each of the 18 districts of Kraków and heads of green space committees in each district were sent official letters to this end. They were asked to advocate the survey among residents and share it on district social media profiles and official district websites. The authors addressed a similar request to the
Kraków’s Municipal Green Administration as the body responsible for managing urban green spaces. Moreover, the authors used their private channels and encouraged residents of Kraków to complete the survey.

2.3. Data composition and analysis

The collected data were intended to provide the maximum amount of useful information with the minimum number of questions to take up to five minutes to complete the questionnaire. The questions involved such matters as:

i. Whether the respondent visited urban green spaces before and during the COVID-19 pandemic (to identify preferences);

ii. The main reasons for visiting or not visiting green spaces both before and during the pandemic (to understand what people believed to be important or unimportant in this domain);

iii. To determine the degree to which visits to green spaces during the COVID-19 pandemic affected selected aspects of well-being (to identify potential preferences);

iv. Green spaces most often visited in the COVID-19 pandemic (to determine the most popular green spaces);

v. The district of residence (for spatial visualisation of results).
The study involved an analysis of survey data. The data from the responses were verified for completeness and preprocessed for analysis (including by linking the district of residence to responses). The data were then analysed. The authors identified green spaces important to the respondents and determined which spaces were most often visited during COVID-19 restrictions. Moreover, the authors assessed the main reasons the respondents visited or did not visit the spaces and to what degree visits to green spaces during the COVID-19 pandemic affected selected aspects of well-being.

2.4. Spatial analysis and GIS methods

The analytical methods for spatial data on urban green spaces and methods for analysing spatial survey results used spatial data and GIS software, namely QGIS (ver. 3.14, GNU-GPL licence). Today, spatial relationships are most often identified using spatial information (Ferreira and Delazari, 2019). Also, GIS and big data technologies have played an important role in many aspects of the fight against COVID-19, as indicated by Zhou et al. (2020). Data processing, analysis, and visualisation for the paper employed geoprocessing algorithms. They included the Cartesian product, spatial data matrix, aggregation, relational links, division of a dataset based on descriptive and geometric attributes, functions for calculating statistical parameters (such as GroupStats), and tools for generating choropleth maps and other methods for result visualisation.

Spatial analyses were based solely on vector data models (ESRI Shapefile layers). The data on municipal green spaces provided by the Kraków’s Municipal Green Administration and administrative and demographic data published by the Municipal Spatial Information System in Kraków were as in December 2020.

Each type of data could be linked to a specific subdivision unit, district, with the topological geoprocessing operator Intersect. Mathematical operations were carried out directly in an attribute table with the Field calculator and outside the attribute table with the GroupStats plugin. Data visualisation was based on a graduated data representation symbol and a signature symbol. Raster models on orthophotos improved the appearance of result visualisation.

3. Results

3.1. Respondents

Respondents provided a total of 1251 responses over nine weeks the survey was conducted online (4 December 2020–4 February 2021). Almost 38% of the respondents were 18–24 years old, over 42% were 25–40, 15.9% were 41–59, 1.6% were 60–65%, and 1.9% were older than 66. The smaller share of respondents older than 60 can be accounted for by their preference for PAP surveys or in-depth interviews (Krol and Hernik, 2020). A pilot survey by (Krol and Hernik 2020) demonstrated that younger people prefer online questionnaires, which they handle with ease, while it is quite the opposite for people above 60. Regrettably, the COVID-19 pandemic made it impossible to conduct a traditional PAP survey. Nevertheless, 44 respondents, or 3.5%, were older than 60.

The largest number of respondents lived in northern districts of Kraków, IV Prądnik Biały and V Krowodrza. They amounted to almost 26% of all the respondents. These districts have one of the lowest ratios of urban green space per capita (Fig. 3), mostly due to a small share of green spaces caused by a significant level of development. The smallest number of respondents were from districts X Swoszowice, XV Mistrzejowice, XVI Bieńczyce, and XVII Wzgórze Krzesławickie. However, apart from district XV, they have the lowest populations. The share of green spaces per capita in these areas is similar to the level in the districts with the largest number of respondents.

3.2. The perception of urban green spaces during the pandemic

The respondents were asked whether they visited urban green spaces before and during the COVID-19 pandemic to identify their preferences. The vast majority, 92% indicated they visited green spaces before the pandemic. Only 8% indicated they did not visit green spaces before COVID-19. The most common reason was no time (54.5%), use of more attractive recreation (30.7%), or too large a distance to green spaces from the place of residence to reach them on foot (25.7%).

During the COVID-19 pandemic, the number of visitors to green
spaces fell to 78.9%, down 13.1%. The pandemic clearly affected the number of visitors to green spaces, which can be accounted for by lockdowns, and the governmental regulation banning the use of green spaces in the first phase of the pandemic.

The respondents were asked why they did not visit (Fig. 4) or what motivated them to visit (Fig. 5) urban green spaces in each phase of the pandemic. It was a multiple answer question.

The main reason for residents of Kraków not to visit green spaces in the first phase of the COVID-19 pandemic was the compliance with governmental mobility restrictions (60%) and fear of infection (46.8%). The smallest number of respondents specified sickness (3%) and insufficient equipment in green spaces (5.7%) as their reasons in phase I. The reasons were similar for phase II and III of the pandemic (Fig. 4). The most common responses were compliance with mobility restrictions (36.6% on average), fear of infection (27.8%), and no spare time (37.9%). Interestingly, the share of people refraining from visits to green spaces due to mobility restrictions or fear of infection apparently fell for each consecutive phase of the pandemic. The percentage of people who indicated lack of free time grew (from 34% in phase I to 40% in phase III). The other reasons were indicated roughly the same number of times in each phase.

Five main reasons for visiting green spaces in the first phase of the COVID-19 pandemic emerge from among those stated by the respondents (Fig. 5). The respondents most often indicated the urge to take a walk (69.8%), improvement of general well-being (68.9%), easy access (can be reached on foot) (65.2%), need to commune with nature (60.6%), and reduction of stress levels (59.1%). Note that these reasons were the most popular in phases II and III of the pandemic as well. The least indicated main reason to visit green spaces in all phases of the pandemic was the use of outdoor gyms. Interestingly, even pet walking was not one of the main reasons residents of Kraków visited green spaces.

### 3.3. The impact of visits to urban green spaces on mental and physical health

Another item in the survey was a Likert scale question about how visits to green spaces during the COVID-19 pandemic influenced selected factors. Its objective was to verify the importance of green spaces for mental and physical health of the city residents. The responses are shown in Fig. 6.

Over 50% of the respondents indicated visits to green spaces during the pandemic as the most important factor for the improvement of their general well-being (54.2%), contact with nature (51%), and having a walk (50.6%). Only 2.4% of the respondents believed visits to green spaces to be of no consequence for the improvement of their general well-being, which is the lowest result for all the available factors. Over 75% of the participants considered visits to green spaces as having a very big (42.2%) or big (34.5%) impact on stress level reduction. Only 4.3% believed it had no effect on stress. Over 60% of the respondents indicated the need for physical activity, possibility to spend time with family and friends, and reduced gloom as the factors that had a big or very big influence on visits to green spaces during the COVID-19 pandemic.

They also indicated factors that had no or very little impact on visits to green spaces during the pandemic. Over 55% of them believed the fear of infection was completely unimportant (35.8%) or had very little impact (20%) in this context. Exercise at an outdoor gym did not matter for 35.5% of the respondents and had a very small importance to 16.5% of them.

### 3.4. The green spaces most often visited during the pandemic

Finally, the authors checked which green spaces in Kraków were visited by residents of the city in the three phases of the COVID-19 pandemic. The respondents could select multiple locations from a list of 20 green spaces and add other places. This question had over 130 unique answers.

The green spaces most frequently visited by residents of Kraków during the pandemic are shown in Fig. 7. The most popular green spaces are situated in the centre of the city. The most often visited green space was the Vistula Promenades (41.9%) followed by the Planty Gardens (35.5%). Note that these locations are adjacent to the most valuable urban sites, the Old Town and Kazimierz. Not far from them, there is the Kraków Blonia Meadow and Jordan Park, which were indicated by 30% of the respondents as places where they maintained contact with nature during the pandemic. The most popular locations outside the city core were the Polish Airmen Park (26.1%) and the Zalew Nowohucki Park (21.9%). These areas are the main points specified by the respondents as the most popular urban green spaces in eastern Kraków. The most popular site in western Kraków was the Wolski Forest with Piłsudski Mound (23.2%).

The most frequently visited green spaces are situated near developments (Fig. 7). One can conclude that the proximity of green spaces to the place of residence significantly affects the frequency and popularity of the location. On the other hand, the prevailing occurrence of parks located in the city centre among the responses indicates that the residents were prepared to cover larger distances to commune with nature in more appealing surroundings. This insight is supported by the fact that the most visited green spaces (the Vistula Promenades and the Planty Gardens) attracted users from virtually the entire area of Kraków.
The COVID-19 pandemic emerged as an extraordinary global crisis, significantly altering how people live (Allam and Jones, 2020), changing how we can travel (Wen et al., 2021), and barring people from public green spaces for a long period, both globally and in Poland. The number of visitors to green spaces in Kraków fell by 13.1% during the pandemic compared to before the pandemic due to mobility restrictions. The result

4. Discussion

![Fig. 5. The main reasons given by the respondents for visiting green spaces in different phases of the COVID-19 pandemic.](image)

![Fig. 6. The impact of selected factors on visits to green spaces during the COVID-19 pandemic.](image)
Fig. 7. The green spaces most popular among residents of Kraków during the COVID-19 pandemic.

The most popular urban green spaces in Kraków

1. Vistula Promenades
2. Planty Gardens
3. Kraków Blonia Meadow
4. Jordan Park
5. Polish Airmen Park
6. Wolski Forest with Piłsudski Mound
7. Zalew Nowohucki Park
8. Zakrzówek and Skalki Twardowskiego
9. Bagry Wielkie Park
10. Krowoderski Park and Sudol Stream
11. Nowa Huta Meadows
12. Tyniec
13. Bednarski Park
14. Kraków-Płaszów concentration camp
15. Młynówka Królewska Park
16. Mistrzejowice Planty Garden and Millennium Park
17. Witkowice Forest
18. Forests in Borek Fałęcki
19. Aleksandra Park
20. Skotniki

Number of visitors
- 50 and less
- 51 - 100
- 101 - 150
- 151 - 250
- 251 - 350
- 351 and more

Kraków boundary
Kraków district boundaries
Urban green spaces
Buildings
VII district number
From other researchers’ findings, such as in Oslo, Norway (Venter et al., 2020) or Burlington, Vermont, USA (Grima et al., 2020). This fact could be accounted for with the decision of the Polish government in April 2020 to close down public green spaces. It is further confirmed by the reasons given by those respondents who claimed not to have visited green spaces in the three phases of the pandemic, mainly to comply with governmental mobility restrictions (60%) and fear of infection (46.8%).

International research shows that contact and interaction with nature positively influence human health and well-being (Navarro-Hernandez and Lafian, 2019; Kim and Miller, 2019). The lockdown caused by the COVID-19 pandemic stimulated interest in urban and home greenery. In Pérez-Urrestarazu et al. (2021), 89.5% of the respondents strongly believed it was necessary to visit open green spaces to improve mental health, while keeping plants was correlated with positive emotions during the pandemic. Moreover, most of the respondents believed that indoor plants positively affected their emotional well-being during isolation (Pérez-Urrestarazu et al., 2021). These findings are consistent with our results where over 75% of the respondents believed visits to green spaces during the COVID-19 pandemic to have a very big or big influence on the reduction of their stress levels; for 54.2%, it had the greatest impact on the improvement of their general well-being. Similar conclusions were offered in an analysis of Twitter content (Schwartz et al., 2019). It confirmed the mental benefits of contact with nature in urban areas. Schwartz et al. (2019) demonstrated that people who repeatedly visited urban green spaces experienced less negative emotions and had better emotional frames of mind expressed on Twitter. The disruption of the usual forms of activities and recreation due to limited or prevented access to green spaces harmed the well-being of their users (Karnon, 2020). Hence, access to urban green spaces can help improve mental health during periods of exacerbated depression (Grima et al., 2020). This conclusion is reflected in recommendations other researchers offered to their governments (Slater et al., 2020). Note that according to the present study, the mental benefits seemed to be related not only to the sheer fact of visiting green spaces but also other factors, such as the ability to take a walk, close access to green spaces, the urge to commune with nature, or the possibility to meet friends and family. These results are in line with those by Wang et al. (2020), Pérez-Urrestarazu et al. (2021), or Du et al. (2021), among others.

The green spaces most popular with residents of Kraków during the pandemic are located mainly in the heavily urbanised centre of the city. The centre has a green belt of the Planty Gardens encircling the main logical effects and build place attachment. One could propose that this proximity to green spaces from home influences the frequency of visits and popularity of a place, but it was not a primary factor in Kraków.

5. Conclusions

The paper presents the results of a survey to demonstrate the value of urban green spaces for the local well-being during the global crisis caused by COVID-19. Urban green spaces play the key role during the pandemic by providing ecosystem services relevant to health, recreation, and temporarily limited public life. The present results confirm observations concerning green spaces during the crisis. Urban green spaces provide an important buffer to ameliorate the effects of crises in the mental (positive impact on well-being, reduced stress levels) and physical dimension (such as reduced temperature in cities). The conclusions are consistent with the literature review, numerous case studies, and the present analysis. Hence the answers to the first two research questions are affirmative.

As is the answer to the third question. The results evidently indicate that the respondents believed that visits to urban green spaces during the COVID-19 pandemic had a significant impact on their mental and physical health and improvement of their well-being. Regarding the fourth research question, the most often visited green spaces were located near the Vistula, main square, and former Jewish district, Kazimierz or near the Wawel Royal Castle. The respondents were willing to travel long distances to spend time in attractive surroundings of green infrastructure. As the pandemic changed the public perception and importance of urban green spaces in Kraków, they need to be protected and even developed further. It helps improve human well-being and mental state.

To sum up, the research on the influence of the COVID-19 pandemic on the importance of urban green spaces in Kraków yielded numerous insights that can be employed when new urban green policies are drafted, whether in Poland or internationally.

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