Arboriculture & Urban Forestry 2024
https://doi.org/10.48044/jauf.2024.012

Effects of Nature-Based Solutions on Mental Well-Being—The Case of Urban Parks in Marivan, Iran

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Abstract. The importance of urban parks for improving the quality of life of residents is becoming increasingly clear as people interact less and less with nature. Urban parks should be designed to have a profound impact on the mental health and well-being of citizens through the provision of high-quality facilities and services. Nevertheless, there are differences in the influencing factors in urban parks. Nowadays, urban parks as the lungs of cities are considered important destinations for citizens to get rid of stress and mental fatigue. Therefore, it is important to understand what factors contribute to people feeling mentally better and improving their well-being. Based on people's experiences and opinions, the present study aims to investigate how urban parks as nature-based solutions in Marivan City, Iran, especially the green infrastructure and its elements in Shano and Zaribar Parks, contribute to respondent's mental health and overall well-being. The necessary data for this study were collected from 277 respondents using a questionnaire. The questionnaire was randomly distributed both in person and online. The questions were categorized based on 3 indicators directly related to mental health and well-being: perceptual, visual, and functional. Data were analyzed using structural equation modeling in Smart-PLS software. Results indicate that the perceptual, visual, and functional indicators in Marivan's urban parks have a significant impact on the mental health and well-being of residents. Among these indicators, the visual indicator has shown the highest level of influence.

Keywords. Nature-Based Solutions; Structural Equation Modeling; Theater Park; Waterfront Park.

INTRODUCTION

In today's society, more and more people are facing problems related to their physical and mental health (bin Hassan et al. 2018; Ward and Scott 2018; Cianconi et al. 2020). Although mental health is a complex construct, this term is often described as the perception of one's mental well-being as manifested in environmental and psychological behaviors (Ward and Scott 2018). In the present study, the concept of perceptions of mental health and mental well-being refers to an individual's cognitive evaluation of their current mental health status (Pietilä et al. 2015; Kamimura et al. 2018). Concerns about the decline in physical activity leading to public health problems such as obesity, type 2 diabetes, metabolic syndrome, and mortality, as well as mental health problems such as depression, are now common worldwide (Nielsen and Hansen 2007). Increasing participation in physical activity is crucial, as an active lifestyle has positive health benefits (de Vries et al. 2003; Kaczynski and Henderson 2007). Nature-based solutions (NBS) are instrumental in addressing the urban mental health crisis, which has been recognized as a societal challenge. Following the World Health Organization's (WHO) broad definition of mental health, NBS goes beyond the alleviation of illness to include the promotion of self-discovery, psychological resilience, and social relationships (Kabisch et al. 2023). Due to the environmental and social challenges that cities are currently facing, NBS have gained popularity among policy makers and urban planners worldwide (Nesshöver et al. 2017; Hanson et al. 2020). The term "nature-based solutions" was first introduced in 2008 in the context of ecosystem services (The World Bank 2008; Potschin et al. 2016). NBS provide cost-effective methods to achieve urban adaptability and flexibility

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while securing human and environmental benefits by supporting communities in sustainably addressing social, environmental, and economic challenges (Dumitru and Wendling 2021). NBS help to address various environmental and social challenges in an environmentally sustainable way, which is receiving increased attention (van den Bosch and Sang 2017; Vujcic et al. 2017). The goals of NBS include restoring connections between man-made environments and semi-natural systems and reintegrating nature into urban environments (Kabisch et al. 2017). Urban green infrastructure is widely recognized as a nature-based solution and offers flexible strategies to address the challenges of modern urban life (Kabisch et al. 2016; Meerow and Newell 2017). Urban green infrastructure includes various types of green spaces, including green roofs, green walls, urban gardens, street trees, and parks (Elmqvist et al. 2013; Riechers et al. 2016; Lu et al. 2017). Urban green infrastructure has the potential to improve climate quality, enhance physical and mental health, and promote social and cultural well-being (Keeler et al. 2019). High-quality green spaces play an important role in improving the well-being of people, especially those living in urban areas (Knight et al. 2022; Macháč et al. 2022; McDougall et al. 2022). Improving the quality of urban green spaces can create a better living environment for city dwellers (Francis et al. 2012).

Among the various human perceptions, visual perception accounts for about 80% (Gholami et al. 2021; Guo et al. 2021). The importance of the visual quality of urban landscapes for physical and psychological recreation, nature conservation, and comprehensive planning and management is widely recognized (Jahani and Saffariha 2020; Jovanovska et al. 2020; Li et al. 2022). Studies suggest that both the experience of natural landscapes (visual and optical stimuli) and contact with natural elements (tactile, olfactory, and auditory stimuli) can reduce psychosocial stress factors, increase biological well-being, and alleviate internal anxiety. It has been repeatedly emphasized that landscapes, especially gentle and calming landscapes, can quickly evoke emotions, effectively reduce tension, and alleviate irritability, fatigue, and physical symptoms (Parsons 1991). The health benefits of mental rejuvenation and serenity resulting from contact with nature and green spaces have been well documented in various studies (Hartig 2007; Hartig et al. 2014). Contact with nature, such as experiencing green landscapes in urban areas, has significant positive effects on people with high stress levels and leads to a more positive emotional state (Ulrich 1983; Ulrich et al. 1991). These stimuli in natural environments help to restore the well-being of people suffering from mental fatigue (Kaplan 1995; Kaplan 2001). A study in the United Kingdom, for example, used wearable sensors to demonstrate the effects of a short walk in the countryside on brain activity, which may be associated with increased relaxation and rejuvenation (Aspinall et al. 2015). Walking in natural environments has been found to provide stronger short-term benefits compared to walking in urban residential areas (Gidlow et al. 2016). In addition, research has shown that exposure to green spaces reduces neuronal activity in the subgenual prefrontal cortex, leading to a decrease in depressive symptoms (Bratman et al. 2015). Recent studies using a nature-based solutions approach suggest that urban green spaces are very effective in improving mental health and well-being by alleviating stress, depression, and anxiety (van den Bosch and Sang 2017; Vujcic et al. 2017; MacKinnon et al. 2019; Kolokotsa et al. 2020; Coventry et al. 2021; Sohaib et al. 2022; Pereira et al. 2023; Singh et al. 2023). As urban green spaces are essential sources of mental and physical well-being for residents and can have a significant impact on leisure and mobility (Tyrväinen et al. 2005; Han and Hyun 2019; Grigoletto et al. 2023), much research has been conducted on the role of urban parks for well-being and mental health, but these studies are not yet sufficient. However, there is no comprehensive model to investigate the effects of visual, perceptual, and functional factors on well-being in urban parks. Also, there are no other studies in this field in the above-mentioned state of Iran.

Previous research shows that urban green spaces help to reduce stress and increase overall psychological well-being (Abkar et al. 2010; Grahn and Stigsdotter 2010; Roe et al. 2013; Tyrväinen et al. 2014; Hedblom et al. 2019; Yang et al. 2019; Berdejo-Espinola et al. 2021). However, not much research has been conducted on which factors in green areas (visual, perceptual, and functional factors) have the most healing effect on visitors. Therefore, this study fills this research gap. The aim of this study is to investigate the role of effective factors in urban parks as nature-based solutions for people's mental health and well- being in two parks in Marivan City, Iran.

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LITERATURE REVIEW

In recent decades, a growing body of research has explored the complex relationship between nature-based solutions and mental health and well-being. This literature review aims to critically examine the existing studies assessing the impact of nature-based solution factors on mental health and well-being, focusing on visual, functional, and conceptual aspects in urban parks. The visual aspects of urban parks play a crucial role in shaping individuals' experiences and perceptions. Previous studies have emphasized the importance of aesthetic qualities, landscaping, and greenery for psychological well-being. For example, Kaplan and Kaplan (1989a) highlighted the positive effects of a visually appealing natural environment on stress reduction and attention restoration. In addition, Ulrich and Parsons (1992) have shown that exposure to natural scenes contributes to psychological well-being. These studies emphasize the importance of visual aspects in promoting mental health in urban parks. Throughout history, people have used plants for a variety of purposes, including food, warmth, protection, emotional stimulation, and, most importantly, healing. The value of aromatic and medicinal plants used for healing has grown over time along with medical research (Arslan et al. 2018). Through the sense of smell, fragrant plants can influence both physical and mental health and serve as an important natural resource (Glass et al. 2014; Swamy and Sinniah 2015). For example, according to Kim et al. (2016), the scent of rose essential oil has been shown to promote both physiological and psychological calm. In addition, numerous empirical studies have investigated the effects of urban parks on health and well-being. These positive effects include a reduction in blood pressure and cortisol levels, a reduction in stress, fewer stress-related illnesses, improved physiological functioning, lower pulse and heart rate, and a decrease in obesity (Moore et al. 1982; Thompson et al. 2012; Loreau and de Mazancourt 2013; Tsunetsugu et al. 2013; Astell-Burt et al. 2014; Lee et al. 2014; Song et al. 2014).

The functional aspect of urban parks deals with the practical and utilitarian dimensions that contribute to psychological well-being. The results of studies (Enssle and Kabisch 2020) have shown that urban green spaces are important for health and well-being because they provide spaces for physical activity and social interactions (Jennings and Bamkole 2019). For example, social interactions can provide opportunities for people to connect with each other, strengthen their sense of community, and relax from the stresses of everyday life in urban green areas (Cattell et al. 2008). Urban green spaces and social interactions may be related to the following factors: open park design that encourages active recreational activities (Peters et al. 2010); accessibility of walkways (Holtan et al. 2015); improved access to parks through quality transportation (Ward Thompson et al. 2016); shaded areas that promote a peaceful environment (Peters et al. 2010); functional playgrounds (Bennet et al. 2012); and the amount of organized activities (Plane and Klodawsky 2013). Recent research has shown that spending at least 120 minutes per week in a natural environment is significantly associated with health and well-being (White et al. 2020). Green and blue spaces, such as parks, provide indirect benefits to physical (and mental) health by promoting physical activity (Smith et al. 2016; Pearce et al. 2022) and facilitating social interactions (Enssle and Kabisch 2020). The results of the study conducted by Liu et al. (2017) showed that physical exercise significantly improved the emotions and energy levels of park visitors. In addition, engagement with nature had a positive effect on mental health and promoted a sense of calm and self-confidence. Research by Herzog and Strevey (2008) suggests that well-designed functional features such as accessible walkways, recreational spaces, and seating are associated with increased physical activity and social interaction, which has a positive impact on mental health. In addition, a study by Cohen et al. (2016) emphasized the role of functional amenities, such as sports facilities, in promoting community engagement and well-being. Understanding the different elements within the functional aspect is crucial for a comprehensive assessment of their impact on mental health. The conceptual aspect encompasses the symbolic and cultural meanings attributed to urban parks. A study by Ramkissoon et al. (2013) examined the importance of designing parks in line with local values and cultural identity when it comes to fostering a sense of place and community connectedness, which has a positive impact on mental well-being. Furthermore, the conceptual aspects are about the perception of safety and security in the park environment. Studies by Kuo and Sullivan (2001) have demonstrated that perceptions of safety contribute to increased park usage and, consequently, enhanced mental health outcomes.

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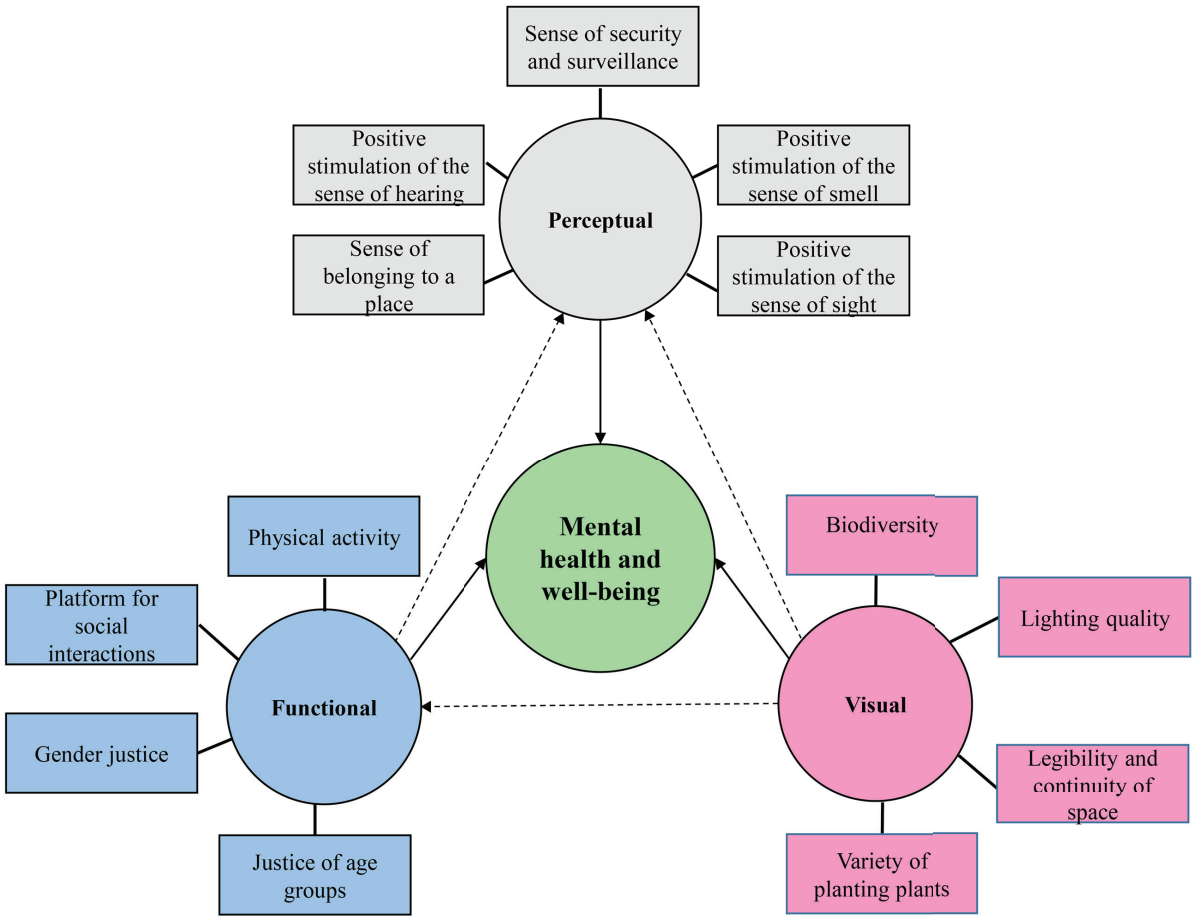

Figure 1. Conceptual model of research.

While previous studies have examined the visual, functional, and conceptual aspects separately, research has only examined their interaction in urban parks to a limited extent. In particular, the integration of these aspects is essential for a comprehensive understanding of their joint effects on mental health and well-being. One study by Hartig et al. (2014) indicated the interplay of visual aesthetics, functional amenity, and conceptual orientation in shaping positive psychological responses. However, a holistic model that incorporates the synergies between visual aspects, functional aspects, and conceptual aspects is clearly lacking in the current literature. Given this research gap, our proposed model aims to investigate and develop a nuanced understanding of the interrelationships between visual aspects, functional aspects, and conceptual aspects in urban parks. Through the use of a comprehensive research design, we aim to investigate how these aspects collectively contribute to the mental health and well-being of park users. Our study aims to fill this gap in the literature and provide valuable insights for urban planners, policy makers, and landscape architects in creating environments that holistically support mental health. The proposed model aims to fill the existing research gap and contribute to a holistic understanding of the interlinked dynamics that shape positive psychological outcomes in urban park environments. In this context, a conceptual model of the research is presented in Figure 1.

METHODS

Study Area

Marivan City, Iran, with an area of 3,196 km^2, is one of the 6 major cities in the Kurdistan province in western Iran (Balist et al. 2019). This city is located at an eastern longitude ranging from 45°46′ to 58°45′ and at a northern latitude ranging from 48°35′ to 19°35′ north of the equator. It is situated at an elevation of

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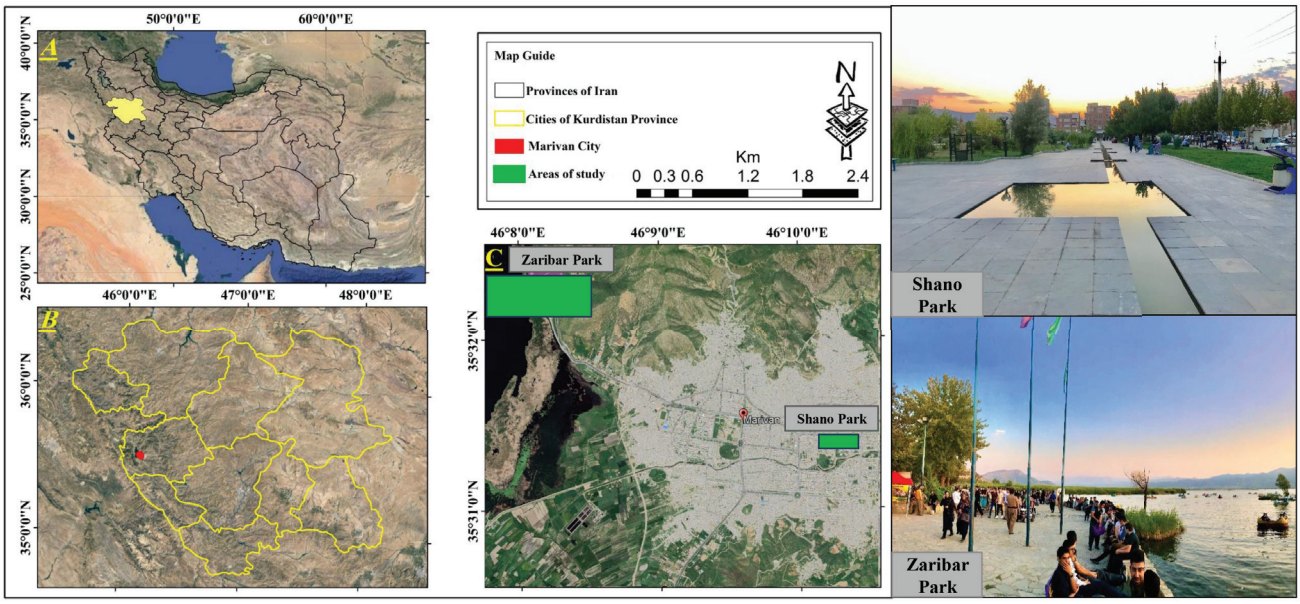

Figure 2. Location of study areas.

1,320 m above sea level (Rashidi et al. 2018). Marivan City, with its abundant natural attractions, is one of the most picturesque regions in the Kurdistan province of western Iran (Rahimi et al. 2024). Due to its diverse natural areas and pristine attractions, it is considered one of the most significant ecotourism areas in the country. Some of its most beautiful tourist attractions include Lake Zaribar and the Zaribar Waterfront Park (Badri et al. 2011). Marivan has a population of over 140,000 people and covers an area of 110 ha of green space, resulting in a per-capita green space area of approximately 8 m^2. Marivan boasts a total of 43 parks, varying in neighborhood, district, and city scales (Marivan Green Spaces Statistics 2023). Among these, the research study areas comprise 2 urban and suburban public parks with high visitation rates, namely Shano Park and Zaribar Waterfront Park. Shano Park, established in 2014, spans an area of 4.6 ha. Shano ("Shano" is a Kurdish word meaning theater) Park has gained prominence as the first theater park in the world (Khani et al. 2023). It serves as the venue for the International Street Theater Festival in Marivan City, which has also been recognized as the capital of street theater in Iran (Manouchehri et al. 2023). Despite its widespread recognition in Iran, Shanu Park boasts abundant cultural and recreational infrastructure and has transformed into a tourist destination, hosting both national and international theater performances. Also, Zaribar Waterfront Park, situated in the Zaribar Lake, stands as the foremost attraction and tourist destination in the Kurdistan province. With a length of 4.5 km and a width of approximately 2 km, the lake spans an area of approximately 850 to 900 ha. Zaribar Lake attained international acclaim as the 25th Iranian wetland during the Ramsar Convention on Wetlands in 2019, held in Ramsar, Iran (Sadeghi et al. 2021). Zaribar Waterfront Park, established in 2000, covers an expansive area of over 12 ha (Marivan Green Spaces Statistics 2023). Zaribar Waterfront Park, adjacent to Zaribar Lake, is surrounded by the Zagros forests and is constructed as a recreational tourism park with minimal topographical alterations, preserving its pristine natural surroundings. The study area locations are illustrated in Figure 2.

Indicators and Items of Research

In the present study, based on previous research conducted in the field of NBS factors in urban green spaces and urban parks, research indicators, items, and their associated benefits were determined. The independent indicators included 3 main types of indicators in urban parks: perceptual, visual, and functional. The mental health and well-being indicator was also determined as the dependent indicator. Accordingly, for the research variables, several factors corresponding to the specific conditions of the study area were determined and used to design the questionnaire (Table 1).

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Table 1. Research indicators and affecting items that have been considered in the questionnaires.

Indicators	Items	Labels	References	Benefits	References
Perceptual	Positive stimulation of the sense of sight (natural forms and elements in landscape or natural attractions)	PCP1 & PCP2	Velarde et al. 2007; Grinde and Patil 2009; Cameron et al. 2020; Kolokotsa et al. 2020; Russo and Andreucci 2023	Psychological well-being: decrease depression, dejection, anger, aggression, frustration, hostility, and stress, and increase creativity, happiness, calmness, comfort, refreshment, vitality, and vigor	Kaplan and Kaplan 1989a, 1989b; Morita et al. 2007; Sugiyama et al. 2008; Nisbet et al. 2011; Kamitsis and Francis 2013; MacKerron and Mourato 2013; Lee et al. 2014; Tyrväinen et al. 2014
	Positive stimulation of the sense of smell (aromatic plant species)	PCP3 & PCP4	Arslan et al. 2018; Jiang et al. 2021		
	Positive stimulation of the sense of hearing (sound-scape: the rustling of leaves, the sound of birds and water)	PCP5 & PCP6	Gascon et al. 2017; White et al. 2020		
	Sense of security and surveillance (proper lighting at night)	PCP7 & PCP8	Karimi et al. 2022; Kimic and Polko 2022		
	Sense of belonging to a place (use of native plants and local symbols)	PCP9 & PCP10	Horwitz et al. 2001; Hausmann et al. 2016		
Visual	Biodiversity (diversity of plants and animals)	VIS1 & VIS2	Sandifer et al. 2015; Marselle et al. 2019; Cameron et al. 2020; Marselle et al. 2021		
	Lighting quality (continuous and regular lighting)	VIS3 & VIS4	Bahriny and Bell 2020; Karimi et al. 2022; Kimic and Polko 2022		
	Legibility and continuity of space (legible and attractive space without confusion)	VIS5 & VIS6	Sullivan and Chang 2011; Razmara et al. 2021; Azizkhani 2022		
	Variety of plants (diversity and attractiveness in the color and form of different plants)	VIS7 & VIS8	Muratet et al. 2015; Southon et al. 2018; Wood et al. 2018		
Functional	Platform for social interactions (existence of gathering places for social interactions)	FNC1 & FNC2	Jennings and Bamkole 2019; Enssle and Kabisch 2020	Reduced blood pressure and cortisol levels; reduced stress/less stress-related illness/ improved physiological functioning; reduced pulse/heart rate; reduced obesity	Moore et al. 1982; Thompson et al. 2012; Loreau and de Mazancourt 2013; Tsunetsugu et al. 2013; Astell-Burt et al. 2014; Lee et al. 2014; Song et al. 2014
	Physical activity (platforms for sports activities and walking)	FNC3 & FNC4	Guite et al. 2006; Liu et al. 2017; Han and Hyun 2019; Kolokotsa et al. 2020; Coventry et al. 2021		
	Justice of age groups (facilities and entertainment for all age groups)	FNC5 & FNC6	Steigen et al. 2018; Kolokotsa et al. 2020		
	Gender justice (accessible and usable green space for all groups of people)	FNC7 & FNC8	Li et al. 2020; Kato-Huerta and Geneletti 2022; Sillman et al. 2022; Rahimi et al. 2023		

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Sampling Size

The statistical population included in this study were the visitors to the parks of Shano and Zaribar. Since exact data on the number of visitors to the city parks was not available, the sample size was determined using the Mitra-Lankford formula (Mitra and Lankford 1999). This formula can be applied when the population size in landscape studies is not known, and usually '*e*' is considered to be 3% or less than 3%. In this study it was set at 3%. After substituting these values into the formula and performing the calculations, an appropriate sample size of 277 was obtained (Equation 1). The total number of respondents to the questionnaires was 277, and the configurations of the online questionnaire platform were carefully prepared to facilitate completion after 277 responses were submitted, thus eliminating the possibility of additional responses by participants. A reliable and valid sample size and method was used in this study, utilizing a known formula to calculate the number of participants. Therefore, the results are valid, confirming previous findings and also suggesting a comprehensive model that can be retested and confirmed with other researchers around the world.

$$e = \sqrt{\frac{P \times (1 - P)}{n}} \quad (1)$$

Where $P = 50\%$ and $e = 3$.

$$3 = \sqrt{\frac{50\% \times (1 - 50\%)}{n}}$$

Therefore, $n = 277$.

Sampling Method

A random sample was used in this study. Therefore, the most important factor in determining the sample size was that the number of participants should be large enough for statistical analysis. The larger the number of participants, the more robust the statistics (Suhardi 2006). The sample size should be large enough to perform a statistical analysis. According to Howell (2002), at least 30 participants are required to perform a statistical analysis. According to Mitra and Lankford's formula (Mitra and Lankford 1999), a sample size with a sampling error of less than 5% is considered a reliable and valid sample to confirm previous studies and also to generalize the new results. Therefore, a sample size of 277 was chosen based on this formula.

An online method was used for the survey. Numerous studies have used online methods to gather public opinion (Žlender and Thompson 2017; Koh et al. 2022; Luo et al. 2022; Xie et al. 2020). The questionnaires were distributed via social media platforms such as Telegram, WhatsApp, and Instagram Messenger (Srivastav et al. 2021). The link to the online questionnaire was disseminated through social media platforms in city groups and information channels in Marivan City (Iran). Participants were asked to complete the questionnaire and were encouraged to share the link with others who were interested in participating. This approach is an example of using the snowballing technique on the internet to increase the reach of the survey by leveraging existing networks and connections.

Survey Procedure

The questionnaire contents were designed according to the indicators and items outlined in Table 1 for the two parks, Zaribar Waterfront and Shano Park. A separate set of questions was designed for each park, aligning with the respective indicators and components. The questionnaire was structured using a 5-point Likert scale (very high = 5; high = 4; medium = 3; low = 2; very low = 1). Collecting research data through traditional approaches (in-person, postal, or telephone surveys) can be costly and time-consuming. Collecting data through new technologies using the internet or electronic platforms (such as online surveys and email) offers a cost-effective alternative. These modern data collection methods can gather a substantial amount of data from participants in a short period of time. Conducting an online survey allows access to a large and geographically diverse population (Regmi et al. 2016). In general, online questionnaires provide reliable and convenient data, safeguard against data loss, and facilitate the transfer of data to analytical tools such as Excel or SPSS for researchers (Carbonaro and Bainbridge 2000; Ilieva et al. 2002). Since online datasets can potentially skew respondents towards younger age groups, this may reduce representativeness and, consequently, the reliability of findings (Koh et al. 2022). Approximately 1/3 of the data, 86 respondents, was collected using this method (from 2023 August 8 to September 21). In order to achieve optimal output and desired research outcomes in terms of respondents' demographic data, the remaining questionnaires were administered in person by researchers within the study areas from

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August 24 to September 2. Another innovation in this research was the facilitation of questionnaire distribution through a hybrid approach, combining in-person and online methods. To streamline the process and economize on time and costs, an online questionnaire was designed with a QR code assigned for easy access. Park visitors were encouraged to contribute by scanning the QR code using their smartphones. This method eliminated the need for participants to wait for questionnaire completion and resulted in the rapid acquisition of a substantial volume of survey responses. Questionnaire settings were configured to allow each respondent to provide only one set of responses via their smartphone. Additionally, mandatory questions were defined to ensure that no questions were left unanswered. The colorful background for the online questionnaire was designed to create a friendly vista to encourage respondents to participate in the survey. In the online questionnaire, respondents could register their answers at any time and place, and due to the absence of the researcher, there was no psychological effect on the respondents. Consequently, more accurate answers were likely to be recorded in the online questionnaire.

Data Analysis Method

This research utilized 2 software applications, Smart PLS 3 and SPSS 26, for analysis. Specifically, SPSS was employed for descriptive statistics, while structural equation modeling (SEM) with a partial least squares (PLS) approach was conducted using the Smart PLS software (Salleh et al. 2022; Mousapour 2023). The application of PLS-SEM in the Smart PLS software is particularly advantageous when working with small sample sizes and non-normally distributed data (Ringle et al. 2020; Hair et al. 2021). The primary reasons for adopting the Partial Least Squares approach include its strong predictive capabilities, its suitability for handling complex models with a substantial number of observed and latent variables, and its utility when researchers aim to develop novel theories or models that were previously non-existent (i.e., new model development)(Jarvis et al. 2003; Henseler et al. 2009; Hair et al. 2010). Another significant advantage driving researchers towards this approach is its ability to use single-item measurement models in contrast to other similar software tools that necessitate a minimum of 3 observable variables per latent variable (Hair et al. 2010). The utilization of structural equation modeling in the present research stems from the novelty of the theoretical model and the inherent complexity of resolving the research questions posed by the model. SEM, implemented through the Smart-PLS software, was chosen as the preferred analytical approach due to its ability to handle non-parametric data. Moreover, SEM, particularly when implemented through Smart-PLS, offers robust predictive power for the proposed theoretical model. This attribute is of paramount importance in deciphering the intricate relationships and dependencies embedded within the research framework, ensuring the accuracy and reliability of the model's predictive capabilities.

RESULTS

Descriptive Statistics of Research

In this study, 64.6% of the respondents were male, while 35.4% were female, with the majority of respondents being married (63.8%). Respondents were categorized into different age groups, namely the age ranges of 20 to 34, 35 to 49, and 50 and above, consisting of 110, 102, and 56 individuals, respectively. In terms of educational attainment, a significant portion of the respondents held a bachelor's degree (43%). Furthermore, concerning their economic status, a substantial proportion of the respondents fell into the middle-income category (58.5%) (Table 2).

Structural Analysis

The Role of Urban Parks for Improving Mental Health and Well-Being

To investigate the research issue, structural equation modeling using partial least squares was employed with the assistance of Smart-PLS software. In order to analyze and assess the role of urban parks in enhancing mental health and well-being, the research was conducted based on theoretical foundations and prior studies, as outlined in the research methodology.

Reliability and Validity of Research Indicators

To assess the reliability and validity of research indicators in the Smart-PLS software, we employed the output from the PLS Algorithm report, focusing on the evaluation of 2 crucial measures: Cronbach's alpha (α) and composite reliability (CR). It is imperative that Cronbach's alpha exceed 0.7 to be considered acceptable (Litwin and Fink 1995; Ghozali and Latan 2015). Additionally, composite reliability is akin to Cronbach's alpha (α) but is superior in terms

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Table 2. Demographic characteristics of respondents.

Variable	Response category	Percentage	Variable	Response category	Frequency	Percentage
Gender	Female	35.4	Economic level	Poor	73	26.4
	Male	64.6		Middle	162	58.5
Marital status	Single	35.7		Good	31	11.2
	Married	63.9		Great	11	4.0
Age	20-34	39.7	Education level	Under diploma	30	10.8
	35-49	36.8		Diploma	87	31.4
	50 and above	23.5		Bachelor	119	43.0
				Master and higher	41	14.8

of internal consistency, as it leverages the loading of items derived from the theoretical model (Fornell and Larcker 1981). As indicated in Figure 3, all the indicators in this study yielded values exceeding 0.7, thus meeting the threshold for acceptance.

$$CR = \frac{\sum_{i=1}^{n} \lambda_i^2}{\sum_{i=1}^{n} \lambda_i^2 + \sum_{i=1}^{n} Var\,(e_i)} \quad (2)$$

$$\alpha = \frac{n\bar{r}}{1 + \bar{r}\,(n-1)} \quad (3)$$

The average variance extracted (AVE) serves to describe the validity of indicators, and an AVE greater than 0.5 is deemed acceptable (Chin 1998; Hair et al. 2011). Meanwhile, Fornell and Larcker (1981) have posited that if the AVE is below 0.5, but the composite reliability exceeds 0.6, the structural model's validity is still considered sufficient. In this study, all indicators yielded AVE values exceeding 0.5, with the exception of the perceptual construct. Given that the CR value for this particular construct is 0.813, the AVE value remains valid.

$$AVE = \frac{\sum_{i=1}^{n} \lambda_i^2}{n} \quad (4)$$

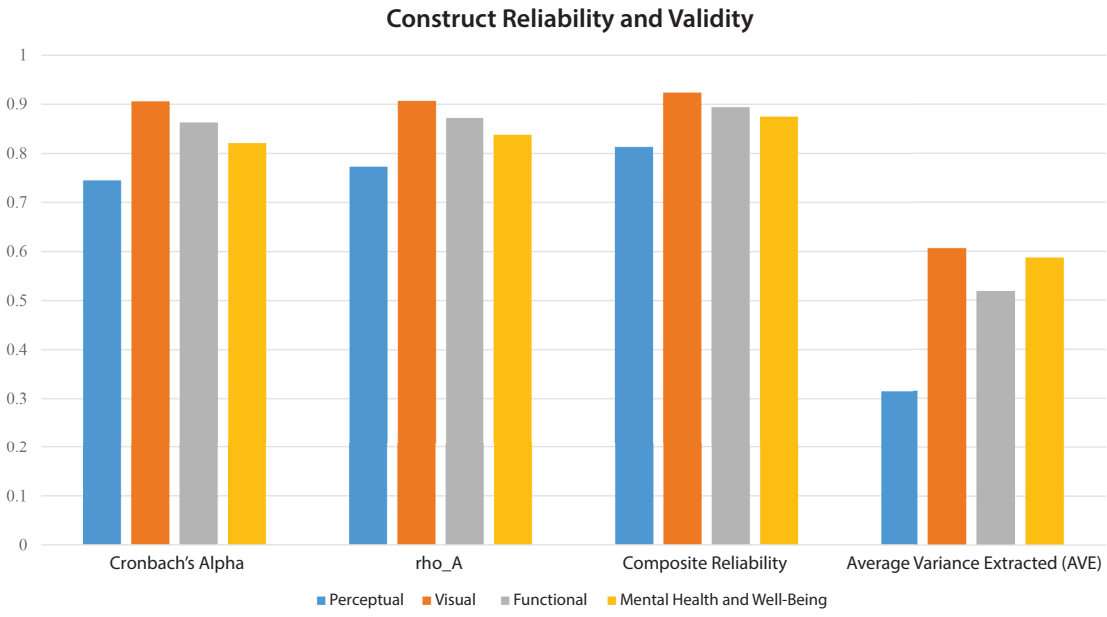

Figure 3. Construct reliability and validity.

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Testing the Quality of the Research Structural Model: R^2 Value

In the analysis of structural models using the partial least squares approach, the R^2 value is a fundamental metric for assessing latent endogenous variables. This indicator demonstrates the percentage of variance in the latent endogenous variable explained by the exogenous variables. Values of 0.19, 0.33, and 0.67 for latent endogenous variables in the structural model are typically described as weak, moderate, and substantial, respectively (Chin 1998; Henseler et al. 2009). In the structural model of this study, as depicted in Figure 4, the R^2 value for the dependent indicator, "mental health and well-being," is 0.732. This implies that the independent indicators of the research, namely perceptual, functional, and visual, have collectively accounted for 73% of the variance in the dependent indicator. This substantial value underscores the high quality of the structural model in the current research.

Path Coefficients and Correlation Between Independent and Dependent Indicators

The term "path coefficients" refers to standardized betas in linear regression. Path coefficients must be examined in terms of their magnitude, sign, and significance. Positive path coefficients (positive betas) indicate direct relationships between latent internal and external variables. In contrast, negative path coefficients (negative betas) signify an inverse relationship between latent internal and external variables. The magnitude of this value reflects the strength of the relationship. In terms of correlation, path coefficients typically range between −1 and +1, with coefficients close to −1 indicating strong negative relationships, and coefficients closer to +1 indicating strong positive relationships (Hair et al. 2021). The significance of path coefficients depends on their magnitude and the direction of the beta coefficient in the model. If the obtained value exceeds the minimum statistic at the confidence level considered (e.g., 90%, 95%, or 99%), the relationship or hypothesis is confirmed. At the 90%, 95%, and 99% significance levels, this value is compared to the minimum statistics of 1.64, 1.96, and 2.58, respectively (Henseler et al. 2009; Hair et al. 2011). The structural model's path coefficients are presented in Figure 4 and Table 3.

In accordance with the results obtained in this structural model, the relationship between the perceptual indicators and mental health and well-being, with a path coefficient of 0.291, signifies a direct association. Consistent with Figure 5, this relationship is confirmed at the 99% confidence level with a *t*-statistic of 4.778. Therefore, of the perceptual indicators, the items aromatic plant species, soundscape (the rustling of leaves, the sound of birds and water), natural forms and elements in the landscape or natural attractions, proper lighting at night, and use of native plants and local symbols have the most significant impact on the mental health and well-being of users of Zaribar Waterfront Park and Shano Park.

The relationship between visual indicators and mental health and well-being, with a path coefficient of 0.458, is positively significant, as confirmed by a direct relationship with a *t*-statistic of 8.243 at the 99% confidence level. In this regard, visual indicators such as a legitimate and attractive space without confusion in the space, diversity of plants and animals, continuous and regular lighting, and diversity and attractiveness in the color and form of different plants have the most significant effect on the mental health and well-being of users of Zaribar Waterfront Parkand Shano Park.

The relationship between the independent variable functional indicators and the dependent variable mental health and well-being, with a path coefficient of 0.201 and a *t*-statistic of 4.175, is confirmed at the 99% confidence level. The most important functional indicators affecting the mental health and well-being of users of Zaribar Waterfront Park and Shano Park include platforms for sports activities and walking, facilities and entertainment for all age groups, accessible and usable green space for all groups of people, and the existence of gathering places for social interactions.

Based on the findings, it has been established that the 3 variables, functional, perceptual, and visual, as independent variables, significantly influence the mental health and well-being (dependent variable) of urban park users in Marivan City. Therefore, all these indicators have close associations with improving the quality and enhancing the level of well-being and mental tranquility of users. These findings indicate that each of the mentioned indicators has played a prominent role.

Furthermore, the relationship between the visual variable and the perceptual and functional variables, with path coefficients of 0.398 and 0.719, respectively, is confirmed with *t*-statistics of 6.633 and 21.410 at the 99% confidence level. Additionally, the relationship between the 2 independent variables,

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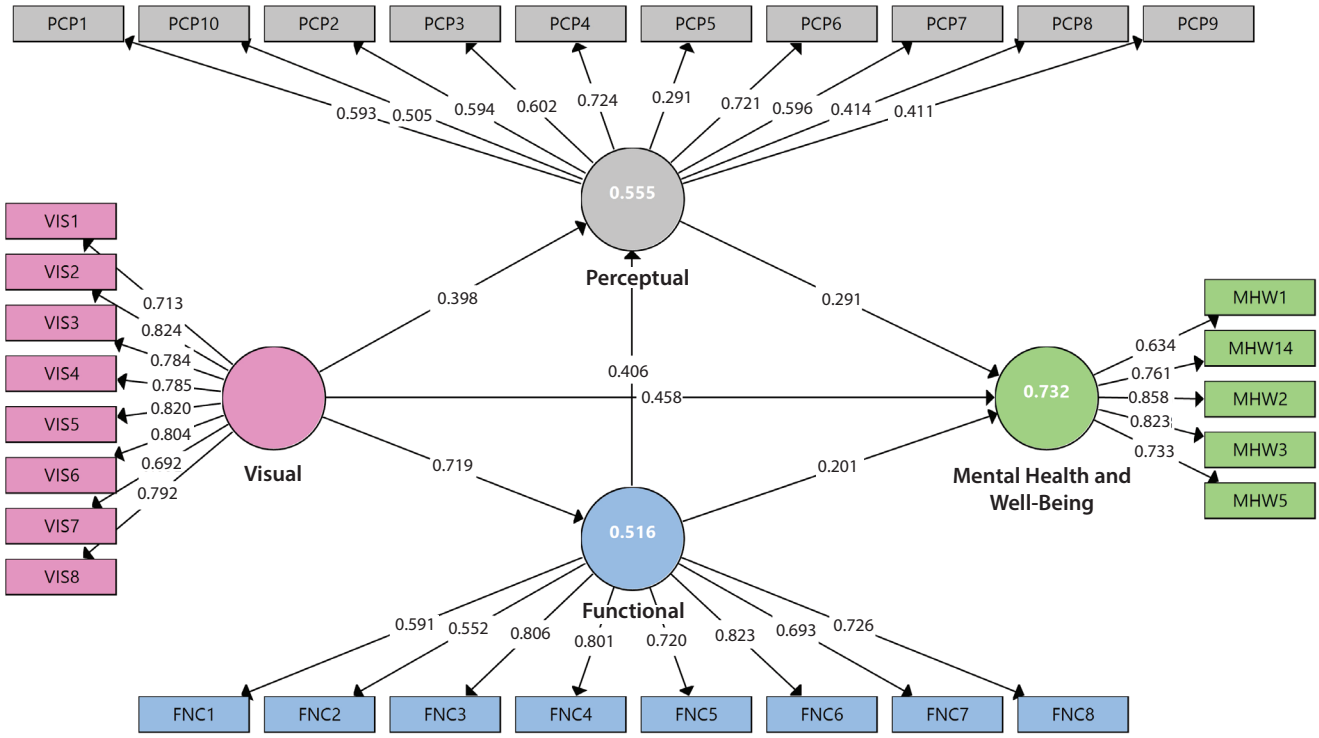

Figure 4. Path coefficients of structural equation model.

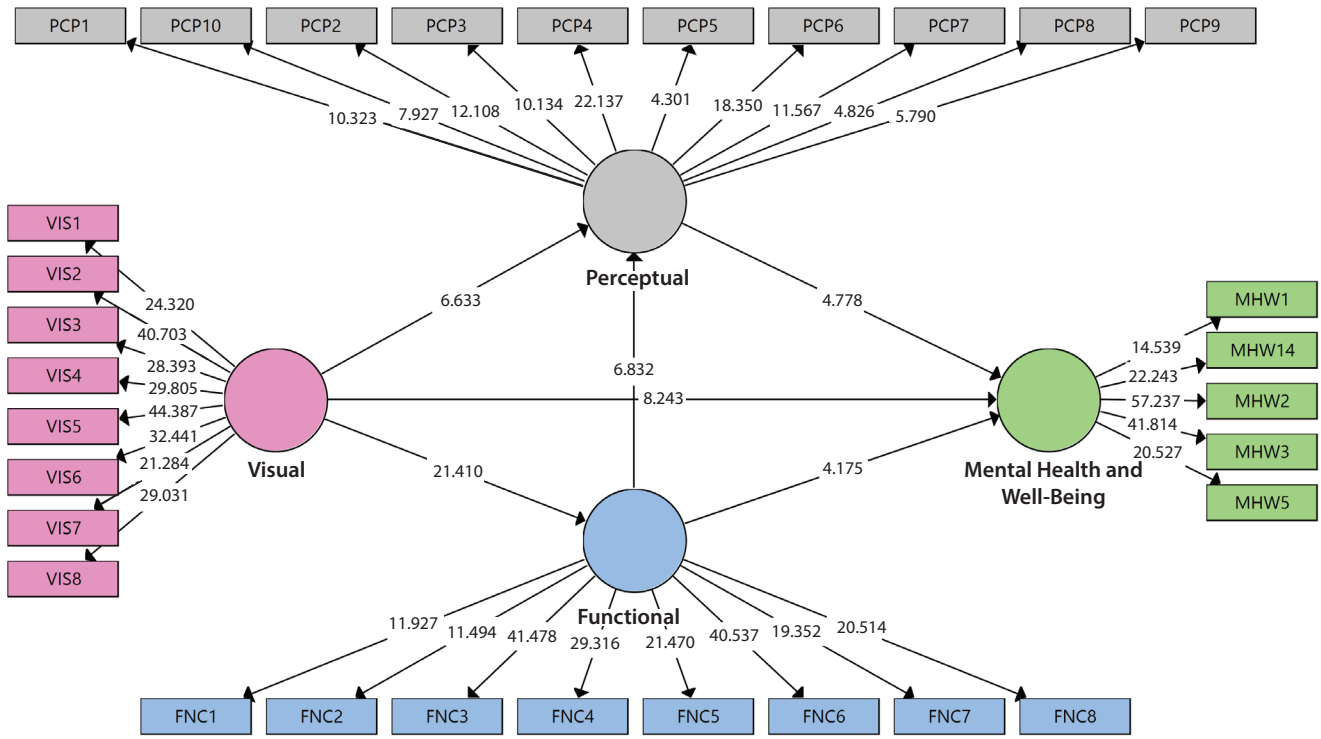

Figure 5. *T*-statistics of indicators and items of the structural equation model.

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Table 3. Results of Path Analysis and Hypothesis Testing.

Path	Path coefficient	*T*-statistic	*P*-value	Remark
Perceptual -> Mental health and well-being	0.291	4.778	0.000	Significant
Visual -> Mental health and well-being	0.458	8.243	0.000	Significant
Functional -> Mental health and well-being	0.201	4.175	0.000	Significant
Visual -> Perceptual	0.398	6.633	0.000	Significant
Visual -> Functional	0.719	21.410	0.000	Significant
Functional -> Perceptual	0.406	6.832	0.000	Significant

perceptual and functional, with a path coefficient of 0.406 and a *t*-statistic of 6.832, is confirmed at the 99% confidence level. Their relationship, as shown in the structural model results in Figure 4, indicates indirect relationships, meaning that the visual indicator simultaneously influences both perceptual and functional indicators. This is because these factors have closely interconnected relationships, and the relationship between the perceptual and functional variables is also similar.

Effective Indicators and Items in Mental Health and Well-Being

Table 4 displays the *t*-statistics and *p*-values for the examined research items, indicating that these values were calculated from the means of the questions for each item. The results indicate that the items investigated for assessing research indicators in Zaribar Waterfront Park and Shano Park have had significant effects on the mental health and well-being of the citizens of Marivan City. Since all these values are higher than 2.58, following the research conducted by Henseler et al. (2009), these items are statistically significant at a 99% confidence level. The visual indicator, with a path coefficient of 0.458 and a *t*-statistic of 8.243, has been the most influential indicator of mental health and well-being in the urban parks of Marivan City. Following in order, the perceptual indicator, with a path coefficient of 0.291 and a *t*-statistic of 4.778, as well as the functional indicator with a path coefficient of 0.201 and a *t*-statistic of 4.175, held the second and third ranks in terms of significance. Within the perceptual indicator, the most influential items included positive stimulation of the senses of hearing and smell. In the visual indicator, 2 items, legibility and continuity of space and biodiversity, had a greater impact on mental health and well-being. Additionally, in the functional indicator, physical activity and gender justice were the most influential items in terms of impact.

The Relationship Between Green Spaces and Different Sociodemographics

Many studies have examined the connection between green space and different sociodemographic traits, but little is known about how men's and women's views of green space differ in their effects on health and well-being (Li et al. 2020). According to the results of this research, gender justice has had a significant impact on mental health and well-being. Because of the decline in human interaction with the natural world, the value of urban green spaces in improving the quality of life for residents has never been greater. Urban green spaces need to be usable and accessible to all societal groups, particularly those of various genders (Rahimi et al. 2023). According to Coggin and Pieterse (2012), a city is a place where a wide variety of social groupings coexist. To create a high-quality urban environment, it is imperative to strive for a setting that is mindful of these distinctions. Green spaces are an essential component of cities that are needed by all social groups, regardless of gender or socioeconomic position, due to their strategic relevance for quality of life and urban livability (Breuste and Rahimi 2015). The examination conducted through the utilization of the SPSS software, employing the Mann-Whitney U test, revealed that there were no statistically significant differences

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Table 4. *T*-statistics of research indicators and items.

Indicators	Items	Label	*T*-statistics	*P*-value	Remark
Perceptual	Positive stimulation of the sense of sight	PCP1	10.323	0.000	Significant
		PCP2	12.108		
	Positive stimulation of the sense of smell	PCP3	10.134	0.000	Significant
		PCP4	22.137		
	Positive stimulation of the sense of hearing	PCP5	4.301	0.000	Significant
		PCP6	18.350		
	Sense of security and surveillance	PCP7	11.567	0.000	Significant
		PCP8	4.826		
	Sense of belonging to a place	PCP9	5.790	0.000	Significant
		PCP10	7.927		
Visual	Biodiversity	VIS1	24.320	0.000	Significant
		VIS2	40.703		
	Lighting quality	VIS3	28.393	0.000	Significant
		VIS4	29.805		
	Legibility and continuity of space	VIS5	44.387	0.000	Significant
		VIS6	32.441		
	Variety of plants	VIS7	21.284	0.000	Significant
		VIS8	29.031		
Functional	Platform for social interactions	FNC1	11.927	0.000	Significant
		FNC2	11.494		
	Physical activity	FNC3	41.478	0.000	Significant
		FNC4	29.316		
	Justice of age groups	FNC5	21.470	0.000	Significant
		FNC6	40.537		
	Gender justice	FNC7	19.352	0.000	Significant
		FNC8	20.514		

between genders concerning the item of gender equity and its impact on mental health and well-being. This assessment was made in light of various factors, such as the accessibility and usability of green spaces for all demographic groups. Based on these findings, it can be inferred that one of the influential factors in the correlation between gender equity, mental health, and overall well-being in the urban parks of Marivan City is the absence of disparities and limitations in access and utilization between males and females (Table 5).

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Table 5. Mann-Whitney U test for gender justice item.

Item	Gender	*N*	Mean rank	Asymp. Sig. (2-tailed)
Gender justice	Female	98	149.27	0.078
	Male	177	131.76	

DISCUSSION AND CONCLUSION

This study aimed to investigate the impact of 2 urban parks, Shano Park and Zaribar Waterfront Park, as nature-based solutions for mental health and well-being based on the experiences and perceptions of the residents of Marivan City. The overall findings of this research are in line with previous studies in the field of positive effects of urban green spaces on mental health and well-being (van den Bosch and Sang 2017; Vujcic et al. 2017; MacKinnon et al. 2019; Kolokotsa et al. 2020; Coventry et al. 2021; Sohaib et al. 2022; Pereira et al. 2023; Singh et al. 2023). The practical significance of this research lies in its potential to inform urban park design and management practices. By identifying the specific visual, functional, and conceptual elements that positively correlate with mental health indicators, park planners and managers can implement targeted interventions. The following section will discuss and analyze the most significant and influential results obtained in the two sections.

Functional Aspect of Urban Parks and Mental Health and Well-Being

The impact of urban parks as nature-based solutions from the point of view of benefits related to the functional physical health of the people of Marivan City in this research, according to people's perceptions, showed that items such as platforms for social interactions, physical activity, justice of age groups, and gender justice in Marivan urban parks have had positive effects on mental health and well-being. Among them, the items of gender justice and physical activities were the most influential. In summary, this study unveiled a favorable connection between urban parks and the benefits of public physical exercise and mental health. In this context, a study was conducted by García de Jalón et al. (2020) to evaluate the benefits of green space on physical activity and the economic value obtained from its health. The study emphasized the financial advantages and disadvantages of giving people access to urban green areas through a range of strategies, such as lowering noise and air pollution, and the positive health consequences of physical exercise. It was calculated that 0.010677 QALYs (quality-adjusted life years; one quality-adjusted life year equals one year of life in perfect health) per person annually would result from 30 minutes of moderate-to-intense physical exercise each week. The monetary worth of the physical activity was assessed at €597,033 over a 20-year time horizon based on an estimated social value of 1 QALY = €22,400. Therefore, the practical implication lies in creating an environment that ensures equitable access and enjoyment of park facilities, fostering a sense of inclusivity and community well-being. In conclusion, the practical significance of these findings lies in the tangible and actionable insights they provide for urban planners, policymakers, and community stakeholders. Recognizing urban parks as integral components of the urban landscape, with the potential to enhance mental health and well- being through social interactions, physical activities, and justice considerations, enables informed decision-making for creating healthier and more inclusive urban environments. Designing park spaces that facilitate physical activity, social interaction, and relaxation thus positively impacts mental well-being. This underscores the practical importance of urban parks in serving as communal spaces that facilitate meaningful social exchanges. Therefore, urban parks serve as practical settings that contribute to the physical fitness and overall health of the community.

Perceptual and Visual Aspects of Urban Parks and Mental Health and Well-Being

Based on the findings of the research, perceptual and visual indicators have a direct and significant impact on the mental health and well-being of citizens in the city of Marivan. Among these indicators, in the perceptual category, which pertains to multi-sensory perceptions of individuals, the urban parks in Marivan City were found to allocate the highest levels of positive sensory stimuli, particularly in the auditory and

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olfactory domains, as reported by the city's residents. Consequently, it can be asserted that these sensory elements have had a more pronounced influence on the mental well-being and overall welfare of citizens. This is attributed to the presence of infrastructure and amenities within the city, as well as the level of acceptance and utilization of urban parks by the local population. Numerous studies corroborate the findings of this research, affirming that auditory aspects encompassing the soundscape, such as the rustling of leaves and the sound of birds and water, along with olfactory aspects, particularly the presence of aromatic plant species, exert substantial and positive effects on the mental well-being and overall welfare of individuals in urban parks (Gascon et al. 2017; Arslan et al. 2018; White et al. 2020; Jiang et al. 2021). The study emphasizes the practical significance of multi-sensory perceptions, particularly auditory and olfactory stimuli, in Marivan urban parks. Residents reported the highest levels of positive sensory experiences in these domains, signaling a tangible connection between sensory elements and mental well-being. Recognizing the role of infrastructure, park amenities, and community acceptance, the practical implication lies in the deliberate incorporation of sensory-rich elements within urban parks to enhance the mental well-being of citizens. The practical implications suggest the integration of fragrant plants within urban park landscapes to harness their healing potential, aligning with the historical and contemporary understanding of plant-based therapies.

Desirable environmental sounds in the urban parks of Marivan City, referred to as the soundscape, encompassing the rustling of leaves and the sounds of birds and water, have had a positive impact on the mental well-being and overall welfare of citizens. Multiple studies (Gascon et al. 2017; White et al. 2020) corroborate this finding. In several empirical studies, water-based sounds, either in isolation (Zhang et al. 2021) or in combination with other natural sounds such as bird songs (Annerstedt et al. 2013), have been found to incline towards reducing stress more rapidly than urban noises, silence, or conditions specifically designed for stress reduction, such as soothing music (Huisman et al. 2012). Furthermore, the addition of pleasant water sounds, such as waterfalls and fountains, to less pleasant traffic noises (effectively increasing overall volume), can also enhance positive ratings (Rådsten Ekman et al. 2015). The findings align with prior studies and suggest that deliberate efforts to enhance visual diversity, such as installing bird boxes and diversifying flowers, can positively influence the psychological reactions of park visitors.

The visual aspects in the urban parks of Marivan City, including the biodiversity of plants and animals, have had positive effects on the mental health and well-being of the people. This finding is consistent with prior studies (Sandifer et al. 2015; Marselle et al. 2019; Cameron et al. 2020; Marselle et al. 2021). Zaribar Waterfront Park and its associated complex, known for their rich biodiversity of 257 plant species (Khorasani et al. 2014) and diverse animal population (Khoram and Hoshmand 2012), have garnered visual appeal and ecological diversity. This, in turn, has had positive effects on the well-being and health of the city's residents. Similarly, Shano Park, characterized by its substantial plant diversity and, to some extent, animal diversity, adheres to this pattern of natural abundance. More favorable psychological reactions have been associated with higher levels of biodiversity (Cracknell et al. 2016; Wood et al. 2018). By installing bird boxes and diversifying the flowers in the park, Shwartz et al. (2014) boosted biodiversity in small parks and discovered that visitors felt better about their well-being when biodiversity rose (except from insects). The collective findings from numerous empirical studies confirm the broader practical significance of perceptual and visual aspects in green spaces. The positive impact extends to a reduction in negative emotions, stress alleviation, and an increase in positive psychological states such as creativity, happiness, and vitality. Therefore, the result of the study revealed that visual factors are more effective than the other green area factors. The implications for urban planning and park design are significant, suggesting that the intentional cultivation of perceptual and visual elements can contribute to the psychological well-being of city residents. In these terms, city planners and landscape architects can create livable and peaceful environments by paying more attention to visual features in their plans and designing green areas that will appeal more to the sense of sight.

Numerous empirical studies have assessed the effects of perceptual and visual aspects in green spaces and urban parks, with findings indicating a positive impact on psychological well-being. These effects encompass a reduction in depression, dejection, anger, aggression, frustration, and hostility while simultaneously contributing to the alleviation of stress.

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Additionally, the presence of green spaces has been associated with an increase in creativity, happiness, calmness, comfort, refreshment, vitality, and vigor (Kaplan and Kaplan 1989b; Morita et al. 2007; Sugiyama et al. 2008; Nisbet et al. 2011; Kamitsis and Francis 2013; MacKerron and Mourato 2013; Lee et al. 2014; Tyrväinen et al. 2014). In conclusion, the practical significance of these research findings lies in their applicability to urban planning, landscape design, and community well-being initiatives. By understanding and leveraging the impact of multi-sensory perceptions, the healing properties of plants, positive soundscapes, and visual diversity, urban parks can be intentionally designed to enhance the mental health and overall welfare of citizens, fostering a more vibrant and resilient community.

LITERATURE CITED

Abkar M, Kamal M, Mariapan M, Maulan S, Sheybanic M. 2010. The role of urban green spaces in mood change. *Australian Journal of Basic and Applied Sciences*. 4(10):5352-5361.

Annerstedt M, Jönsson P, Wallergård M, Johansson G, Karlson B, Grahn P, Hansen AM, Währborg P. 2013. Inducing physiological stress recovery with sounds of nature in a virtual reality forest—Results from a pilot study. *Physiology and Behavior*. 118:240-250. https://doi.org/10.1016/j.physbeh.2013.05.023

Arslan M, Kalaylioglu Z, Ekren E. 2018. Use of medicinal and aromatic plants in therapeutic gardens. *Indian Journal of Pharmaceutical Education and Research*. 52(4s):151-154. https://doi.org/10.5530/ijper.52.4s.92

Aspinall P, Mavros P, Coyne R, Roe J. 2015. The urban brain: Analyzing outdoor physical activity with mobile EEG. *British Journal of Sports Medicine*. 49(4):272-276. https://doi.org/10.1136/bjsports-2012-091877

Astell-Burt T, Feng X, Kolt GS. 2014. Greener neighborhoods, slimmer people? Evidence from 246 920 Australians. *International Journal of Obesity*. 38(1):156-159. https://doi.org/10.1038/ijo.2013.64

Azizkhani K. 2022. Assessing the effects of external environmental factors in public spaces on mental health and well-being [dissertation]. Torino (Italy): Politecnico di Torino.

Badri SA, Rahmani K, Sojasi Qeydari M, Hasan Poor O. 2011. Strategies of ecotourism development in Marivan township. *Journal of Rural Research*. 2(6):31-54. https://jrur.ut.ac.ir/article_23215.html

Bahriny F, Bell S. 2020. Patterns of urban park use and their relationship to factors of quality: A case study of Tehran, Iran. *Sustainability*. 12(4):1560. https://doi.org/10.3390/su12041560

Balist J, Heydarzadeh H, Salehi E. 2019. Modeling, evaluation, and zoning of Marivan county ecotourism potential using fuzzy logic, FAHP, and TOPSIS. *Geographica Pannonica*. 23(1):47-63. https://doi.org/10.5937/gp23-18879

Bennet SA, Yiannakoulias N, Williams AM, Kitchen P. 2012. Playground accessibility and neighbourhood social interaction among parents. *Social Indicators Research*. 108:199-213. https://doi.org/10.1007/s11205-012-0062-4

Berdejo-Espinola V, Suárez-Castro AF, Amano T, Fielding KS, Oh RRY, Fuller RA. 2021. Urban green space use during a time of stress: A case study during the COVID-19 pandemic in Brisbane, Australia. *People and Nature*. 3(3):597-609. https://doi.org/10.1002/pan3.10218

bin Hassan MF, Hassan NM, Kassim ES, Hamzah MI. 2018. Issues and challenges of mental health in Malaysia. *International Journal of Academic Research in Business and Social Sciences*. 8(12):1685-1696. https://doi.org/10.6007/IJARBSS/v8-i12/5288

Bratman GN, Hamilton JP, Hahn KS, Daily GC, Gross JJ. 2015. Nature experience reduces rumination and subgenual prefrontal cortex activation. *Proceedings of the National Academy of Sciences*. 112(28):8567-8572. https://doi.org/10.1073/pnas.1510459112

Breuste J, Rahimi A. 2015. Many public urban parks, but who profits from them? The example of Tabriz, Iran. *Ecological Processes*. 4:1-15. https://doi.org/10.1186/s13717-014-0027-4

Cameron RWF, Brindley P, Mears M, McEwan K, Ferguson F, Sheffield D, Jorgensen A, Riley J, Goodrick J, Ballard L, Richardson M. 2020. Where the wild things are! Do urban green spaces with greater avian biodiversity promote more positive emotions in humans? *Urban Ecosystems*. 23:301-317. https://doi.org/10.1007/s11252-020-00929-z

Carbonaro M, Bainbridge J. 2000. Design and development of a process for web-based survey research. *Alberta Journal of Educational Research*. 46(4). https://doi.org/10.11575/ajer.v46i4.54834

Cattell V, Dines N, Gesler W, Curtis S. 2008. Mingling, observing, and lingering: Everyday public spaces and their implications for well-being and social relations. *Health and Place*. 14(3):544-561. https://doi.org/10.1016/j.healthplace.2007.10.007

Chin WW. 1998. The partial least squares approach to structural equation modeling. In: Marcoulides GA, editor. *Modern methods for business research*. New York (NY, USA): Psychology Press. p. 295-336.

Cianconi P, Betrò S, Janiri L. 2020. The impact of climate change on mental health: A systematic descriptive review. *Frontiers in Psychiatry*. 11:74. https://doi.org/10.3389/fpsyt.2020.00074

Coggin T, Pieterse M. 2012. Rights and the city: An exploration of the interaction between socio-economic rights and the city. *Urban Forum*. 23:257-278. https://doi.org/10.1007/s12132-011-9135-8

Cohen MJ, Creed IF, Alexander L, Basu NB, Calhoun AJK, Craft C, D'Amico E, DeKeyser E, Fowler L, Golden HE, Jawitz JW, Kalla P, Kirkman LK, Lane CR, Lang M, Leibowitz SG, Lewis DB, Marton J, McLaughlin DL, Mushet DM, Raanan-Kiperwas H, Rains MC, Smith L, Walls SC. 2016. Do geographically isolated wetlands influence landscape functions? *Proceedings of the National Academy of Sciences*. 113(8):1978-1986. https://doi.org/10.1073/pnas.1512650113

Coventry PA, Brown JVE, Pervin J, Brabyn S, Pateman R, Breedvelt J, Gilbody S, Stancliffe R, McEachan R, White PCL. 2021. Nature-based outdoor activities for mental and physical health: Systematic review and meta-analysis. *SSM—Population Health*. 16:100934. https://doi.org/10.1016/j.ssmph.2021.100934

©2024 International Society of Arboriculture

Cracknell D, White MP, Pahl S, Nichols WJ, Depledge MH. 2016. Marine biota and psychological well-being: A preliminary examination of dose–response effects in an aquarium setting. *Environment and Behavior*. 48(10):1242-1269. https://doi.org/10.1177/0013916515597512

de Vries S, Verheij RA, Groenewegen PP, Spreeuwenberg P. 2003. Natural environments—Healthy environments? An exploratory analysis of the relationship between greenspace and health. *Environment and Planning A*. 35(10):1717-1731. https://doi.org/10.1068/a35111

Dumitru A, Wendling L. 2021. *Evaluating the impact of nature-based solutions: Appendix of methods*. Brussel (Belgium): European Commission, Directorate-General for Research and Innovation. 1174 p. https://doi.org/10.2777/11361

Elmqvist T, Fragkias M, Goodness J, Güneralp B, Marcotullio PJ, McDonald RI, Parnell S, Schewenius M, Sendstad M, Seto KC, Wilkinson C. 2013. *Urbanization, biodiversity and ecosystem services: Challenges and opportunities: A global assessment*. Dordrecht (Netherlands): Springer. 783 p.

Enssle F, Kabisch N. 2020. Urban green spaces for the social interaction, health and well-being of older people—An integrated view of urban ecosystem services and socio-environmental justice. *Environmental Science and Policy.* 109:36-44. https://doi.org/10.1016/j.envsci.2020.04.008

Fornell C, Larcker DF. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*. 18(1):39-50. https://doi.org/10.1177/002224378101800104

Francis J, Wood LJ, Knuiman M, Giles-Corti B. 2012. Quality or quantity? Exploring the relationship between Public Open Space attributes and mental health in Perth, Western Australia. *Social Science and Medicine*. 74(10):1570-1577. https://doi.org/10.1016/j.socscimed.2012.01.032

García de Jalón S, Chiabai A, Mc Tague A, Artaza N, de Ayala A, Quiroga S, Kruize H, Suarez C, Bell R, Taylor T. 2020. Providing access to urban green spaces: A participatory benefit-cost analysis in Spain. *International Journal of Environmental Research and Public Health*. 17(8):2818. https://doi.org/10.3390/ijerph17082818

Gascon M, Zijlema W, Vert C, White MP, Nieuwenhuijsen MJ. 2017. Outdoor blue spaces, human health and well-being: A systematic review of quantitative studies. *International Journal of Hygiene and Environmental Health*. 220(8):1207-1221. https://doi.org/10.1016/j.ijheh.2017.08.004

Gholami Y, Taghvaei SH, Norouzian-Maleki S, Mansouri Sepehr R. 2021. Identifying the stimulus of visual perception based on eye-tracking in urban parks: Case study of Mellat Park in Tehran. *Journal of Forest Research*. 26(2):91-100. https://doi.org/10.1080/13416979.2021.1876286

Ghozali I, Latan H. 2015. *Partial least squares: Konsep, Teknik dan Aplikasi Menggunakan Program SmartPLS 3.0, -2/E*. Semarang (Indonesia): UNDIP Publishing Agency. 290 p.

Gidlow CJ, Jones MV, Hurst G, Masterson D, Clark-Carter D, Tarvainen MP, Smith G, Nieuwenhuijsen M. 2016. Where to put your best foot forward: Psycho-physiological responses to walking in natural and urban environments. *Journal of Environmental Psychology*. 45:22-29. https://doi.org/10.1016/j.jenvp.2015.11.00

Glass ST, Lingg E, Heuberger E. 2014. Do ambient urban odors evoke basic emotions? *Frontiers in Psychology*. 5:340. https://doi.org/10.3389/fpsyg.2014.00340

Grahn P, Stigsdotter UK. 2010. The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and Urban Planning*. 94(3-4):264-275. https://doi.org/10.1016/j.landurbplan.2009.10.012

Grigoletto A, Toselli S, Zijlema W, Marquez S, Triguero-Mas M, Gidlow C, Grazuleviciene R, Van den Berg M, Kruize H, Maas J, Nieuwenhuijsen MJ. 2023. Restoration in mental health after visiting urban green spaces, who is most affected? Comparison between good/poor mental health in four European cities. *Environmental Research*. 223:115397. https://doi.org/10.1016/j.envres.2023.115397

Grinde B, Patil GG. 2009. Biophilia: Does visual contact with nature impact on health and well-being? *International Journal of Environmental Research and Public Health*. 6(9):2332-2343. https://doi.org/10.3390/ijerph6092332

Guite HF, Clark C, Ackrill G. 2006. The impact of the physical and urban environment on mental well-being. *Public Health*. 120(12):1117-1126. https://doi.org/10.1016/j.puhe.2006.10.005

Guo S, Sun W, Chen W, Zhang J, Liu P. 2021. Impact of artificial elements on mountain landscape perception: An eye-tracking study. *Land*. 10(10):1102. https://doi.org/10.3390/land10101102

Hair JF, Black WC, Babin BJ, Anderson RE. 2010. *Multivariate data analysis*. 7th Ed. New York (NY, USA): Pearson. 816 p.

Hair JF, Hult GTM, Ringle CM, Sarstedt M, Danks NP, Ray S. 2021. *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook.* Cham (Switzerland): Springer Nature. 197 p. https://doi.org/10.1007/978-3-030-80519-7

Hair JF, Ringle CM, Sarstedt M. 2011. PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*. 19(2):139-152. https://doi.org/10.2753/MTP1069-6679190202

Han H, Hyun SS. 2019. Green indoor and outdoor environment as nature-based solution and its role in increasing customer/employee mental health, well-being, and loyalty. *Business Strategy and the Environment*. 28(4):629-641. https://doi.org/10.1002/bse.2269

Hanson HI, Wickenberg B, Olsson JA. 2020. Working on the boundaries—How do science use and interpret the nature-based solution concept? *Land Use Policy*. 90:104302. https://doi.org/10.1016/j.landusepol.2019.104302

Hartig T. 2007. Three steps to understanding restorative environments as health resources. In: Thompson CW, Travlou P, editors. *Open space: People space.* London (United Kingdom): Taylor and Francis. p. 183-200. https://doi.org/10.4324/9780203961827

Hartig T, Mitchell R, de Vries S, Frumkin H. 2014. Nature and health. *Annual Review of Public Health.* 35:207-228. https://doi.org/10.1146/annurev-publhealth-032013-182443

Hausmann A, Slotow R, Burns JK, Di Minin E. 2016. The ecosystem service of sense of place: Benefits for human well-being and biodiversity conservation. *Environmental Conservation*. 43(2):117-127. https://doi.org/10.1017/S0376892915000314

Hedblom M, Gunnarsson B, Iravani B, Knez I, Schaefer M, Thorsson P, Lundström JN. 2019. Reduction of physiological

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stress by urban green space in a multisensory virtual experiment. *Scientific Reports*. 9:10113. https://doi.org/10.1038/s41598-019-46099-7

Henseler J, Ringle CM, Sinkovics RR. 2009. The use of partial least squares path modeling in international marketing. In: Sinkovics RR, Ghauri PN, editors. *New challenges to international marketing*. Vol. 20. Leeds (United Kingdom): Emerald Group Publishing Limited. p. 277-319. https://doi.org/10.1108/S1474-7979(2009)0000020014

Herzog TR, Strevey SJ. 2008. Contact with nature, sense of humor, and psychological well-being. *Environment and Behavior*. 40(6):747-776. https://doi.org/10.1177/0013916507308524

Holtan MT, Dieterlen SL, Sullivan WC. 2015. Social life under cover: Tree canopy and social capital in Baltimore, Maryland. *Environment and Behavior*. 47(5):502-525. https://doi.org/10.1177/0013916513518064

Horwitz P, Lindsay M, O'Connor M. 2001. Biodiversity, endemism, sense of place, and public health: Inter-relationships for Australian inland aquatic systems. *Ecosystem Health*. 7(4):253-265. https://doi.org/10.1046/j.1526-0992.2001.01044.x

Howell DC. 2002. *Statistical methods for psychology*. 5th Ed. Pacific Groove (CA, USA): Duxbury Thomson Learning. 816 p.

Huisman ERCM, Morales E, van Hoof J, Kort HSM. 2012. Healing environment: A review of the impact of physical environmental factors on users. *Building and Environment*. 58:70-80. https://doi.org/10.1016/j.buildenv.2012.06.016

Ilieva J, Baron S, Healey NM. 2002. Online surveys in marketing research: Pros and cons. *International Journal of Market Research*. 44(3):361-376. https://doi.org/10.1177/147078530204400303

Jahani A, Saffariha M. 2020. Aesthetic preference and mental restoration prediction in urban parks: An application of environmental modeling approach. *Urban Forestry & Urban Greening*. 54:126775. https://doi.org/10.1016/j.ufug.2020.126775

Jarvis CB, MacKenzie SB, Podsakoff PM. 2003. A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research*. 30(2):199-218. https://doi.org/10.1086/376806

Jennings V, Bamkole O. 2019. The relationship between social cohesion and urban green space: An avenue for health promotion. *International Journal of Environmental Research and Public Health*. 16(3):452. https://doi.org/10.3390/ijerph16030452

Jiang S, Deng L, Luo H, Li X, Guo B, Jiang M, Jia Y, Ma J, Sun L, Huang Z. 2021. Effect of fragrant primula flowers on physiology and psychology in female college students: An empirical study. *Frontiers in Psychology*. 12:607876. https://doi.org/10.3389/fpsyg.2021.607876

Jovanovska D, Swetnam RD, Tweed FS, Melovski L. 2020. Assessing the landscape visual quality of Shar Planina, North Macedonia. *Landscape Ecology*. 35:2805-2823. https://doi.org/10.1007/s10980-020-01122-5

Kabisch N, Basu S, van den Bosch M, Bratman GN, Masztalerz O. 2023. Nature-based solutions and mental health. In: McPhearson T, Kabisch N, Frantzeskaki N, editors. *Nature-based solutions for cities*. Cheltenham (United Kingdom): Edward Elgar Publishing Ltd. p. 193-212. https://doi.org/10.4337/9781800376762

Kabisch N, Frantzeskaki N, Pauleit S, Naumann S, Davis M, Artmann M, Haase D, Knapp S, Korn H, Stadler J, Zaunberger K, Bonn A. 2016. Nature-based solutions to climate change mitigation and adaptation in urban areas: Perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society*. 21(2):39. https://doi.org/10.5751/ES-08373-210239

Kabisch N, van den Bosch M, Lafortezza R. 2017. The health benefits of nature-based solutions to urbanization challenges for children and the elderly—A systematic review. *Environmental Research*. 159:362-373. https://doi.org/10.1016/j.envres.2017.08.004

Kaczynski AT, Henderson KA. 2007. Environmental correlates of physical activity: A review of evidence about parks and recreation. *Leisure Sciences*. 29(4):315-354. https://doi.org/10.1080/01490400701394865

Kamimura A, Trinh HN, Johansen M, Hurley J, Pye M, Sin K, Nguyen H. 2018. Perceptions of mental health and mental health services among college students in Vietnam and the United States. *Asian Journal of Psychiatry*. 37:15-19. https://doi.org/10.1016/j.ajp.2018.07.012

Kamitsis I, Francis AJP. 2013. Spirituality mediates the relationship between engagement with nature and psychological wellbeing. *Journal of Environmental Psychology*. 36:136-143. https://doi.org/10.1016/j.jenvp.2013.07.013

Kaplan R, Kaplan S. 1989a. The experience of nature: A psychological perspective. Cambridge (United Kingdom): Cambridge University Press. 360 p.

Kaplan S. 1995. The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*. 15(3):169-182. https://doi.org/10.1016/0272-4944(95)90001-2

Kaplan S. 2001. Meditation, restoration, and the management of mental fatigue. *Environment and Behavior*. 33(4):480-506. https://doi.org/10.1177/00139160121973106

Kaplan S, Kaplan R. 1989b. The visual environment: Public participation in design and planning. *Journal of Social Issues*. 45(1):59-86. https://doi.org/10.1111/j.1540-4560.1989.tb01533.x

Karimi N, Sajadzadeh H, Aram F. 2022. Investigating the association between environmental quality characteristics and mental well-being in public open spaces. *Urban Science*. 6(1):20. https://doi.org/10.3390/urbansci6010020

Kato-Huerta J, Geneletti D. 2022. Environmental justice implications of nature-based solutions in urban areas: A systematic review of approaches, indicators, and outcomes. *Environmental Science and Policy*. 138:122-133. https://doi.org/10.1016/j.envsci.2022.07.034

Keeler BL, Hamel P, McPhearson T, Hamann MH, Donahue ML, Meza Prado KA, Arkema KK, Bratman GN, Brauman KA, Finlay JC, Guerry AD, Hobbie SE, Johnson JA, MacDonald GK, McDonald RI, Neverisky N, Wood SA. 2019. Social-ecological and technological factors moderate the value of urban nature. *Nature Sustainability*. 2(1):29-38. https://doi.org/10.1038/s41893-018-0202-1

Khani S, Rastkhadiv A, Abdollahi A. 2023. Vandalism in urban parks: An analysis on demographic characteristics and the

©2024 International Society of Arboriculture

intention and behavior of vandals in Marivan City. *Journal of Social Problems of Iran*. 14(2):165-200. https://doi.org/10.61186/jspi.14.2.165

Khoram MR, Hoshmand K. 2012. Assessment of biodiversities and spatial structure of Zarivar Wetland in Kurdistan Province, Iran. *Biodiversitas Journal of Biological Diversity*. 13(3). https://doi.org/10.13057/biodiv/d130305

Khorasani N, Riazi B, Aliehiaee A. 2014. Investigating the diversity of plant species around Zarivar Lake in Marivan. *Journal of Natural Environment*. 67(1):53-64. https://doi.org/10.22059/jne.2014.50999

Kim SM, Park S, Hong JW, Jang EJ, Pak CH. 2016. Psychophysiological effects of orchid and rose fragrances on humans. *Horticultural Science and Technology*. 34(3):472-487. https://doi.org/10.12972/kjhst.20160048

Kimic K, Polko P. 2022. The use of urban parks by older adults in the context of perceived security. *International Journal of Environmental Research and Public Health*. 19(7):4184. https://doi.org/10.3390/ijerph19074184

Knight SJ, McClean CJ, White PC. 2022. The importance of ecological quality of public green and blue spaces for subjective well-being. *Landscape and Urban Planning.* 226:104510. https://doi.org/10.1016/j.landurbplan.2022.104510

Koh YF, Loc HH, Park E. 2022. Towards a "City in Nature": evaluating the cultural ecosystem services approach using online public participation GIS to support urban green space management. *Sustainability*. 14(3):1499. https://doi.org/10.3390/su14031499

Kolokotsa D, Lilli AA, Lilli MA, Nikolaidis NP. 2020. On the impact of nature-based solutions on citizens' health and well being. *Energy and Buildings*. 229:110527. https://doi.org/10.1016/j.enbuild.2020.110527

Kuo FE, Sullivan WC. 2001. Environment and crime in the inner city: Does vegetation reduce crime? *Environment and Behavior*. 33(3):343-367. https://doi.org/10.1177/0013916501333002

Lee J, Tsunetsugu Y, Takayama N, Park BJ, Li Q, Song C, Komatsu M, Ikei H, Tyvainen L, Kagawa T, Miyazaki Y. 2014. Influence of forest therapy on cardiovascular relaxation in young adults. *Evidence-Based Complementary and Alternative Medicine*. 2014:834360. https://doi.org/10.1155/2014/834360

Li X, Liu L, Zhang Z, Zhang W, Liu D, Feng Y. 2020. Gender disparity in perceived urban green space and subjective health and well-being in China: Implications for sustainable urban greening. *Sustainability*. 12(24):10538. https://doi.org/10.3390/su122410538

Li X, Wang X, Jiang X, Han J, Wang Z, Wu D, Lin Q, Liang L, Zhang S, Dong Y. 2022. Prediction of riverside greenway landscape aesthetic quality of urban canalized rivers using environmental modeling. *Journal of Cleaner Production*. 367:133066. https://doi.org/10.1016/j.jclepro.2022.133066

Litwin MS, Fink A. 1995. *How to measure survey reliability and validity.* Vol. 7. Thousand Oaks (CA, USA): Sage. 87 p.

Liu H, Li F, Li J, Zhang Y. 2017. The relationships between urban parks, residents' physical activity, and mental health benefits: A case study from Beijing, China. *Journal of Environmental Management*. 190:223-230. https://doi.org/10.1016/j.jenvman.2016.12.058

Loreau M, de Mazancourt C. 2013. Biodiversity and ecosystem stability: A synthesis of underlying mechanisms. *Ecology Letters*. 16(s1):106-115. https://doi.org/10.1111/ele.12073

Lu J, Li Q, Zeng L, Chen J, Liu G, Li Y, Li W, Huang K. 2017. A micro-climatic study on cooling effect of an urban park in a hot and humid climate. *Sustainable Cities and Society.* 32:513-522. https://doi.org/10.1016/j.scs.2017.04.017

Luo S, Jiang H, Yi D, Liu R, Qin J, Liu Y, Zhang J. 2022. PM2SFCA: Spatial access to urban parks, based on park perceptions and multi-travel modes. A case study in Beijing. *ISPRS International Journal of Geo-Information*. 11(9):488. https://doi.org/10.3390/ijgi11090488

Macháč J, Brabec J, Arnberger A. 2022. Exploring public preferences and preference heterogeneity for green and blue infrastructure in urban green spaces. *Urban Forestry & Urban Greening.* 75*:*127695. https://doi.org/10.1016/j.ufug.2022.127695

MacKerron G, Mourato S. 2013. Happiness is greater in natural environments. *Global Environmental Change*. 23(5):992-1000. https://doi.org/10.1016/j.gloenvcha.2013.03.010

MacKinnon K, van Ham C, Reilly K, Hopkins J. 2019. Nature-based solutions and protected areas to improve urban biodiversity and health. In: Marselle M, Stadler J, Korn H, Irvine K, Bonn A, editors. *Biodiversity and health in the face of climate change*. p. 363-380. https://doi.org/10.1007/978-3-030-02318-8_16

Manouchehri S, Mohammadi S, Eskandari H. 2023. A qualitative analysis of the development of event-oriented tourism based on the International Street Theater Festival of Marivan City. *Geography and Territorial Spatial Arrangement*. 13(46):1-32. https://doi.org/10.22111/gaij.2022.41197.2997

Marivan Green Spaces Statistics. 2023. *Statistics of Marivan Municipality's Green Space Organization*. Kurdistan (Iran): Marivan Municipality. 120 p.

Marselle MR, Lindley SJ, Cook PA, Bonn A. 2021. Biodiversity and health in the urban environment. *Current Environmental Health Reports*. 8(2):146-156. https://doi.org/10.1007/s40572-021-00313-9

Marselle MR, Martens D, Dallimer M, Irvine KN. 2019. Review of the mental health and well-being benefits of biodiversity. In: Marselle M, Stadler J, Korn H, Irvine K, Bonn A, editors. *Biodiversity and health in the face of climate change*. p. 175-211. https://doi.org/10.1007/978-3-030-02318-8_9

McDougall CW, Hanley N, Quilliam RS, Oliver DM. 2022. Blue space exposure, health and well-being: Does freshwater type matter? *Landscape and Urban Planning*. 224:104446. https://doi.org/10.1016/j.landurbplan.2022.104446

Meerow S, Newell JP. 2017. Spatial planning for multifunctional green infrastructure: Growing resilience in Detroit. *Landscape and Urban Planning.* 159:62-75. https://doi.org/10.1016/j.landurbplan.2016.10.005

Mitra A, Lankford S. 1999. *Research methods in park, recreation, and leisure services*. Champaign (IL, USA): Sagamore-Venture Publishing. 334 p.

Moore JW, Clark GMG, Bulbrook RD, Hayward JL, Murai JT, Hammond GL, Siiteri PK. 1982. Serum concentrations of total and non-protein-bound oestradiol in patients with breast cancer and in normal controls. *International Journal of Cancer*. 29(1):17-21. https://doi.org/10.1002/ijc.2910290105

©2024 International Society of Arboriculture

Morita E, Fukuda S, Nagano J, Hamajima N, Yamamoto H, Iwai Y, Nakashima T, Ohira H, Shirakawa T. 2007. Psychological effects of forest environments on healthy adults: Shinrin-yoku (forest-air bathing, walking) as a possible method of stress reduction. *Public Health*. 121(1):54-63. https://doi.org/10.1016/j.puhe.2006.05.024

Mousapour B. 2023. Assessment of biophilic design's impact on citizens' residential satisfaction to enhance pro-environmental behavior. *Architectural Engineering and Design Management*. 1-15. https://doi.org/10.1080/17452007.2023.2209709

Muratet A, Pellegrini P, Dufour AB, Arrif T, Chiron F. 2015. Perception and knowledge of plant diversity among urban park users. *Landscape and Urban Planning*. 137:95-106. https://doi.org/10.1016/j.landurbplan.2015.01.003

Nesshöver C, Assmuth T, Irvine KN, Rusch GM, Waylen KA, Delbaere B, Haase D, Jones-Walters L, Keune H, Kovacs E, Krauze K, Kulvik M, Rey F, van Dijk J, Vistad OI, Wilkinson ME, Wittmer H. 2017. The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of the Total Environment*. 579:1215-1227. https://doi.org/10.1016/j.scitotenv.2016.11.106

Nielsen TS, Hansen KB. 2007. Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators. *Health and Place*. 13(4):839-850. https://doi.org/10.1016/j.healthplace.2007.02.001

Nisbet EK, Zelenski JM, Murphy SA. 2011. Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being. *Journal of Happiness Studies*. 12:303-322. https://doi.org/10.1007/s10902-010-9197-7

Parsons R. 1991. The potential influences of environmental perception on human health. *Journal of Environmental Psychology*. 11(1):1-23. https://doi.org/10.1016/S0272-4944(05)80002-7

Pearce M, Garcia L, Abbas A, Strain T, Schuch FB, Golubic R, Kelly P, Khan S, Utukuri M, Laird Y, Mok A, Smith A, Tainio M, Brage S, Woodcock J. 2022. Association between physical activity and risk of depression: A systematic review and meta-analysis. *JAMA Psychiatry*. 79(6):550-559. https://doi.org/10.1001/jamapsychiatry.2022.0609

Pereira P, Yin C, Hua T. 2023. Nature-based Solutions, ecosystem services, disservices and impacts on wellbeing in urban environments. *Current Opinion in Environmental Science and Health*. 33:100465. https://doi.org/10.1016/j.coesh.2023.100465

Peters K, Elands B, Buijs A. 2010. Social interactions in urban parks: Stimulating social cohesion? *Urban Forestry & Urban Greening*. 9(2):93-100. https://doi.org/10.1016/j.ufug.2009.11.003

Pietilä M, Neuvonen M, Borodulin K, Korpela K, Sievänen T, Tyrväinen L. 2015. Relationships between exposure to urban green spaces, physical activity and self-rated health. *Journal of Outdoor Recreation and Tourism*. 10:44-54. https://doi.org/10.1016/j.jort.2015.06.006

Plane J, Klodawsky F. 2013. Neighbourhood amenities and health: Examining the significance of a local park. *Social Science and Medicine*. 99:1-8. https://doi.org/10.1016/j.socscimed.2013.10.008

Potschin M, Kretsch C, Haines-Young R, Furman E, Berry P, Baro F. 2016. Nature-based solutions. In: Potschin M, Jax K, editors. *OpenNESS ecosystem services reference book*. EC FP7 Grant Agreement No. 308428. http://www.openness-project.eu/library/reference-book

Rådsten Ekman M, Lundén P, Nilsson ME. 2015. Similarity and pleasantness assessments of water-fountain sounds recorded in urban public spaces. *The Journal of the Acoustical Society of America*. 138(5):3043-3052. https://doi.org/10.1121/1.4934956

Rahimi A, Khorsand ED, Breuste J, Karimzadeh H. 2023. Gender justice in green space use in relation to different socio-economic conditions in Tabriz, Iran. *Sustainable Cities and Society*. 99:104973. https://doi.org/10.1016/j.scs.2023.104973

Rahimi A, Rastkhadiv A, Ketabollahi K. 2024. Urban agriculture as a new potential for development of urban green spaces in Marivan City. *Journal of Geography and Planning*. 28(88):1-19. https://doi.org/10.22034/gp.2024.59592.3215

Ramkissoon H, Smith LDG, Weiler B. 2013. Testing the dimensionality of place attachment and its relationships with place satisfaction and pro-environmental behaviours: A structural equation modelling approach. *Tourism Management*. 36:552-566. https://doi.org/10.1016/j.tourman.2012.09.003

Rashidi M, Hamzepour R, Ismaelzadeh S, Fateh K. 2018. Regional planning tourism strategies based on the SOAR approach (Case study: Marivan City). *Asian Journal of Water, Environment and Pollution*. 15(2):13-21. https://doi.org/10.3233/AJW-180013

Razmara M, Asadpour H, Taghipour M. 2021. Healing landscape: How healing parameters in different special organization could affect user's mental health? *A|Z ITU Journal of the Faculty of Architecture*. 18(2):269-283. https://doi.org/10.5505/itujfa.2021.32549

Regmi PR, Waithaka E, Paudyal A, Simkhada P, van Teijlingen E. 2016. Guide to the design and application of online questionnaire surveys. *Nepal Journal of Epidemiology*. 6(4):640. https://doi.org/10.3126/nje.v6i4.17258

Riechers M, Barkmann J, Tscharntke T. 2016. Perceptions of cultural ecosystem services from urban green. *Ecosystem Services*. 17:33-39. https://doi.org/10.1016/j.ecoser.2015.11.007

Ringle CM, Sarstedt M, Mitchell R, Gudergan SP. 2020. Partial least squares structural equation modeling in HRM research. *The International Journal of Human Resource Management*. 31(12):1617-1643. https://doi.org/10.1080/09585192.2017.1416655

Roe JJ, Thompson CW, Aspinall PA, Brewer MJ, Duff EI, Miller D, Clow A. 2013. Green space and stress: Evidence from cortisol measures in deprived urban communities. *International Journal of Environmental Research and Public Health*. 10(9):4086-4103. https://doi.org/10.3390/ijerph10094086

Russo A, Andreucci MB. 2023. Raising healthy children: Promoting the multiple benefits of green open spaces through biophilic design. *Sustainability*. 15(3):1982. https://doi.org/10.3390/su15031982

Sadeghi A, Galalizadeh S, Zehtabian G, Khosravi H. 2021. Assessing the change of groundwater quality compared with land-use change and precipitation rate (Zrebar Lake's Basin). *Applied Water Science*. 11:1-15. https://doi.org/10.1007/s13201-021-01508-z

Salleh MZM, Othman N, Abd Malek N, Suddin LS. 2022. A paradoxical proposition of connectedness to nature, recycling

©2024 International Society of Arboriculture

behaviour and psychological restoration relationship in urban park context: A path analysis evidence. Planning Malaysia. 20(1). https://doi.org/10.21837/pm.v20i20.1082

Sandifer PA, Sutton-Grier AE, Ward BP. 2015. Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. *Ecosystem Services*. 12:1-15. https://doi.org/10.1016/j.ecoser.2014.12.007

Shwartz A, Turbé A, Simon L, Julliard R. 2014. Enhancing urban biodiversity and its influence on city-dwellers: An experiment. *Biological Conservation*. 171:82-90. https://doi.org/10.1016/j.biocon.2014.01.009

Sillman D, Rigolon A, Browning MH, McAnirlin O. 2022. Do sex and gender modify the association between green space and physical health? A systematic review. *Environmental Research*. 209:112869. https://doi.org/10.1016/j.envres.2022.112869

Singh N, Yu J, Ramkissoon H, Amponsah M, Han H. 2023. Nature-based solution for state park travelers' self-rated mental health, emotional well-being, and life satisfaction: Impact of national culture. *Journal of Travel and Tourism Marketing*. 40(1):55-74. https://doi.org/10.1080/10548408.2023.2215251

Smith AD, Crippa A, Woodcock J, Brage S. 2016. Physical activity and incident type 2 diabetes mellitus: A systematic review and dose–response meta-analysis of prospective cohort studies. *Diabetologia*. 59(12):2527-2545. https://doi.org/10.1007/s00125-016-4079-0

Sohaib M, Wang Y, Iqbal K, Han H. 2022. Nature-based solutions, mental health, well-being, price fairness, attitude, loyalty, and evangelism for green brands in the hotel context. *International Journal of Hospitality Management*. 101:103126. https://doi.org/10.1016/j.ijhm.2021.103126

Song C, Ikei H, Igarashi M, Miwa M, Takagaki M, Miyazaki Y. 2014. Physiological and psychological responses of young males during spring-time walks in urban parks. *Journal of Physiological Anthropology*. 33(1):1-7. https://doi.org/10.1186/1880-6805-33-8

Southon GE, Jorgensen A, Dunnett N, Hoyle H, Evans KL. 2018. Perceived species-richness in urban green spaces: Cues, accuracy and well-being impacts. *Landscape and Urban Planning*. 172:1-10. https://doi.org/10.1016/j.landurbplan.2017.12.002

Srivastav AK, Sharma N, Samuel AJ. 2021. Impact of coronavirus disease-19 (COVID-19) lockdown on physical activity and energy expenditure among physiotherapy professionals and students using web-based open E-survey sent through WhatsApp, Facebook and Instagram messengers. *Clinical Epidemiology and Global Health*. 9:78-84. https://doi.org/10.1016/j.cegh.2020.07.003

Steigen AM, Eriksson B, Kogstad RE, Toft HP, Bergh D. 2018. Young adults in nature-based services in Norway—In-group and between-group variations related to mental health problems. *Nordic Journal of Social Research*. 9(1):110-133. https://doi.org/10.7577/njsr.2301

Sugiyama T, Murabayashi N, Umekawa T, Nagao K, Kamimoto Y, Sugihara T, Sagawa N. 2008. Rapid overgrowth of a fetus after interruption of insulin therapy in a diabetic woman. *Diabetes Research and Clinical Practice*. 80(2):e9-e11. https://doi.org/10.1016/j.diabres.2008.01.020

Suhardi M. 2006. *A perceptual study of wetlands: Implications for wetland restoration in the urban areas in Malasia.* Blackburg (VA, USA): Virginia Polytechnic Institute and State University. http://hdl.handle.net/10919/26966

Sullivan WC, Chang CY. 2011. Mental health and the built environment. In: Dannenberg AL, Frumkin H, Jackson RJ, editors. *Making healthy places: Designing and building for health, well-being, and sustainability*. Washington (DC, USA): Island Press. p. 106-116. https://doi.org/10.5822/978-1-61091-036-1

Swamy MK, Sinniah UR. 2015. A comprehensive review on the phytochemical constituents and pharmacological activities of *Pogostemon cablin* Benth.: An aromatic medicinal plant of industrial importance. *Molecules*. 20(5):8521-8547. https://doi.org/10.3390/molecules20058521

The World Bank. 2008. Biodiversity, climate change, and adaptation: Nature-based solutions from the World Bank Portfolio. Washington (DC, USA): The International Bank for Reconstruction and Development/The World Bank. 112 p. https://documents1.worldbank.org/curated/en/149141468320661795/pdf/467260WP0REPLA1sity1Sept020081final.pdf

Thompson CW, Roe J, Aspinall P, Mitchell R, Clow A, Miller D. 2012. More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. *Landscape and Urban Planning*. 105(3):221-229. https://doi.org/10.1016/j.landurbplan.2011.12.015

Tsunetsugu Y, Lee J, Park BJ, Tyrväinen L, Kagawa T, Miyazaki Y. 2013. Physiological and psychological effects of viewing urban forest landscapes assessed by multiple measurements. *Landscape and Urban Planning*. 113:90-93.

Tyrväinen L, Ojala A, Korpela K, Lanki T, Tsunetsugu Y, Kagawa T. 2014. The influence of urban green environments on stress relief measures: A field experiment. *Journal of Environmental Psychology*. 38:1-9. https://doi.org/10.1016/j.jenvp.2013.12.005

Tyrväinen L, Pauleit S, Seeland K, de Vries S. 2005. Benefits and uses of urban forests and trees. In: Konijnendijk C, Nilsson K, Randrup T, Schipperijn J, editors. *Urban forests and trees: A reference book*. p. 81-114. https://doi.org/10.1007/3-540-27684-X_5

Ulrich RS. 1983. Aesthetic and affective response to natural environment. In: *Behavior and the natural environment*. Boston (MA, USA): Springer. p. 85-125. https://doi.org/10.1007/978-1-4613-3539-9_4

Ulrich RS, Parsons R. 1992. Influences of passive experiences with plants on individual well-being and health. In: Relf D, editor. *The role of horticulture in human well-being and social development*. Portland (OR, USA): Timber Press. p. 93-105.

Ulrich RS, Simons RF, Losito BD, Fiorito E, Miles MA, Zelson M. 1991. Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology.* 11(3):201-230. https://doi.org/10.1016/S0272-4944(05)80184-7

van den Bosch M, Sang ÅO. 2017. Urban natural environments as nature-based solutions for improved public health–A systematic review of reviews. *Environmental Research*. 158:373-384. https://doi.org/10.1016/j.envres.2017.05.040

Velarde MD, Fry G, Tveit M. 2007. Health effects of viewing landscapes—Landscape types in environmental psychology.

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Urban Forestry & Urban Greening. 6(4):199-212. https://doi.org/10.1016/j.ufug.2007.07.001
Vujcic M, Tomicevic-Dubljevic J, Grbic M, Lecic-Tosevski D, Vukovic O, Toskovic O. 2017. Nature based solution for improving mental health and well-being in urban areas. *Environmental Research*. 158:385-392. https://doi.org/10.1016/j.envres.2017.06.030
Ward R, Scott NJ. 2018. Cues to mental health from men's facial appearance. *Journal of Research in Personality*. 75:26-36. https://doi.org/10.1016/j.jrp.2018.04.007
Ward Thompson C, Aspinall P, Roe J, Robertson L, Miller D. 2016. Mitigating stress and supporting health in deprived urban communities: The importance of green space and the social environment. *International Journal of Environmental Research and Public Health*. 13(4):440. https://doi.org/10.3390/ijerph13040440
White MP, Elliott LR, Gascon M, Roberts B, Fleming LE. 2020. Blue space, health and well-being: A narrative overview and synthesis of potential benefits. *Environmental Research*. 191:110169.
Wood E, Harsant A, Dallimer M, Cronin de Chavez A, McEachan RR, Hassall C. 2018. Not all green space is created equal: Biodiversity predicts psychological restorative benefits from urban green space. *Frontiers in Psychology.* 9:2320. https://doi.org/10.3389/fpsyg.2018.02320
Xie J, Luo S, Furuya K, Sun D. 2020. Urban parks as green buffers during the COVID-19 pandemic. *Sustainability*. 12(17):6751. https://doi.org/10.3390/su12176751
Yang T, Barnett R, Fan Y, Li L. 2019. The effect of urban green space on uncertainty stress and life stress: A nationwide study of university students in China. *Health and Place.* 59:102199. https://doi.org/10.1016/j.healthplace.2019.102199
Zhang X, Zhang Y, Zhai J, Wu Y, Mao A. 2021. Waterscapes for promoting mental health in the general population. *International Journal of Environmental Research and Public Health*. 18(22):11792. https://doi.org/10.3390/ijerph182211792
Žlender V, Thompson CW. 2017. Accessibility and use of peri-urban green space for inner-city dwellers: A comparative study. *Landscape and Urban Planning*. 165:193-205. https://doi.org/10.1016/j.landurbplan.2016.06.011

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Conflicts of Interest:
The authors reported no conflicts of interest.

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