Original Paper

Mountain Therapy as a support in breast cancer treatment.

A pilot study in Southern Italy

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Abstract. *This paper offers a pilot study on Mountain Therapy (MT) as a therapeutic-rehabilitative and/or socio-educational methodological approach aimed at the secondary prevention, treatment and rehabilitation of people with different pathologies. The study was conducted in 2021 in the Sila National Park in the Calabria region (Southern Italy) and involved a group of 19 breast cancer patients after surgery, chemotherapy and radiotherapy. The main results show that the patient's quality of life improved after the MT approach, reducing stress and anxiety levels. These effects were measured by the submission of the HADS - Hospital Anxiety and Depression Scale - questionnaires at time 0 (start) and time 1 (end) of the treatment and by an NCCN Distress Thermometer. The study confirms the regenerative capacity of the natural environment in people suffering from a disabling disease, monitored through the assessment of psycho-physical parameters, helping to improve their quality of life and reduce hospitalisations.*

1. Introduction

Several studies have shown that a genetic predisposition can influence an individual's risk of developing chronic diseases (Jukarainen et al., 2022; Wehby et al., 2018). In addition, external or environmental factors such as diet, lifestyle and climatic conditions may also lead to an increasing number of non-transmissible diseases (Frumkin & Haines, 2019; Pichler et al., 2022), mainly due to the negative impact of urbanisation and anthropisation of ecosystems on a global scale (Guagliardi, 2022). Aside from the progress of medical research in treating and preventing several diseases, growing scientific evidence shows that the natural environment has great potential for disease prevention and health promotion (Gladwell et al., 2013; Martin et al., 2020; Mitchell and Popham, 2008). Natural environments, such as forests or urban green spaces, are incredible resources that have a great impact on human health. The relationship between natural environments and psycho-physical well-being is one of the benefits classified as ecosystem services. These are defined in the Millennium Ecosystem Assessment (2005) as "multiple benefits that ecosystems provide to humanity". The positive effects of green spaces on human mental and physical

health, both in terms of prevention and treatment, have been extensively documented in the scientific literature since the 1980s and continue to be tested today (Anundi et al., 2023; Cerulli et al., 2014; Kondo et al., 2018). The influence of the environment on people's well-being and psycho-physical recovery was first investigated in studies with patients, particularly hospitalised patients and elderly people visiting healthcare facilities (Gross et al., 1998; Ulrich, 1984). Direct exposure to urban and non-urban green spaces brings various psychological, cognitive, social and spiritual benefits (Ricca and Guagliardi, 2015, 2023). The hypothesis is based on the fact that biophilia (Wilson, 1984) has a regenerative capacity and an "innate tendency to focus interest on life and vital processes". This regenerative capacity of natural environments has also been illustrated by Stress Reduction Theory (SRT, Ulrich, 1981; Ulrich et al., 1991), according to which a non-threatening natural environment or the sight of natural elements can activate stress reduction, support key indicators central to discomfort response such as blood pressure and heart rate, improve mood and induce relaxation. More frequent and longer stays in green spaces have a more substantial and lasting effect than isolated and shorter stays (van den Berg et al., 2017). The importance of daily contact with the nearest green spaces for psychophysical health has also been demonstrated by studies conducted during the COVID-19 pandemic, with people forced to stay home (Farì et al., 2023; Gola et al., 2021; Noszczyk et al., 2022).

The subjects who could observe trees and green spaces from their windows or visit nearby parks and even community gardens reported lower rates of depression and anxiety (Marselle et al., 2020; Vivona et al., 2021). On the physiological side, very significant effects were observed in improving cardiovascular functions and hemodynamic, neuroendocrine, metabolic, immunological, inflammatory and oxidative indices (Song et al., 2016).

Among the several nature-based health interventions, forest and mountain therapies are emerging as potential alternatives to complement or replace other forms of treatment (Robinson and Breed, 2019). Forest therapy (FT, Karjalainen et al., 2010; Li, 2018; Schuh and Immich, 2019; Shin et al., 2010) encompasses the activities undertaken by individuals and groups in forests - and other natural or semi-natural environments such as landscaped gardens and urban green spaces - to achieve mental and physical health and other well-being outcomes. Several authors believe that mindful, multi-sensory, immersive contact experiences with nature are particularly likely to promote positive health outcomes, from psychological stress reduction and mood enhancement to physiological improvements with increased parasympathetic activity. FT plays an essential role

in physical recovery (Stigsdotter et al., 2017) but can also have a positive effect on blood pressure (Mao et al., 2017) and heart rate (Ikei et al., 2015). Moreover, FT can be used to reduce risk factors for cardiovascular disease (Mao et al., 2018). Depression (Shin et al., 2012), exhaustion (Sonntag-Öström et al., 2015) and sleep disorders (Morita et al., 2011) can also be positively influenced by spending time in a forest environment.

A systematic analysis of the literature on the effects of green spaces on health (Wolf et al., 2020) shows that 41% of the studies concern the reduction of harm both in terms of harmful effects (air pollution, ultraviolet radiation, exposure to pollen) and benefits (ability of trees to reduce greenhouse gases, mitigation of heat). Another 31% of the studies concern the psychological and cognitive areas, the restoration of mental health and the reduction of stress and anxiety. 28% of the studies relate to improving well-being in terms of active living, physical activity, strengthening the immune system and improving cardiovascular function. Notably, the studies listed in the above review mainly focused on the effects of healthy individuals or people with non-disabling conditions staying in the natural environment. A particular type of FT that can be found in therapeutic interventions in mountain environments is mountain therapy (MT). It has been documented that MT can enhance the effects of being in a natural environment by combining the benefits of green spaces with the benefits of mindfulness, climate therapy and occupational therapy (Huber et al., 2023; Pichler et al., 2022). In particular, MT has been shown to help cancer patients recover during and after the specific medical treatments their disease requires. Over the past ten years, the literature has examined the effects of exposure to the natural environment on the psychophysical well-being of cancer patients and survivors. According to the World Health Organization, cancer is the leading cause of death worldwide, with nearly 10 million victims in 2020, and early diagnosis and treatment remain the most important ways to reduce mortality. Experiences in nature, especially in the forest, can be a powerful intervention to create a potentially safe space for cancer survivors, as they facilitate a connection to self and strengthen the ability to address health needs (Park et al., 2022). The natural environment of the mountains is an important background for a therapeutic path that reactivates both the motor and cognitive dimensions, which is rediscovered through movement, fatigue and contact with the multisensory stimuli that the mountains offer. In addition, thanks to the silence and moments of solitude, patients rediscover their inner selves and share their feelings collectively with the other group members. Spending time in nature has a positive effect on the cancer-related quality of life and impacts immune system markers such as natural killer cells and T cells, cortisol and anxiety levels (Bikomeye et al., 2022). Another

systematic review of the literature on the effects of exposure to nature on cancer survivors (Timko Olson et al., 2023) reveals that studies were conducted mainly in the United States, Canada, Australia, New Zealand, Sweden, the Netherlands, Iran, South Korea and Japan as of 2018. Study participants were predominantly female (approximately 81%), had an average age of 50.4 years, and had breast cancer as their primary disease. The experimental interventions involved walking, resting or relaxing in the fresh air, FT/MT activities and immersive experiences in nature. At the same time, some studies tested seeing and hearing nature using virtual reality devices.

The researchers developed standardised questionnaires to collect qualitative and quantitative data on the effects of spending time in nature on anxiety, stress, depression, pain, fatigue, sleep, quality of life, and mental well-being.

In this perspective, in this paper, we present and discuss the results of a study conducted from June to October 2021 by the Annunziata Hospital in Cosenza (Italy) and the Cosenza chapter of the Italian Alpine Club (CAI), in collaboration with researchers of the University of Calabria (Italy), the University of Magna Graecia (Italy) and the Institute of Mediterranean Agricultural and Forestry Systems (ISAFOM) of the National Research Council (Italy). The study aims to evaluate the effects of MT interventions in the Sila National Park (Italy), a protected natural area recognised as part of the UNESCO heritage, on the psychophysical features of women with breast cancer. Although recognizing the limitations imposed by a small sample size, the present study aims to explore the potential role of mountain therapy in supporting health and rehabilitation. It does not seek to draw broad or definitive conclusions about the effectiveness of such interventions in a quantitative sense. Instead, it represents a pilot study, with the primary objective of developing a methodological framework to study, analyze, and measure whether - and how - mountain therapy may contribute to patient well-being. By focusing on this approach, the study provides a foundation for more extensive, future research in this emerging area of therapeutic practice.

The paper is organised as follows. In Section 2, the materials and methods used in the study are described. Section 3 presents and comments on the main empirical results. In Section 4, a discussion of the theoretical and methodological implications of the study is developed. Section 5 concludes the work with some final remarks, highlighting limitations and future developments.

2. Materials and Methods

2.1 Geological, geomorphological and climatic setting of the study area

The whole area involved in the study is in the Sila Massif (Figure 1), in the central-northern sector of the Calabria region (Italy), where a complex geodynamics environment occurs (Iovine et al., 2018).

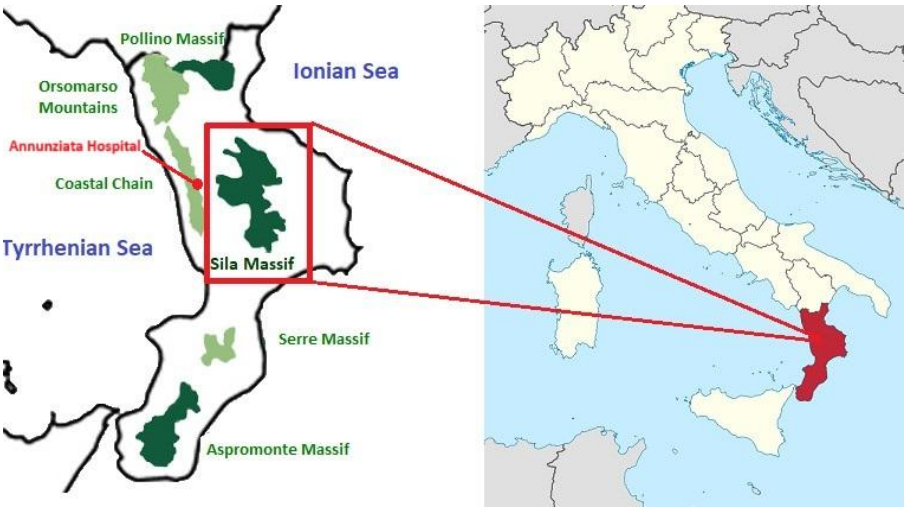

Figure 1. Study area location.

The Calabrian tectonic system is controlled by two major transversal structural formations dividing the crystalline rock from the Southern Apennines chain (Sangineto lines) and Maghrebide chain (Taormina line), containing the Calabrian-Peloritani area characterised by structures with covering layers (Guagliardi et al., 2016). From a geological point of view, the Sila Massif represents a batholith constituted by late Hercynian intrusive rocks, prevalently paragneiss, biotite schists and grey phyllitic schists, and Paleozoic medium- to high-grade metamorphites. They have heterogeneous texture and composition from gabbro to leucomonzogranite, with prevailing tonalite and granodiorite (Gaglioti et al., 2019), on which Mesozoic and Miocene to Quaternary sedimentary terranes have imposed. Pliocene sediments represent these last, generally light brown and red sands and gravels, blue-grey silty clays with silt interlayers, Pleistocene to Holocene alluvial sands and gravels and very small outcrops of Miocene carbonate rocks (Guagliardi et al., 2021, 2022). The Sila

Massif is geomorphologically defined by the Sibari Plain and the final part of the Crati River to the north, the valleys of the Crati and Savuto Rivers to the west, the Lamezia Terme Plain, the Amato River, the Sella di Marcellinara and the Catanzaro Ionian coast to the south, and the Marchesato and the Crotone and Cosenza Ionian coast to the east (Infusino et al., 2022). Its climate is typically Mediterranean but, considering the Sila Massif orography, the area is differentiated by altitude, and it also shows an Apennine Mountain climate (cold continental) with cold and snowy winters and warm summers (Buttafuoco et al., 2016). Precisely, the Tyrrhenian side is influenced by western air currents, which causes milder temperatures and higher precipitation amount on the mountains than on the Ionian side, which is affected by warm air currents coming from Africa (Buttafuoco et al., 2018). The drought period is short, and particularly heavy rains are recorded from October to March, while frost can occur from September to May. The same geological, geomorphological and climatic features characterise all four mountain hikes.

2.2 The mountain hikes

The mountain hikes were carried out in four locations: Righio-Ariamacina, Carrumanco, Cupone (Nordic Walking), Pietra dell'Altare, all of which are in the Sila Massif in the Calabria region (Italy). The selection criteria for the mountain hikes considered physical factors such as topography and accessibility, as well as travel time, trail length, and elevation changes. The goal was to ensure that the hikes would not be physically demanding for the participants. A detailed description was prepared for each trail, focusing on the geographical and environmental features, weather conditions, and its main structural characteristics (Table 1).

The Righio-Ariamacina trail: The Righio–Ariamacina trail traverses a managed black pine (*Pinus nigra laricio*) forest, approximately 30 years old, characterized by sparse undergrowth and well-defined paths. The route passes through ecologically diverse areas that support a variety of plant and animal species, including squirrels, deer, and birds such as the nuthatch (*Sitta europaea*) and chaffinch (*Fringilla coelebs*). Open meadows along the trail are rich in native herbaceous species, including legumes, fescue, chamomile, thyme, and orchids. The mix of forest and open landscapes offers varied environmental stimuli, making this route suitable for observing participant responses to different natural settings. Its accessibility and range of ecological features make it a valuable setting for evaluating nature-based therapeutic interventions.

Table 1. Description of the four trails used in the MT intervention.

	Trail			
	Righio-Ariamacina	Carrumanco	Cupone	Pietra
Date	2021/06/06	2021/09/05	2021/09/12	2021/10/17
Latitude	39.317310	39.24629	39.386108	39.24629
Longitude	16.546793	16.52937	16.547951	16.52937
Altitude (m)	1400	1646	1143	1484
Length (km)	7.0	4.6	7.0	2.4
Travel time (hh:mm)	04:00	03:00	04:00	02:00
Wildlife presence	Y	Y	Y	Y
Weather (on trail day)	Clear sky	Few clouds	Clear sky	Few clouds
Waterways/lakes	Y	Y	Y	Y
Refreshment points	N	N	Y	N
Trail surface	Natural	Natural	Dirt	Natural

The Carrumanco trail: Following the contours of the Sila Massif, this trail alternates between mixed forests and open agricultural landscapes. Tree cover includes pine, beech, and hazel, providing shaded environments and microclimatic variation. Proximity to watercourses introduces riparian vegetation, such as alders and willows, contributing to sensory diversity. Shrublands with species like juniper and heather are present in drier, more exposed areas. The diversity of land cover types along this trail supports the investigation of how different environmental contexts may influence psychological or physiological responses in participants, especially in relation to landscape variety and perceived naturalness.

The Cupone trail: Located near the Sila National Park visitor centre, the Cupone trail covers approximately 7 km with a 500 m elevation gain. It traverses both natural and reforested stands of black pine, beech, and holly, with a structurally complex undergrowth including mosses, ferns, and flowering plants. The trail provides a semi-challenging terrain suitable for studying physical engagement and effort in natural environments. It also offers panoramic views of Lake Cecita and surrounding mountains, presenting opportunities to assess the potential restorative effects of expansive natural vistas. Its mix of ecological richness and physical challenge aligns with objectives to evaluate the multifaceted impacts of mountain-based therapy.

The Pietra dell'Altare trail: This trail progresses through dense coniferous and beech forests, with varied canopy structures and undergrowth compositions. A nearby stream introduces auditory and thermal variability, while the riparian vegetation adds to the habitat complexity. Transitions from conifer to broadleaf forest allow for comparative assessments of environmental perception and therapeutic impact. The gradual elevation gain leads to viewpoints over an artificial lake, which may contribute to mood regulation and cognitive restoration. The combination of immersive forest environments and scenic views makes this trail particularly suited to exploring the psychological and physiological effects of nature immersion.

2.3 Study setting

A pilot study is a crucial preliminary step in research, helping to ensure that the full-scale main study is feasible, methodologically sound, and effective. In the case of the proposed MT study for breast cancer patients, the pilot is essential for several reasons. First, it tests the intervention's practical aspects, ensuring that the participants - who are recovering from surgery, chemotherapy, and radiotherapy - can physically handle the mountain hikes. This step is important to confirm that the intervention is safe and feasible for this vulnerable population. The pilot study also allows us to refine the research tools, ensuring that these instruments accurately measure the intended psychological outcomes like anxiety, depression, and stress. Thus, any issues with these tools can be identified and corrected before the full study. Moreover, the pilot provides early data showing if MT positively affects the participants' mental well-being, offering initial evidence of its potential efficacy. This information is vital for justifying a larger study, showing whether the intervention may improve psychological health. Finally, the pilot reveals potential challenges, such as participant dropout, and allows the research team to address these issues before scaling up. It also helps to confirm that ethical considerations - such as the consent process and participant monitoring - are adequately handled.

For the reasons mentioned above, we decided to perform an initial test on a small sample of patients, analyse the results, and report on all the experiences in the design of the main study.

2.4 Data collection and analysis

The study aims to test the effects of MT on patients with breast cancer, considering the impact of the intervention on the physical and psychological side. The inclusion criteria considered adult women diagnosed with breast cancer

undergoing surgery or post-treatment (chemotherapy and radiotherapy) at the Oncology Multispecialty Unit (OMU) of the Annunziata Hospital in Cosenza (Italy). The study was conducted by observing the well-being of patients, some of whom were members of the Italian Alpine Club. Patients with signs of stress, sleep deprivation or other problems who are judged capable of participating in a group MT activity were asked to participate. The exclusion criteria are physical and/or psychological inability to participate in the intervention. OMU staff recruited suitable participants through direct contact. In addition, advertisements were placed in the clinic to reach other potential participants. The patients were recruited during the post-therapeutic phase and joined the study by signing a consent form. A physician specialising in cancer made the final assessment of eligibility. The methodological approach was based on quantitative data analysis using validated instruments and structured interviews. The effectiveness of the intervention was evaluated using different questionnaires to assess the main sociodemographic characteristics of the patients, the Italian version of the EORTC QLQ-C30 questionnaire to determine the quality of life of participating patients (Fayers et al., 2001a; Fayers and Bottomley, 2002), the Italian version of the National Comprehensive Cancer Network's Distress Thermometer (NCCN DT) (Civilotti et al., 2020; Grassi et al., 2009) to screen patients for distress and the Italian version of the Hospital Anxiety and Depression Scale (HADS) questionnaire (Costantini et al., 1999; Snaith, 2003). The EORTC QLG Core Questionnaire is a 30-item (Physical, Role, Emotional, Cognitive, Social) and eight symptom scales/items (Fatigue, Nausea/vomiting, Pain, Dyspnoea, Insomnia, Appetite loss, Constipation and Diarrhoea) instrument meant to assess some of the different aspects that define the quality of life of cancer patients (Aaronson et al., 1993). All EORTC QLQ-C30 scale scores range from 0 to 100, with a high score on a functional scale indicating a high level of functioning and a high score on a symptom scale indicating a high level of symptomatology (Fayers et al., 2001b). The NCCN definition of distress is "a multifactorial unpleasant emotional experience of a psychological (cognitive, behavioural, emotional), social, and/or spiritual nature that may interfere with the ability to cope effectively with cancer, its physical symptoms and its treatment". Distress extends along a continuum, ranging from common normal feelings of vulnerability, sadness, and fears to problems that can become disabling, such as depression, anxiety, panic, social isolation, and existential and spiritual crises (NCCN, National Comprehensive Cancer Network, 2010). The NCCN Distress Thermometer (DT) is a one-line, 11-point Likert scale displayed on a visual graph of a thermometer, ranging from 0 (no distress) to 10 (extreme distress), which patients use to indicate their distress during the week preceding the assessment.

Patients who report a high level of distress may be given the accompanying 40-item Problem List (PL), which lists common problems associated with cancer. Providers can use this PL to identify whether the patient has practical, family, emotional, spiritual/religious or physical problems (Psychosocial Distress Practice Guidelines Panel, 1999). A high score on a problem scale indicates a high level of the specific problem or concern. The HADS questionnaire is divided into two subscales relating to symptoms associated with anxiety and depression. The total score for each subscale ranges from 0 to 21, with a cut-off point of 11 for both scales to divide the sample into those with a balanced to mild level of anxiety and depression (normal) and those with a moderate to severe level of anxiety and depression (elevated). We set T0 as the baseline time point and give patients the self-administered paper questionnaires, asking them to complete and return them at least one week before the program start. In a pre-test-post-test design, we asked patients to complete and return the same type of questionnaire after the intervention (T1). The OMU recruited 19 volunteers at the end of May 2021. The Italian Alpine Club organized four walks in collaboration with the ONCOrosa Voluntary Association between June and October 2021. After the testing period, there were 15 valid cases, as three participants withdrew from the study for personal reasons, and one withdrew due to medical conditions. Descriptive statistics were used to analyse the study sample. A two-tailed paired t-test was conducted to assess whether there was a difference between the baseline and follow-up measures. The hypothesis is that over time, patients experience improved quality of life, reduced depression/anxiety and distress, and improved mood. A p-value of less than 0.05 is considered statistically significant. The analyses were performed with the R software environment.

3. Results

As reported above, 15 volunteers completed the MT program. The sample mean age was 53.40 years (SD = ±7.10 years). All the participants were patients with breast cancer with a mean time since diagnosis of 3.24 months (SD = ±3.08 months). Pie charts reported in Figure 2 depict the main socio-demographic characteristics of the sample. We observed a prevalence of married women (73.33%) with a college degree (66.67%). As concerns physical activity, almost half of the sample (46.67%) declared not to exercise regularly. Nearly the totality of the sample showed a positive or very positive attitude towards mountain hiking. Concerning the treatment followed at the time of the baseline, all but two

received chemotherapy. For psychological support, almost half benefited from the service and only one required psycho-pharmaceutical treatment.

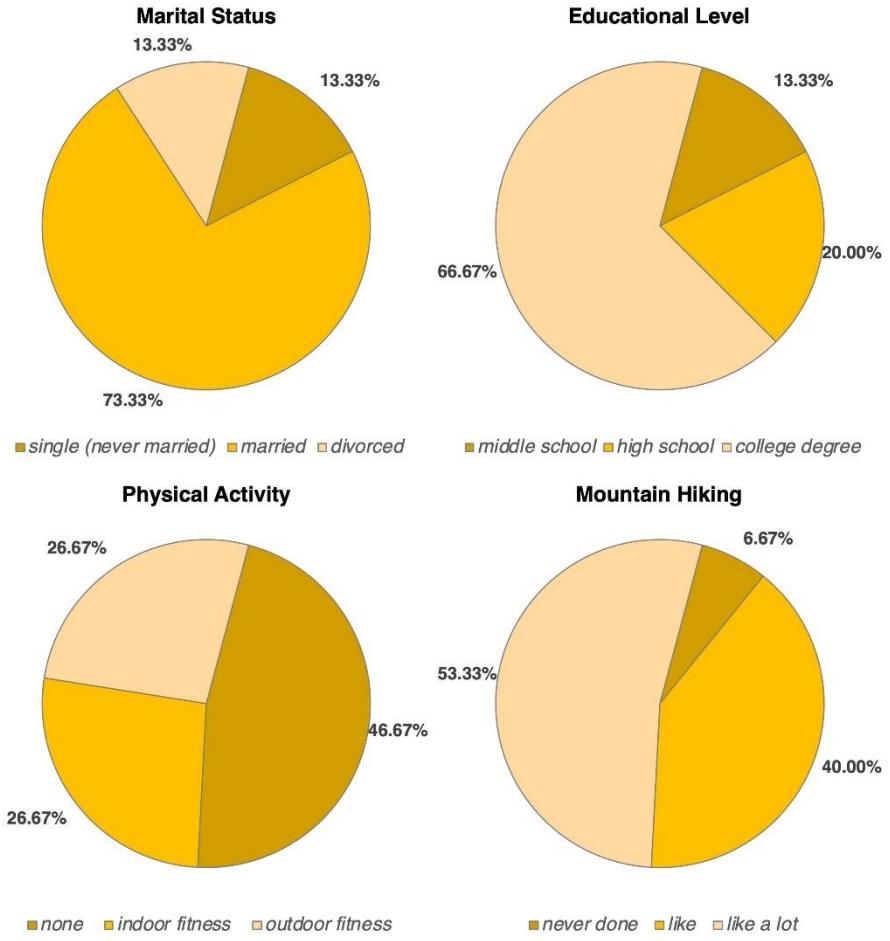

Figure 2. Descriptive statistics of the study sample.

As concerns the patients' quality of life, surveyed with the EORTC QLQ-C30 questionnaire, we can see in Table 2 that after the MT experiences the global health scale mean value as well as all the other mean values referred to the different function scales showed an improvement. At the same time, we observed a reduced range of values and variability of the measures in terms of coefficient

of variation (CV = 330 SD/|Mx| – Global health T0 = 38.18% → T1 = 21.56%, Physical function T0 = 23.37% → T1 = 15.86%, Role function T0 = 42.78% → T1 = 20.65%, Emotional function T0 = 35.21% → T1 = 11.34%, Cognitive function T0 = 32.06% → T1 = 13.60%, Social function T0 = 30.35% → T1 = 19.50%). Regarding the symptom scales, we observed a decline in the related mean values and a reduced range of values but with a higher variability (Fatigue T0 = 49.04% → T1 = 62.93%, Nausea T0 = 158.11% → T1 = 263.90%, Pain. T0 = 81.26% → T1 = 146.39%). Moreover, we calculated the QLQ-Total summary score (Giesinger et al. 2016), composed by taking the mean of all the scores of the EORTC QLQ-C30 except for Global health and financial difficulties. We observed an improvement in this latter score (higher is better functioning, fewer symptoms), with a declining variability (T0 = 18.10% → T1 = 8.71%).

Table 2. Results of the EORTC QLQ-C30 questionnaire administration (n = 15).

	T0 (baseline)			T1 (follow-up)		
	Mx	**SD**	**Range**	**Mx**	**SD**	**Range**
Global health	53.33	±19.67	25 - 100	73.33	±15.28	33 - 100
Physical funct.	76.89	±17.36	47 - 100	81.33	±12.46	60 - 100
Role funct.	73.33	±30.31	0 - 100	85.56	±17.07	50 - 100
Emotional funct.	61.11	±20.79	25 - 100	83.33	± 9.13	67 - 100
Cognitive funct.	77.78	±24.09	33 - 100	91.11	±11.97	67 - 100
Social funct.	74.44	±21.83	33 - 100	86.67	±16.33	50 - 100
Fatigue	41.48	±19.65	0 - 78	27.41	±16.66	0 - 67
Nausea	6.67	±10.18	0 - 33	2.22	± 5.67	0 - 17
Pain	25.56	±20.06	0 - 67	16.67	±23.57	0 - 67
QLQ-Total	78.02	±14.12	47 - 100	88.68	±7.72	75 - 100

Mx: mean; SD: standard deviation

As concerns the patients' psychological distress, surveyed with the DT questionnaire, we observed before and after the MT intervention a low number of problems for each aspect but the emotional ones (Table 3). We observed a

decline in the problem scale values and their ranges in the analysed sample but with a higher variability (Practical problems T0 = 30.86% → T1 = 35.41%, Family problems T0 = 39.17% → T1 = 57.48%, Emotional problems T0 = 12.65% → T1 = 17.42%, Physical problems T0 = 14.94% → T1 = 19.90%).

Table 3. Results of the DT questionnaire administration (n = 15).

	T0 (baseline)			T1 (follow-up)		
Problems	**Mx**	**SD**	**Range**	**Mx**	**SD**	**Range**
Practical	20.00	±23.90	0 - 60	9.33	±12.80	0 - 40
Family	20.00	±30.34	0 - 100	8.89	±19.79	0 - 67
Emotional	48.89	±23.96	0 - 83	22.22	±15.00	0 - 50
Spiritual	6.67	±25.82	0 - 100	0.00	± 0.00	–
Physical	28.60	±16.55	0 - 52	16.63	±12.82	0 - 40
Stress level (DT)	7.13	± 0.64	6 - 8	1.87	± 1.30	0 - 4

Mx: mean; SD: standard deviation

The overall stress level changed after the experience from 7.13 ±0.64 to 1.87 ±1.30 (Figure 3), suggesting a positive impact of the MT intervention.

As concerns the anxiety and depression states of the patients, surveyed with the HADS questionnaire, we observed initially a share of 46.67% for anxiety cases and a share of 13.33% for depression cases. After the MT intervention, both subscales showed a reduction to zero of critical cases, together with a decline in the mean value of normal cases (Table 4).

Even in the presence of a small sample of patients involved in the study, we performed a statistical test on the abovementioned key measures. A two-tailed paired t-test was performed to compare T0 and T1 scores, as only two time points were measured. Although the analysis of variance (ANOVA) results is reported for exploratory purposes, we acknowledge that a paired t-test is more appropriate for the current design. Assumptions of normality were tested using the Shapiro-Wilk test, which did not reject normality for the key variables ($p > .05$). In Table 5, we can see that the MT intervention produced a significant

change in the observed values, especially for the DT level ($p < .001$) but also for the QLQ-Total level and the anxiety level ($p < .01$).

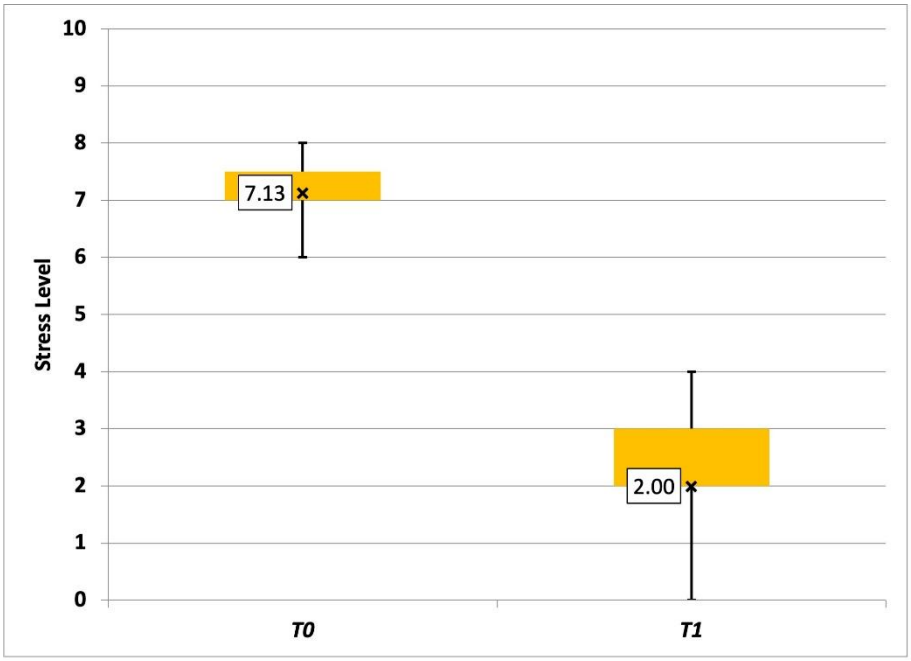

Figure 3. Changes in stress level before and after the MT intervention

Table 4. Results of the HADS questionnaire administration (n = 15).

	T0 (baseline)			T1 (follow-up)		
	%	Mx	SD	%	Mx	SD
Anxiety		9.93	±4.76		5.87	±2.39
normal (< 11)	53.33	6.00	±3.71	100	5.87	±2.39
elevated (≥ 11)	46.67	13.57	±3.51	0	0.00	±0.00
Depression		7.67	±4.75		4.40	±2.80
normal (< 11)	86.67	5.71	±2.70	100	4.40	±2.80
elevated (≥ 11)	13.33	17.50	±2.12	0	0.00	±0.00

Mx: mean; SD: standard deviation

Table 5. Comparison of baseline and follow-up measures.

	$Mx_{(T1\ T0)}$	**SD**	**SE**		**t**	**ϱ-value**
QLQ-Total	10.66	±13.41	3.46	$\alpha = 0.05$	3.08	0.008**
DT	-5.27	± 1.49	0.38	$t_c = 2.14$	13.70	0.000***
HADS-A	-4.07	± 5.18	1.34		3.04	0.009**
HADS-D	-3.27	± 5.59	1.44		2.26	0.040*
HADS-T	-7.30	±10.20	2.63		2.80	0.015*

Mx: mean; SD: standard deviation; SE: standard error; * $\varrho < .05$, ** $\varrho < .01$, *** $\varrho < .001$.

We also performed an analysis of variance (ANOVA) for repeated measures on the scores mentioned above to evaluate the significance of the MT intervention on the patients involved in the study. Table 6 reports the results of the ANOVA test.

Table 6. ANOVA test results.

	$Mx_{(\Delta T)}$	**SD**	**SE**		**F**	**ϱ-value**
QLQ-Total	10.66	±13.41	3.46	$\alpha = 0.05$	329.35	0.000***
DT	-5.27	±1.49	0.38	$F_c = 3.34$	20.83	0.000***
HADS-A	-4.07	±5.18	1.34		5.21	0.012*
HADS-D	-3.27	±5.59	1.44		4.03	0.029*
HADS-T	-7.30	±10.20	2.63		10.64	0.000***

Mx: mean; SD: standard deviation; SE: standard error; * $\varrho < .05$, ** $\varrho < .01$, *** $\varrho < .001$.

An ANOVA test for repeated QLQ-Total measures showed a significant difference between T0 and T1 ($F = 329.35$, $p < .001$). The mean QLQ-Total at T0 was 78.02, rising to a mean QLQ-Total of 88.68 at T1, for a difference of 10.66. A contrast in this difference was also significant ($t = -3.08$, $p < .01$). Concerning DT, the ANOVA test showed a significant difference between T0 and T1 ($F = 20.83$, $p < .001$). The mean DT at T0 was 7.13, dropping to a mean DT of 1.87 at T1, for a difference of -5.27. A contrast in this difference was also

significant ($t = 13.70$, $p < .001$). Concerning HADS, the ANOVA test showed a significant difference for anxiety and depression subscales and for the overall measure between T0 and T1 ($F = 5.21$, $p < .05$, $F = 4.03$, $p < .05$,$F = 10.64$, $p < .001$, respectively).

4. Discussion

4.1 Comparison with related literature

Mountain Therapy (MT), as a nature-based intervention (NBI), has increasingly attracted scholarly interest in the context of oncological care, owing to its potential to support both physical and psychological health. Several recent studies have explored the specific benefits of immersive experiences in natural environments for individuals undergoing or recovering from cancer treatment. Gawrych and Słonka (2021) emphasised that therapeutic mountain hiking can be an effective modality for psychiatric rehabilitation, with natural settings contributing to emotional resilience and mental well-being. This is particularly relevant for oncology patients, who frequently experience elevated levels of anxiety and depression as a result of their diagnosis and treatment pathways.

Our findings align with this body of literature. Notably, the reduction in anxiety and depression scores observed in our sample (see Table 6) supports the view that MT may serve as a meaningful adjunctive tool in psycho-oncology. The improvement in psychological indicators observed in our study resonates with broader evidence that NBIs can provide a sense of psychological relief and promote emotional processing in individuals facing life-threatening illness (Park et al., 2022). From a physical health perspective, our results are consistent with existing studies demonstrating the role of physical activity in nature in improving patients' overall quality of life. Huber et al. (2023), in a randomised controlled trial comparing forest therapy with mountain hiking, found significant enhancements in both physical and psychological health among participants. These improvements are significant in oncology, where treatment regimens often result in fatigue and decreased physical function. Our data likewise show significant gains in the global health score and functional subscales of the EORTC QLQ-C30 questionnaire, indicating a similar trend. In addition to these psychological and functional outcomes, the physiological benefits of MT merit consideration. Exposure to high-altitude environments has been associated with cardiovascular adaptation and improved respiratory function – especially relevant outcomes for cancer patients with compromised physical endurance (Sydykov et al., 2021; De Pieri et al., 2021). Moreover, outdoor physical activities can help

mitigate Vitamin D deficiency, a common issue in oncology due to limited sunlight exposure during treatment. As Kárász et al. (2023) noted, restoring Vitamin D levels may be beneficial for overall health and potentially impact cancer prognosis. The combination of improved mood, reduced distress, and potential physiological benefits makes MT a promising holistic intervention.

Our study also contributes to theoretical frameworks such as the biophilia hypothesis (Wilson, 1984) and the stress reduction theory (Ulrich, 1981), which posit that natural environments possess restorative capacities that positively affect human health. The results support these theories' relevance in clinical contexts, reinforcing the value of incorporating environmental and psychological dimensions into cancer care. Furthermore, our findings are consistent with integrative oncology paradigms, which advocate for including complementary therapies – such as NBIs – alongside conventional medical treatments (Cassileth & Deng, 2004). By demonstrating measurable improvements in well-being, our study reinforces the notion that psychological and emotional support interventions are crucial in managing the overall disease burden in cancer patients. These outcomes also resonate with the concept of ecosystem services, particularly cultural ecosystem services, which include mental health enhancement and social connectedness as non-material benefits provided by interaction with nature (Millennium Ecosystem Assessment, 2005).

4.2 Study limitations and future research directions

While the findings of this pilot study are promising, several methodological limitations must be acknowledged. The most critical limitation concerns the small sample size (n = 15), which inherently limits the statistical power of the results and constrains the generalisability of the findings. Although the study was explicitly designed as a pilot, future research should involve a substantially larger cohort to increase robustness and allow for subgroup analyses. A target sample of 60–80 participants, divided into smaller sub-groups for the therapeutic sessions, may compromise statistical validity and preservation of individualised, supportive group dynamics.

A second major limitation is the absence of a control group. Without a comparator arm (e.g. standard care or an alternative non-nature-based intervention), it is not possible to isolate the effect of the MT intervention from other contributing factors such as time effects, placebo responses, or natural psychological recovery. The inclusion of a randomised controlled trial (RCT) design is therefore a crucial next step. Randomisation and blinding procedures would enhance the internal validity of the research and allow for more conclusive

causal inferences. The study also relied exclusively on self-reported psychometric measures, such as the HADS, NCCN Distress Thermometer, and EORTC QLQ-C30. While all instruments employed are widely validated, integrating objective physiological indicators – for instance, cortisol levels, heart rate variability, or immune markers such as T-lymphocytes and NK cells – would provide a more comprehensive and multi-dimensional assessment of the intervention's impact. This integration aligns with the broader movement in medical research to triangulate subjective and objective data for enhanced credibility.

Another limitation is the short-term nature of the intervention and assessment. The MT programme was conducted over four months (June to October 2021), and participants were evaluated only at baseline and immediately post-intervention. The absence of medium- or long-term follow-up prevents assessing sustained benefits or potential relapses. Given the chronic and often recurrent nature of cancer-related psychological distress, longitudinal studies with follow-up points at six months and one year would yield valuable insights into the durability of the observed improvements. Finally, the lack of physiological monitoring in the present study limits its capacity to capture the full scope of MT's potential effects. As indicated in the manuscript, these dimensions will be addressed in a more comprehensive protocol currently under review by the University of Calabria Ethics Committee. Future iterations of this research will aim to integrate a multidisciplinary assessment framework combining clinical, psychological, physiological, and environmental variables.

In sum, while this pilot study offers compelling preliminary evidence for the benefits of MT in post-treatment breast cancer patients, its limitations suggest that findings should be interpreted with caution. Nonetheless, the results provide a solid foundation for designing more rigorous, large-scale studies and reinforce the relevance of nature-based therapeutic interventions in contemporary oncology. Future studies will evaluate how the inclusion of biomarkers and longitudinal assessments can be balanced with ecological and logistical sustainability. The design will consider decentralised sample collection, minimal environmental impact, and efficient group management to ensure the preservation of the natural setting.

5. Conclusions

Cancer is the leading cause of death worldwide. Early diagnosis and treatment are crucial in reducing mortality. However, the relationship with natural

environments plays a significant role in the overall well-being of individuals with severe illnesses. This has been highlighted in the scientific literature over the past decade and is supported by this pilot study conducted in an area of high naturalistic interest, such as the Sila National Park. Cultural Ecosystem Services, in particular, play a vital role in improving the quality of life by restoring capabilities, cognition, attention, mental health, and social cohesion. They also have a positive impact on clinical outcomes, as well as the immune system and cardiovascular function. Forest-care activities can be carried out in informal or unstructured ways in suitable areas and green facilities with qualified professionals. Ongoing scientific research and field experiments in Italy and worldwide seek to identify specific health intervention protocols as alternatives to traditional medical treatments. Limiting the study to breast cancer patients excludes other cancer types and stages. Including patients with different types of cancer or at different stages of treatment (e.g., pretreatment, during treatment, or long-term survivors) could reveal whether MT is beneficial across a broader spectrum of cancer experiences. Additionally, expanding the participant demographics (e.g., men and younger patients) would enhance the inclusivity and relevance of the research. The benefits of FT or MT may also be evaluated in terms of reducing personal and collective expenditures, such as the cost of treatments, medical consultations, pharmaceutical therapies, rehabilitation, and patient care facilities. Furthermore, greater care for biodiversity and improved accessibility and use of green spaces, including urban areas, help reduce the gap in caring for the most vulnerable individuals who are more exposed to an unequal environment. The study demonstrates significant relevance to the three overarching pillars of the United Nations Sustainable Development Goals (SDGs): social, economic, and environmental sustainability. First, the social implications of the study directly contribute to the aims of SDG 3, which seeks to ensure healthy lives and promote well-being for individuals of all ages. By addressing the psycho-physical rehabilitation of breast cancer patients, the research highlights the potential for nature-based interventions to improve quality of life significantly. The findings demonstrate that engaging with natural environments can reduce stress, anxiety, and depression while enhancing emotional resilience and social support among participants. This contributes to the broader objective of equitable and inclusive healthcare by promoting mental health as an integral component of overall well-being. Moreover, the study fosters community and collective support among participants, further embedding social cohesion into the therapeutic process. Such outcomes resonate with the commitment to health equity and the creation of inclusive care systems that address the holistic needs of vulnerable populations. Economically, the study

aligns with SDG 8, which promotes sustained, inclusive, and sustainable economic growth alongside decent work for all. By demonstrating the therapeutic potential of cost-effective, nature-based interventions, the research suggests avenues for reducing healthcare expenditures associated with chronic and post-treatment conditions such as cancer. The use of accessible natural settings, rather than reliance on extensive pharmaceutical or high-cost medical interventions, introduces a sustainable healthcare model that has the potential to alleviate economic burdens on health-care systems and patients. This approach is particularly beneficial in resource-constrained settings, where innovative, low-cost interventions can substantially relieve public health infrastructures. Environmentally, the study underscores the importance of natural landscapes in advancing human health, aligning with SDG 15, which advocates conserving terrestrial ecosystems and preserving biodiversity. Conducted in the Sila National Park, a protected natural area recognised for its ecological value, the study exemplifies how responsibly managed natural environments serve dual roles as therapeutic spaces and conservation priorities. The research reinforces the concept of ecosystem services, particularly cultural and health-related benefits, by utilising the park's landscapes to foster physical and mental health improvements. Furthermore, it highlights the interconnectedness of environmental preservation and human well-being, suggesting that maintaining and expanding access to green spaces can be essential to public health strategies.

Future research should focus on several critical areas for enhancement to build upon the findings of this pilot study. As reported above, a larger and more diverse sample size will be employed to increase the robustness and generalisability of the results, allowing for the exploration of MT's effects across different patient groups and types of cancer. Moreover, introducing a randomised controlled trial design would address the current lack of a control group, ensuring that the effects observed are attributable specifically to MT. The promising results of the pilot study will be the basis of a most extended survey on the phenomenon. The next research phase could also benefit from the multidisciplinary approach used in our experimentation, involving experts from various fields to deepen the analysis of MT's physical and psychological effects. Finally, the possibility of expanding the study to different natural environments would help assess whether the observed benefits are specific to mountainous settings or extend to other types of nature-based interventions. These refinements will enhance the evidence base for the application of MT.

References

Aaronson, N.K., Ahmedzai, S., Bergman, B., Bullinger, M., Cull, A., Duez, N.J., et al. (1993). The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J. Natl. Cancer Inst.*, *85*, 365-376. DOI: doi.org/10.1093/jnci/85.5.365

Anundi, H., Dolling, A., Pálsdóttir, A.M. (2023). Forest Therapy for Women with Gynaecological Cancer - A Feasibility Study to Find New Alternatives in Cancer Rehabilitation. *Forests*, *14*, 333. https://doi.org/10.3390/f14020333

Bikomeye, J.C., Balza, J.S., Kwarteng, J.L., Beyer, A.M., Beyer, K.M.M. (2022). The Impact of Greenspace or Nature-Based Interventions on Cardiovascular Health or Cancer-Related Outcomes: A Systematic Review of Experimental Studies. *PLoS ONE*, *17*, e0276517, 246. https://doi.org/10.1371/journal.pone.0276517

Buttafuoco, G., Caloiero, T., Guagliardi, I., Ricca, N. (2016). Drought assessment using the reconnaissance drought index (RDI) in a southern Italy region. *6th IMEKO TC19 Symposium on Environmental Instrumentation and Measurements 2016*, 124123, 52-55.

Buttafuoco, G., Caloiero, T., Ricca, N., Guagliardi, I. (2018). Assessment of drought and its uncertainty in a southern Italy area (Calabria region). *Meas.: J. Int. Meas., 113*, 205-210. https://doi.org/10.1016/j.measurement.2017.08.007

Cassileth, B.R., Deng, G. (2004). Complementary and alternative therapies for cancer. *Oncologist*, *9*, 80-89. https://doi.org/10.1634/theoncologist.9-1-80

Cerulli, C., Minganti, C., De Santis, C., Tranchita, E., Quaranta, F., Parisi, A. (2014). Therapeutic horseback riding in breast cancer survivors: a pilot study. *J. Altern. Complement. Med., 20*, 623-629. DOI: 10.1089/acm.2014.0061

Civilotti, C., Acquadro Maran, D., Santagata, F., Varetto, A., Stanizzo, M.R. (2020). The use of the Distress Thermometer and the Hospital Anxiety and Depression Scale for screening of anxiety and depression in Italian women newly diagnosed with breast cancer. *Support. Care Cancer, 28*, 4997-5004. DOI: 10.1007/s00520-020-05343-x

Costantini, M., Musso, M., Viterbori, P., Bonci, F., Del Mastro, L., Garrone, O., Venturini, M., Morasso, G. (1999). Detecting psychological distress in cancer patients: validity of the Italian version of the Hospital Anxiety and Depression Scale. *Support. Care Cancer, 7*, 121-127. DOI: 10.1007/s005200050241

De Pieri, C., Arigliani, M., Francescato, M., Droli, M., Vidoni, M., Liguoro, I., Ferrari, M., Cogo, P., Canciani, M. (2021). The effects of climate therapy on cardiorespiratory fitness and exercise-induced bronchoconstriction in children with asthma. *Atmosphere, 12, 1486*. https://doi.org/10.3390/atmos12111486

Farì, G., Fiore, P., Ricci, V., Zonno, A., Joksimovic, M., Petruzzella, D., Gioia, G., Giarrizzo, D., Mastrorillo, S., Coretti, B., et al. (2023). The Impact of the COVID-19 Pandemic on Outdoor Physical Activities for People with Disabilities, including

the Risks for Psychophysical Well-Being. *Sustainability, 15*, 1436. https://doi.org/10.3390/su15021436

Fayers, P., Aaronson, N.K., Bjordal, K., Groenvold, M., Curran, D., Bottomley, A., et al. (2001a). EORTC QLQ-C30 Scoring Manual (3rd edition).

Fayers, P.M., Aaronson, N.K., Groenvold, M., Bottomley, A. (2001b). EORTC QLQ-C30 scoring manual; EORTC: Brussels, Belgium.

Fayers, P., Bottomley, A. (2002). Quality of life research within the EORTC – the EORTC QLQ-C30. *Eur. J. Cancer, 38*, 125-133. DOI: 10.1016/s0959-8049(01)00448-8

Frumkin, H., Haines, A. (2019). Global Environmental Change and Noncommunicable Disease Risks. *Annu. Rev. Public Health, 40*, 261-282. DOI: 10.1146/annurev-publhealth-040218-043706

Gaglioti, S., Infusino, E., Caloiero, T., Callegari, G., Guagliardi, I. (2019). Geochemical Characterization of Spring Waters in the Crati River Basin, Calabria (Southern Italy). *Geofluids*, 3850148. https://doi.org/10.1155/2019/3850148

Gawrych, M., Słonka, R. (2021). Therapeutic mountain hiking in psychiatric rehabilitation. *Psychiatr. Psychol. Kl., 21*, 65-70. DOI: 10.15557/PiPK.2021.0007

Giesinger, J., Kieffer, J., Fayers, P., Groenvold, M., Petersen, M., Scott, N., Sprangers, M., Velikova, G., Aaronson, N. (2016). Replication and validation of higher order models demonstrated that a summary score for the EORTC QLQ-C30 is robust. *J. Clin. Epidemiol., 69*, 79-88.

Gladwell, V.F., Brown, D.K., Wood, C., Sandercock, G.R., Barton, J.L. (2013). The Great Outdoors: How a Green Exercise Environment Can Benefit All. *Extreme Physiol. Med., 2*, 3.

Gola, M., Botta, M., D'Aniello, A.L., Capolongo, S. (2021). Influence of Nature at the Time of the Pandemic: An Experience-Based Survey at the Time of SARS-CoV-2 to Demonstrate How Even a Short Break in Nature Can Reduce Stress for Healthcare Staff. *HERD, 14(2)*, 49-65.

Grassi, L., Sabato, S., Rossi, E., Marmai, L., Biancosino, B. (2009). Affective syndromes and their screening in cancer patients with early and stable disease: Italian ICD-10 data and performance of the Distress Thermometer from the Southern European Psycho-Oncology Study (SEPOS). *J. Affect. Disord., 114*, 193-199. DOI: 10.1016/j.jad.2008.07.016

Gross, R., Sasson, Y., Zarhy, M., Zohar, J. (1998). Healing environment in psychiatric hospital design. *Gen. Hosp. Psychiatry, 20*, 108-114. DOI: 10.1016/s0163-8343(98)00007-3

Guagliardi, I. (2022). Editorial for the Special Issue "Potentially Toxic Elements Pollution in Urban and Suburban Environments". *Toxics, 10*, 775. https://doi.org/10.3390/toxics10120775

Guagliardi, I., Astel, A.M., Cicchella, D. (2022). Exploring Soil Pollution Patterns Using Self-Organizing Maps. *Toxics, 10*, 416. https://doi.org/10.3390/toxics10080416

Guagliardi, I., Caloiero, T., Infusino, E., Callegari, G., Ricca, N. (2021). Environmental Estimation of Radiation Equivalent Dose Rates in Soils and Waters of Northern Calabria (Italy). *Geofluids*, 6617283. https://doi.org/10.1155/2021/6617283

Guagliardi, I., Rovella, N., Apollaro, C. et al. (2016). Modelling seasonal variations of natural radioactivity in soils: A case study in southern Italy. *J. Earth Syst. Sci.,125*, 1569-1578. DOI 10.1007/s12040-016-0758-y

Huber, D., Freidl, J., Pichler, C., Bischof, M., Kiem, M., Weisböck-Erdheim, R., Squarra, G., De Nigris, V., Resnyak, S., Neberich, M., et al. (2023). Long-Term Effects of Mountain Hiking vs. Forest Therapy on Physical and Mental Health of Couples: A Randomized Controlled Trial. *Int. J. Environ. Res. Public Health, 20*, 1469. DOI: 10.3390/ijerph20021469

Ikei, H., Song, C., Miyazaki, Y. (2015). Physiological Effect of Olfactory Stimulation by Hinoki Cypress (Chamaecyparis obtusa) Leaf Oil. *J. Physiol. Anthropol., 34*, 44. https://doi.org/10.1186/s40101-015-0082-2

Infusino, E., Guagliardi, I., Gaglioti, S., Caloiero, T. (2022). Vulnerability to Nitrate Occurrence in the Spring Waters of the Sila Massif (Calabria, Southern Italy). *Toxics, 10*, 137. https://doi.org/10.3390/toxics10030137

Iovine, G., Guagliardi, I., Bruno, C. et al. (2018). Soil-gas radon anomalies in three study areas of Central-Northern Calabria (Southern Italy). *Nat. Hazards 91*(1), 193-219. https://doi.org/10.1007/s11069-017-2839-x

Jukarainen, S., Kiiskinen, T., Kuitunen, S., Havulinna, A.S., Karjalainen, J., Cordioli, M., Rämö, J.T., Mars, N., FinnGen, Samocha, K.E., Ollila, H.M., Pirinen, M., Ganna, A. (2022). Genetic risk factors have a substantial impact on healthy life years. *Nat. Med., 28*, 1893-1901. DOI: 10.1038/s41591-022-01957-2

Kárász, N., Juhász, O., Imrei, M., Garami, M. (2023). Long-Term Prognosis in Relation to Vitamin D Status in Pediatric Solid Tumor Patients. *Nutrients,* 15, 4571. DOI: 10.3390/nu15214571

Karjalainen, E., Sarjala, T., Raitio, H. (2010). Promoting Human Health through Forests: Overview and Major Challenges. *Environ. Health Prev. Med.*, 15, 1. DOI: 10.1007/s12199-008-0069-2

Kondo, M.C., Fluehr, J.M., McKeon, T., Branas, C.C. (2018). Urban Green Space and Its Impact on Human Health. *Int. J. Environ. Res. Public Health, 15*, 445. https://doi.org/10.3390/ijerph15030445

Li, Q. Shinrin-Yoku. (2018). The Art and Science of Forest Bathing; Penguin Books: London, UK.

Mao, G.X., Cao, Y., Wang, B., Wang, S., Chen, Z., Wang, J., Xing, W., Ren, X., Lv, X., Dong, J., et al. (2017). The Salutary Influence of Forest Bathing on Elderly Patients with Chronic Heart Failure. *Int. J. Environ. Res. Public Health*, 14, 368. DOI: 10.3390/ijerph14040368

Mao, G.X., Cao, Y.B., Yang, Y., Chen, Z.M., Dong, J.H., Chen, S.S., Wu, Q., Lyu, X.L., Jia, B.B., Yan, J., et al. (2018). Additive Benefits of Twice Forest Bathing Trips in

Elderly Patients with Chronic Heart Failure. *Biomed. Environ. Sci., 31*, 159-162. DOI: 10.3967/bes2018.020

Marselle, M.R., Bowler, D.E., Watzema, J., Eichenberg, D., Kirsten, T., Bonn, A. (2020). Urban street tree biodiversity and antidepressant prescriptions. *Sci. Rep., 10*, 22445. https://doi.org/10.1038/s41598-020-79924-5

Martin, L., White, M.P., Hunt, A., Richardson, M., Pahl, S., Burt, J. (2020). Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. *J. Environ. Psychol., 68*, 101389. https://doi.org/10.1016/j.jenvp.2020.101389

Millennium Ecosystem Assessment. Ecosystems and Human Well-being: Synthesis; Island Press: Washington, DC, (2005). Available online: http://www.https://www.millenniumassessment.org/documents/document.356.aspx.pdf

Mitchell, R., Popham, F. (2008). Effect of exposure to natural environment on health inequalities: an observational population study. *Lancet, 372*, 1655-1660. DOI: 10.1016/S0140-6736(08)61689-X

Morita, E., Imai, M., Okawa, M., Miyaura, T., Miyazaki, S. (2011). A before and after Comparison of the Effects of Forest Walking on the Sleep of a Community-Based Sample of People with Sleep Complaints. *Biopsychosoc. Med., 5*, 13. DOI: 10.1186/1751-0759-5-13

National Comprehensive Cancer Network (NCCN) NCCN Clinical Practice Guidelines in Oncology: Distress Management. Fort Washington, PA: NCCN; 2010. Version 1.2011. [Available online at: http://www.nccn.org/professionals/physician_gls/pdf/distress.pdf (free registration required); cited August 30, 2011].

Noszczyk, T., Gorzelany, J., Kukulska-Kozieł, A., Hernik, J. (2022). The impact of the COVID-19 pandemic on the importance of urban green spaces to the public. *Land Use Policy, 113*, 105925. https://doi.org/10.1016/j.landusepol.2021.105925

Park, E.Y., An, M.Y., Sung, J.H. (2022). A present from the forest: Focus group interviews on cancer survivors' forest experiences. *Asia Pac. J. Oncol. Nurs., 9*, 100105. DOI: 10.1016/j.apjon.2022.100105

Pichler, C., Freidl, J., Bischof, M., Kiem, M., Weisböck-Erdheim, R., Huber, D., Squarra, G., Murschetz, P.C., Hartl, A. (2022). Mountain Hiking vs. Forest Therapy: A Study Protocol of Novel Types of Nature-Based Intervention. *Int. J. Environ. Res. Public Health, 19*, 3888. DOI: 10.3390/ijerph19073888

Psychosocial Distress Practice Guidelines Panel. (1999). NCCN Practice guidelines for the management of psychosocial distress. *Oncology, 13*, 113-47.

Ricca, N., Guagliardi, I. (2015). Multi-temporal dynamics of land use patterns in a site of community importance in Southern Italy. *Appl. Ecol. Environ. Res., 13*, 677-691. DOI: 10.15666/aeer/1303_677691

Ricca, N., Guagliardi, I. (2023). Evidences of soil consumption dynamics over space and time by data analysis in a Southern Italy urban sprawling area. *Land, 12*, 1056. https://doi.org/10.3390/land12051056

Robinson J, Breed M. (2019). Green Prescriptions and Their Co-Benefits: Integrative Strategies for Public and Environmental Health. *Challenges, 10*, 9. https://doi.org/10.3390/challe10010009

Schuh, A., Immich, G. (2019). Waldtherapie – Das Potential des Waldes für Ihre Gesundheit; Springer: Berlin, Germany.

Shin, W.S., Shin, C.S., Yeoun, P.S. (2012). The Influence of Forest Therapy Camp on Depression in Alcoholics. *Environ. Health Prev. Med., 17*, 73-76. DOI: 10.1007/s12199-011-0215-0

Shin, W.S., Yeoun, P.S., Yoo, R.W., Shin, C.S. (2010). Forest Experience and Psychological Health Benefits: The State of the Art and Future Prospect in Korea. *Environ. Health Prev. Med., 15*, 38-47. DOI: 10.1007/s12199-009-0114-9

Snaith, R.P. (2003). The Hospital Anxiety And Depression Scale. Health Qual. *Life Outcomes, 1*, 29. DOI: 10.1186/1477-7525-1-29

Song, C., Ikei, H., Miyazaki, Y. (2016). Physiological Effects of Nature Therapy: A Review of the Research in Japan. *Int. J. Environ. Res. Public Health, 13*, 781. DOI: 10.3390/ijerph13080781

Sonntag-Öström, E., Nordin, M., Dolling, A., Lundell, Y., Nilsson, L., Slunga Järvholm, L. (2015). Can Rehabilitation in Boreal Forests Help Recovery from Exhaustion Disorder? The Randomised Clinical Trial ForRest. *Scand. J. For. Res., 30*, 732-748. https://doi.org/10.1080/02827581.2015.1046482

Stigsdotter, U.K., Corazon, S.S., Sidenius, U., Refshauge, A.D., Grahn, P. (2017). Forest Design for Mental Health Promotion - Using Perceived Sensory Dimensions to Elicit Restorative Responses. *Landsc. Urban Plan., 160*, 1-15. https://doi.org/10.1016/j.landurbplan.2016.11.012

Stigsdotter, U. K., Palsdottir, A. M., Burls, A., Chermaz, A., Ferrini, F., Grahn, P. (2011). Nature-based therapeutic interventions. In K. Nilsson, M. Sangster, C. Gallis, T. Hartig, S. de Vries, K. Seeland, J. Schipperijn (Eds.), *Forests, Trees and Human Health* (pp. 309-342). Dordrecht: Springer Netherlands.

Sydykov, A., Mamazhakypov, A., Maripov, A., Kosanovic, D., Weißmann, N., Ghofrani, H., Sarybaev, A., Schermuly, R. (2021). Pulmonary hypertension in acute and chronic high altitude maladaptation disorders. *Int. J. Environ. Res. Public Health, 18*, 1692. DOI: 10.3390/ijerph18041692

Timko Olson, E.R., Olson, A.A., Driscoll, M., Vermeesch, A.L. (2023). Nature-Based Interventions and Exposure among Cancer Survivors: A Scoping Review. *Int. J. Environ. Res. Public Health, 20*, 2376. DOI: 10.3390/ijerph20032376

Ulrich, R.S. (1981). Natural versus urban scenes: Some psychophysiological effects. *Environ. Behav., 13*, 523-556. DOI: 10.1177/0013916581135001

Ulrich, R.S. (1984). View through a window may influence recovery from surgery. *Science, 224*, 420-421. DOI: 10.1126/science.6143402

Ulrich, R.S., Simons, R.F., Losito, B.D., Fiorito, E., Miles, M.A., Zelson, M. (1991). Stress Recovery During Exposure to Natural and Urban Environments. *J. Environ. Psychol., 11*, 201-230. https://doi.org/10.1016/S0272-4944(05)80184-7

van den Berg, M., van Poppel, M., Smith, G., Triguero-Mas, M., Andrusaityte, S., van Kamp, I., van Mechelen, W., Gidlow, C., Gražulevi˘ciene, R., Nieuwenhuijsen, M.J., Kruize, H., Maas, J. (2017). Does Time Spent on Visits to Green Space Mediate the Associations between the Level of Residential Greenness and Mental Health? *Urban For. Urban Green., 25*, 94-102. DOI: 10.1016/j.healthplace.2016.01.003

Vivona, S., Romeo, N., Sdao, P., Veltri, A. (2021). The search for well-being in natural environments: a case study in the Covid-19 era. *Forest@, 18*, 41-48. https://doi.org/10.3832/efor3878-018

Wehby, G.L., Domingue, B.W., Wolinsky, F.D., (2018). Genetic Risks for Chronic Conditions: Implications for Long-term Wellbeing. *J. Gerontol. A Biol. Sci. Med. Sci., 3,* 477-483. DOI: 10.1093/gerona/glx154

Wilson, E.O. (1984). Biophilia; Harvard University Press: Cambridge, MS.

Wolf, K.L., Lam, S.T., McKeen, J.K., Richardson, G.R.A., van den Bosch, M., Bardekjian, A.C. (2020). Urban Trees and Human Health: A Scoping Review. *Int. J. Environ. Res. Public Health, 17*, 4371. DOI: 10.3390/ijerph17124371

Zemlin, C., Altmayer, L., Lang, M., Schleicher, J., Stuhlert, C., Wörmann, C., Scherer, L., Thul, I., Spenner, L., Simon, J., Wind, A., Kaiser, E., Weber, R., Goedicke-Fritz, S., Wagenpfeil, G., Zemlin, M., Solomayer, E., Reichrath, J., Müller, C. (2024). Course of vitamin D levels in newly diagnosed non-metastatic breast cancer patients over one year with quarterly controls and substitution. *Nutrients, 16*, 854. https://doi.org/10.3390/nu15061450

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Competing Interests

The study was conducted following the Declaration of Helsinki. Ethical approval was obtained from the Annunziata Hospital Internal Committee, according to the Italian Law (Ministerial Circular n. 6/2002, published on G.U. n. 214, 12 September 2002), which specifies that observational studies need to be notified to the local ethics committee, which will then proceed either to a formal approval or to a simple acknowledgement of the ongoing study.

A letter of permission authorising the survey has been obtained from Annunziata Hospital. Informed consent was obtained from all participants for this study.

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