


## The Outdoor Against Cancer Connects Us (OACCU) Project: A European initiative promoting healthy lifestyle among young cancer survivors

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### ABSTRACT

**Objective:** The main project objectives will be to characterize the lifestyle behaviours of young cancer survivors (YCS) and to examine the associations of physical activity, balanced nutrition and sustainability and nature behaviours with mental well-being and quality of life. **Methods:** The present cross-sectional project will include YCS between 15 to 39 years from Germany, Greece, Italy, Portugal, Spain, and Sweden. Sociodemographic aspects and disease history will be collected. The International Physical Activity Questionnaire and The International Fitness Scale will be applied to assess physical activity and sedentary levels; and self-reported fitness, respectively. The questionnaire on adherence to the Mediterranean diet will evaluate healthy diet habits, and a short set of questions will cover the environmental quality of residence of the participants, as well as their outdoor habits. In addition, the EQ-5D-5L instrument will measure health-related quality of life, and the Hospital Anxiety and Depression Scale will collect depression and anxiety symptoms. **Results:** It is hypothesised that positive lifestyle behaviours, such as increasing physical activity and following balanced nutrition, may correlate with improved mental well-being and quality of life in YCS. These findings have the potential to deepen our understanding of the intricate interplay between cancer, lifestyle and mental health.

**Keywords:** Physical activity, Healthy diet, Environmental pollution, Mental health.

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## INTRODUCTION

Due to increased risk factors and improved early diagnostic methods, the worldwide incidence of cancer is rising (World Health Organization, 2024a). It is therefore expected that there will be more than 35 million new cases of cancer in the entire population by 2050, an increase of 77% from the 20 million cases in 2022 (World Health Organization, 2024a). With the current improvements in cancer treatment, the number of young cancer patients who can be defined as survivors is increasing. In 2022, there were 1,321,779 new cases of this disease reported globally among individuals aged 15-39, with 151,086 cases documented in Europe alone (World Health Organization, 2024b). This group of YCS may face several challenges specifically linked to their young age (e.g. related to school/university, vocational education and professional life, sexuality/fertility and family life, insurances, and loans) that impact their quality of life (Fox et al., 2023; Soanes & White, 2018). Therefore, from the perspective of public administration, such as the European Commission, interest and effort have been focused on supporting the study and description of the fundamental characteristics of this population group, with the intention of improving and customizing strategies to promote the enhancement of quality of life and integration into society (European Commission, 2022, 2023).

Talking about cancer survivors could generate some confusion regarding the concept, as the term “*cancer survivors*” does not have a unique definition (Marzorati et al., 2017). Here we will refer to the most widely used definition, provided by the National Cancer Institute, which sees cancer survivorship as a process that begins from the time of diagnosis and continues until the end of life (Denlinger et al., 2014). However, there are considerable differences between people living with cancer who are undergoing cancer treatment and those who have completed all treatments. Then, we could even make an additional differentiation between those being under treatment and those free of treatment.

In order to properly develop strategies to promote the enhancement of quality of life, it is necessary to describe the fundamental characteristics of YCS and then, act on potential risk factors among YCS to reduce long-term side effects and improve longevity as well as long-term quality of life (Marzorati et al., 2017). Among the modifiable risk factors, lifestyle components are those on which we can act to modify the probability of having cancer, for instance, healthy diet, smoking cessation, reducing alcohol intake, increase physical activity levels and sleep quality among others (Bull et al., 2020). Often, lifestyle changes are also targeted during and after cancer therapy in order to improve prognosis and recovery. However, it is not always easy to change lifestyles and modify population behaviours. Thus, it is of vital importance to address these behaviours that have the greatest impact on the health of cancer survivors to maximize the reduction of cancer burden and long-term consequences (Palma et al., 2022). Targeting behavioural change, which is intended “*as the extent to which a person’s behaviour coincides with medical, professional or health advice*”, may also be useful for higher adherence, since modifying survivors’ lifestyle could be challenging (Horwitz & Horwitz, 1993).

In relation to physical activity for cancer survivors, the American College of Sports Medicine and the World Health Organisation (Bull et al., 2020) suggest three sessions per week of aerobic training for 30 minutes (at moderate intensity) and two sessions per week of resistance training (at moderate intensity) but adjusted to the needs of the individual cancer survivor. Complying with these guidelines and increasing physical activity levels can prolong longevity (Bull et al., 2020). However, the literature agrees on the need to develop and implement guidelines specifically for YCS (Marzorati et al., 2017), for which becomes very relevant to better know their particular profile and characteristics. Additionally, implementing outdoor physical activity interventions may lead to extra physiological and psychological benefits and thus should be promoted for both YCS and cancer patients in general (Blaschke, 2017), especially when this outdoor physical activity is

developed in green-blue environments because the contact with nature has shown to be an added value for overall health (Rojas-Rueda et al., 2019).

On the other hand, embracing a healthy nutrition pattern should also be considered as being beneficial for longevity in YCS. The Mediterranean diet (García-Conesa et al., 2020; Martínez-González et al., 2012) is considered a valuable nutritional approach with multiple benefits allowing individuals to get older healthier. This type of diet is also considered sustainable since it builds on fresh and local seasonal food (García-Conesa et al., 2020). Promoting adherence to the Mediterranean diet in YCS can help in sustaining balanced healthy nutrition and well-being related indicators.

An emerging modifiable risk factor that has been identified today is the lack of sustainability and connection to nature, which should be integrated into our lifestyle. Particularly, concerns raised by climate change and environmental pollution not only have direct consequences on people's lives but also compromise their mental health (King et al., 2022; Rojas-Rueda et al., 2019). Daily actions, keeping in mind nature contact and its sustainability, can reduce this burden and ameliorate our emotional condition especially if impacted by severe disease.

Finally, mental and physical well-being are hence strictly related. YCS may suffer mental and psychological distress due to cancer diagnosis, pharmacological treatment (National Comprehensive Cancer Network Foundation, 2020) and associated life's changes. Physiological and psychological cancer consequences should thus be investigated together to better design future approaches to promote healthy lifestyle behaviour. Particularly, to better understand how those modifiable risk factors could interact with mental well-being and quality of life in YCS would be of great interest.

Therefore, the main objectives of the current project will be to characterize the lifestyle behaviours of YCS and to examine the associations of physical activity, outdoor sports, balanced nutrition and sustainability and nature behaviours with mental well-being and quality of life in YCS. As a secondary objective, the project aims to develop and offer a comprehensive suite of digital tools for YCS to facilitate easier access to a healthy lifestyle. Additionally, it seeks to establish a network among YCS by leveraging this project and promoting the adoption of healthier lifestyles.

## METHODS

### ***Participants and selection criteria***

The present cross-sectional project includes study research conducted in the partner countries conforming to the Outdoor Against Cancer Connects Us (OACCU) consortium (<https://oac-connect.eu/>), i.e. Germany, Greece, Italy, Portugal, Spain, and Sweden. Inclusion criteria, which delimit the term YCS to those being between 15 and 39 years old; having been diagnosed with cancer at any time in their life; not currently under chemotherapy; not suffering cancer relapse or a secondary tumour; not under palliative treatment/care; and be able to perform everyday activities freely and independently. Conversely, individuals presenting the following characteristics will be excluded: inability to perform everyday activities; recent cancer diagnosis, including cancer relapse and secondary tumours; undergoing primary treatment with curative intent; or diagnosed with basal cell skin carcinoma. The individuals who meet these eligibility criteria will be asked to complete the multidisciplinary questionnaire.

### **Data collection**

In order to gain insight into the attitudes of YCS towards healthy lifestyles and into their need for support, the consortium considered it essential to establish 4 fundamental pillars Physical Activity and Outdoor Sports (Pillar 1), Balanced Nutrition (Pillar 2), Sustainability and Nature (Pillar 3), and Physical and Mental Well-being (Pillar 4). We will require YCS from the OACCUs consortium countries to complete a multidisciplinary, digital, and online questionnaire, that is called the "OACCUs e-Questionnaire" (<https://oac-connect.eu/survey/en>). The OACCUs e-Questionnaire has been developed in English and then translated into each country's language, and it will be available online through the OACCUs homepage in seven languages. Various methods will be used to engage the target group and collect input anonymously, including dissemination of the OACCUs e-Questionnaire via the project website and QR codes, direct distribution by project staff at OACCUs events, externally organised events, distribution to country-specific stakeholder groups such as patient associations and hospital data collections, as well as recruitment through population-based cancer registries.

### **Outcomes measures**

The OACCUs e-Questionnaire included patient history plus validated questionnaires on the main 4 pillars of a healthy lifestyle on which the project is based. Therefore, the final OACCUs e-Questionnaire has 5 parts; the first includes questions on anthropometric and sociodemographic information and disease characteristics. The resting 4 sections are based on behavioural and lifestyle factors related to the 4 pillars: Physical Activity and Outdoor Sports, Balanced Nutrition, Sustainability and Nature, and Physical and Mental Well-being. Briefly, the 5 sections are partitioned as follows:

#### *Section 1: OACCUs-specific section*

This section comprises information on sociodemographic aspects, socioeconomic status, comorbidities, barriers to physical activity, sport and nutrition is asked for as well as self-reported anthropometric information such as height and weight. Moreover, cancer-related information such as date of diagnosis, diagnosis methods and hospital, types of cancer, treatment history, treatment-related effects, and follow-up care are also collected.

#### *Section 2: Pillar 1. Physical activity, Exercise and Sport/Physical Activity and Sedentary levels*

The International Physical Activity Questionnaire (Craig et al., 2003) is chosen to assess the physical activity and sedentary levels of YCS. Even if not specifically suggested for use with cancer survivors (Meh et al., 2021), this validated questionnaire has been selected since it is easy to fill in and is fully accessible. This questionnaire collects vigorous physical activity, moderate physical activity, walking activity and sitting time, ascertaining the number of days and hours per day to estimate the total physical activity in a typical week.

The International Fitness Scale (Ortega et al., 2011, 2013) is applied to assess physical fitness in a self-reported measure. It collects data on general physical fitness, strength, flexibility, agility and speed, and aerobic capacity. It is a validated questionnaire, translated into 9 languages, which has been found useful in epidemiological studies aimed at estimating fitness levels in all age groups, including adolescents and young adults (Ortega et al., 2011, 2013).

#### *Section 3. Pillar 2. Healthy Nutrition Behaviours*

The questionnaire about adherence to the Mediterranean diet is included (Martínez-González et al., 2012). This 14-item screener consists of twelve questions on food consumption frequency and two questions on food intake habits considered characteristic of the Mediterranean diet. Five of these questions are critical to an assessment of adherence to the traditional Mediterranean diet in the present population. Each question

is scored 0 or 1. The final questionnaire score ranges from 0 to 14. This questionnaire is selected due to the relevance of the Mediterranean diet for the promotion of a healthy lifestyle (García-Conesa et al., 2020). The questionnaire is also selected considering that its validity has been tested across European countries, including the majority of the countries participating in the OACCUs project (García-Conesa et al., 2020).

#### *Section 4: Pillar 3. Healthy Environment / Nature*

A short set of questions covers environmental quality and features of places, where participants use to do physical activity, sport or leisure time activities (air quality, pollution, noise, temperature, indoor/outdoor, etc). This section is designed considering the main aim of OACCUs, i.e. promoting an active outdoor lifestyle and considering the benefits that being connected with Nature may have (King et al., 2022; Rojas-Rueda et al., 2019).

#### *Section 5: Pillar 4. Psychological well-being/ Mental Health/ Quality of life*

This section consists of two sections:

- i. *Health-related quality of life* is measured using the EQ-5D-5L instrument (Herdman et al., 2011). EQ-5D-5L consists of two parts: the first part evaluates the prevalence of problems in five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) obtaining an EQ-index (0-1), and the second part, the EQ visual analogue scale records self-reported health status (0-100). This questionnaire is widely used in studies of cancer populations; it provides a high discriminatory power and validity (Chai et al., 2023).
- ii. *Depression and anxiety*. Information on depression and anxiety is collected using the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), which measures anxiety and depression in people with physical illnesses and has been used to assess mood in cancer patients both in clinical and research practice (Carey et al., 2012; Walker et al., 2007). This questionnaire has seven items for each anxiety and depression, with total scores ranging from 0 to 21. Items are rated on a 4-point severity scale, and each question is scored between 0 (no impairment) and 3 (severe impairment).

#### **Sample size**

It is expected to obtain a minimum of 30 and up to 100 completed questionnaires from each of the six countries which make a total of expected responses ranging from 180 to 600. This estimation will provide a comprehensive understanding of YCS that accurately reflects the general population and their characteristics. It will enable statistical analysis of cohorts, including potential sensitivity analyses based on factors such as cancer type, treatment pattern (e.g. treated with agents that increase the risk of specific toxicities), gender, time since diagnosis (> 5 year overall survival), demographics, or any other unique group relevant to the research interest.

#### **Digital toolbox for YCS**

The OACCUs project also aims to create and deliver a comprehensive set of digital tools for YCS to facilitate access to a healthy lifestyle and to establish a network among them, called “OACCUs Network Toolbox”. It will host outreach articles based on updated scientific evidence adapted for easy understanding and applicability, learning and empowerment tools in each of the 4 pillars of OACCUs such as audio podcasts, video podcasts, infographics, interactive guides and booklets, online planners, a repository of exercise videos and exercise blocks among others. On the other hand, it will also offer a section with video testimonials from YCS ambassadors of OACCUs and other inspirational videos and a community section for interaction between YCS.

**Ethical considerations**

All participants will be asked to agree (by clicking online) that the data collected in the questionnaire may be used for research purposes within the framework of the European OACCUs project, knowing that the data are completely anonymous and do not identify participants personally. Participants will also confirm that they understand the questionnaire complies with the General Data Protection Regulation (GDPR) for the processing of personal data in the European Union published on 17 April 2016, repealing the former Directive 95/46/EC. Ethical approval for this project has been obtained from the ethical committee of University of Patras, Swedish Ethical Review Authority and University of Palermo.

**Statistical analyses**

Descriptive analyses will be performed for continuous and categorical variables. The mean, standard deviation, minimum, maximum and quartiles or percentages will be calculated for continuous and categorical variables, respectively. Multiple linear regression analyses will be used to examine the association of relevant independent variables by pillars (e.g. days per week of vigorous physical activity, adherence to the Mediterranean diet, days per week of exposure to nature, among others) with anxiety and depressive symptoms as indicators of well-being and quality of life (dependent variables). Logistic regression analyses will be applied to examine the associations of relevant independent variables by pillars with anxiety symptoms and depressive symptoms as dichotomized variables (no clinical disorder versus potential clinical disorder). Additionally, three-way ANOVA will be conducted to determine between-group differences in anxiety and depressive symptoms related to pillar-relevant independent variables. Relevant variables will be selected from the different pillars with a clear role of independent variable. All analyses will be performed using the STATA software for Windows version 13.0. The level of significance was set at  $p < 0.05$  in the statistical model.

**EXPECTED RESULTS**

The anticipated outcomes of the current project are multifaceted and carry significant implications for both research and practice within the realm of YCS.

In terms of lifestyle characterization, the project is poised to offer a comprehensive insight into the diverse array of lifestyle behaviours exhibited by YCS. By delving into their engagement with physical activity, outdoor sports, balanced nutrition, sustainability and nature behaviours, the project aims to fill critical knowledge gaps surrounding the lifestyle habits of YCS. These findings hold promise in guiding international public health strategies geared towards promoting healthier lifestyles among YCS, thereby fostering improved well-being and quality of life.

Moreover, the project seeks to uncover the intricate associations between lifestyle behaviours and the mental well-being and quality of life of YCS. By exploring these correlations, the project endeavours to shed light on the profound impact of lifestyle choices on psychosocial outcomes. It is anticipated that positive lifestyle behaviours, such as increased physical activity and adherence to balanced nutrition, may correlate with enhanced mental well-being and quality of life among YCS. These findings have the potential to deepen our understanding of the intricate interplay between cancer, lifestyle, and mental health, particularly within the European context. As one of the pioneering initiatives to adopt this approach and focus specifically on YCS at a European level, this project stands poised to make significant contributions to the field, shaping future research endeavours and informing targeted interventions aimed at optimizing the well-being of YCS.

On the other hand, as a secondary objective, the project seeks to develop and offer a suite of digital tools for YCS to facilitate easier access to a healthy lifestyle. Expected outcomes include the creation of user-friendly

digital platforms tailored to the specific needs and preferences of YCS, thereby empowering them to adopt and maintain healthier lifestyles. In addition, the project aims to establish a network among YCS by leveraging the developed digital tools and promoting the adoption of healthier lifestyles. It is anticipated that this network will facilitate communication, information sharing, and peer support among YCS, fostering a sense of community and empowerment.

Overall, the expected results of the project have the potential to advance our understanding of YCS' lifestyle behaviours, their impact on mental well-being and quality of life, and the effectiveness of digital tools in promoting healthier lifestyles among this population. These findings may inform future research, clinical practice, and public health initiatives aimed at optimizing the health and well-being of YCS.

## AUTHOR CONTRIBUTIONS

S.O.G.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-original draft. A.C.B., and J.G.P.G.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing. D.J.P.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing, Supervision. L.D.B., J.V., B.G., S.P.2., P.T., A.V., A.B.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing. J.T., S.P.1., M.K., F.G., V.R.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing.

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## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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