UcanACT
Physical Activity for Cancer Prevention

PRACTICAL INTERVENTION METHODOLOGY ON DELIVERING PHYSICAL ACTIVITY EXERCISES FOR CANCER PREVENTION FOR ADULT AND SENIOR CITIZENS WITHIN PUBLIC URBAN GREEN SPACES (deliverable D3.1)

Contribution to WP3 – Design of the Pilot Programme Methodology and Tools

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With the Support of:

- Europe Region of World Physiotherapy

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INDEX

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1. Abbreviations and Acronyms

ASCM	American College of Sports Medicine
CPPA	Cancer Prevention Physical Activity
GP	General Practitioner
HEPA	Health Enhancing Physical Activity
IPAQ-SF	International Physical activity questionnaire- Short Form
MET	Metabolic equivalents of task
MOOC	Massive Open Online Course
NCCN	National Comprehensive Cancer Network
PA	Physical Activity
PIM	Practical Intervention Methodology
PUGS	Public Urban Green Spaces
WHO	World Health Organization

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2. Glossary

Aerobic physical activity - activity in which the body's large muscles move in a rhythmic manner for a sustained period of time. Improves cardiorespiratory fitness (Bull et al, 2020).

Balance – an individual's ability to control their centre of gravity within the limits of base of support (Sturnieks, 2021).

Balance training - static and dynamic exercises that are designed to improve an individual's ability to withstand challenges from postural sway or destabilizing stimuli caused by self-motion, the environment, or other objects (Bull et al, 2020).

Bone-strengthening activity – physical activity primarily designed to increase the strength of specific sites in bones that make up the skeletal system. Produce an impact or tension on the bones that promotes bone growth and strength (Bull et al, 2020).

Cancer Prevention Physical Activity – physical activity that may play a role in cancer prevention.

Cancer Related Fatigue - is defined as a distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and that significantly interferes with usual functioning (Bower et al, 2014).

Exercise – a subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective (Caspersen et al, 1985).

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Health Enhancing Physical Activity – physical activity that aims to promote lifelong engagement with different practices that develop health (Europe Active).

Light-intensity physical activity – on an absolute scale, refers to physical activity that is performed between 1.5 and 3 METs. On a scale of relative to an individual's personal capacity, usually a 2-4 on a rating scale of perceived exertion scale of 0-10 (Bull et al, 2020).

Moderate intensity physical activity – on an absolute scale refers to the physical activity that is performed between and 3 and <6 times the intensity of rest (METs). On a scale relative to an individual's personal capacity. On a scale of relative to an individual's personal capacity, usually a 5 o6 6 on a rating scale of perceived exertion scale of 0-10 (Bull et al, 2020).

Major muscle groups – include the legs, back, abdomen, chest, shoulders and arms (US Department of Health and Human Services, 2008).

Multicomponent Physical Activity - an activity that includes more than 1 type of physical activity, such as aerobic, muscle strengthening, and balance training. Examples include some dancing or sports (Cadore et al, 2012).

Muscle-strengthening activity – increase muscle strength, power, endurance and mass (Garber et al, 2011).

Physical activity – any bodily movement produced by skeletal muscles that requires energy expenditure (Caspersen CJ et al, 1985).

Physical exercise – a subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective. Physical activity includes exercise as well as other activities which involve bodily movement and

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are done as part of playing, working, active transportation, house chores and recreational activities (WHO, 2019).

Physical inactivity – an insufficient physical activity level to meet present physical activity recommendations (Bull et al, 2020).

Practical Intervention Methodology – contains guidelines and recommendations for physiotherapists and other health professionals for implementation of CPPA sessions for adults and senior citizens within PUGS in accordance with emerging scientific research evidence on cancer prevention (UcanACT — ERASMUS-SPORT-2021-SCP).

Prevention – activities that are directed toward achieving and restoring optimal functioning, minimising impairments, limitations, and participation restrictions, maintaining health (thereby preventing further deterioration or future illness), creating appropriate environmental adaptations to enhance independent function (WHO, 2011; APTA, 2001).

Primary prevention – actions to avoid or remove the cause if a health problem in an individual or a population before it arises (WHO, 2011; APTA, 2001).

Public Urban Green Space – land covered by vegetation of any kind, that is an important part of urban public open spaces and common services provided by an urban area (cities and towns) serving as a health-promoting setting for all members of an urban community (e.g., garden, parks, playground, urban meadow, urban woodlands, forest and natural wildlife areas (WHO, 2017).

Secondary prevention – actions to detect a health problem at an early stage in an individual or a population, facilitating cure, or reducing or preventing spread, or reducing or preventing its long term effects (WHO, 2011; APTA, 2001).

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Sedentary behaviour – any waking behaviour characterized by an energy expenditure of 1.5 METS or lower while sitting, reclining, or lying (Bull et al, 2020).

Tertiary prevention – actions to reduce the impact of an already established disease by restoring function and reducing disease related complications (WHO, 2011; APTA, 2001).

Types of physical activity - occupational, recreational, domestic, active transport (Caspersen CJ, Powell KE. Christensen GM, 1985).

Vigorous-intensity physical activity – physical activity that is performed at 6.0 or more METs. On a scale relative to an individual's personal capacity, usually a 7 or 8 on a rating scale of perceived exertions scale of 0–10 (Bull et al, 2020).

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3. Introduction to UcanACT

The UcanACT project - Urban ACTion for cancer prevention: adult and senior citizens practice physical activity within public urban green spaces to prevent cancer diseases - is an intersectoral initiative funded by the European Union, and joining together physiotherapists, local authorities, non-profit organisations, higher education, and research institutions from eight organisations from five EU countries. Coordinated by the Europe Region of World Physiotherapy (ERWP), the UcanACT partnership all come together to engage adults and senior citizens to practice physical activity (PA) as a tool for cancer prevention within public urban green spaces (PUGS).

To apply PA as a tool for cancer prevention for adults and senior citizens, a set of research tasks were first made by the project partners. Within the preparation phase, the consortium reviewed scientific research demonstrating positive benefits of PA for cancer-prevention for adults and senior citizens with a special focus on outdoor PA sessions, collected in the document “Desk Study on recent scientific evidence of PA for cancer prevention for adults and senior citizens”, and identified efficient ways of organizing cancer-preventive physical activity (CPPA) within PUGS, collected in the document “Desk Research on good practices in organizing PA sessions for cancer prevention for adult and senior citizens within urban environments”. The project consortium also identified in a report on NEEDs analyses barriers and issues that adults and senior citizens might face to start participation in CPPA actions within PUGS.

These research activities have been taken into consideration for building two key project deliverables: the Citizens Engagement Strategy and the Practical Intervention Methodology. These two outcomes are needed tools for the implementation phase of the UcanACT project, which consists in the execution of CPPA Pilot actions that aim at testing and validating the physical activity

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exercises developed during the preparation phase within the three pilot territories of the project: Bologna (Italy), Kilkenny (Ireland) and Munich (Germany). Two additional core deliverables will be developed to support the implementation phase: a Massive Open Online Course (MOOC) and the UcanACT App.

Given that cancer is the main cause of death both for men and women between the ages of 55 and 74 years (Eurostat data, 2017) and that the project is dealing with cancer-preventive measures, its activities should be aimed at people younger than 55 years old to meet the project's objectives and increase impact reducing the physical inactivity levels and inform EU citizens about positive benefits of PA of cancer prevention. In this regard, the primary target group of the present project is adults and senior citizens over the age of 50 who never have suffered from cancer diseases (primary prevention), who were diagnosed with cancer (secondary prevention) or who are cancer survivors (tertiary prevention).

3.1 Prevention of cancer

The field of cancer prevention was chosen by the project partners due to the high urgency and importance of this topic for European public health. Cancer prevention, treatment and care are recognized by the von der Leyen Commission as a main priority in the area of health (Europe Beating Cancer Plan, 2021). The President of the European Commission stated that "unless we take decisive action, lives lost to cancer in the EU are set to increase by more than 24% by 2035, making it the leading cause of death in the EU."

In the EU 3.5 million people are diagnosed with cancer and 1.3 million die from it each year (Eurostat, 2018). The World Health Organization (WHO), recognizes cancer as a leading cause of death globally, with an estimated 10 million deaths from cancer in 2020, or nearly one in six deaths (WHO, 2022). The Robert Kock institution and the Society for epidemiology cancer register in Germany report that everyone has a 50% risk of developing cancer (Centre for Cancer Registry).

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Prevention of cancer is one of the most significant public health challenges of the 21st century (IARC,2011). Regular physical activity and maintaining a healthy body weight, after tobacco control, is the second most important means of cancer prevention. It is suggested that public health action is aimed at tackling these risk factors and physical activity should be encouraged (IARC, 2011).

3.2 Physical Activity for prevention of cancer

A possible measure for cancer prevention recognised by WHO is PA, which has been recognised scientifically on a global scale. 'Be physically active' is one of the Cancer Prevention Recommendations developed by the World Cancer Research Fund. Moreover, practicing physical exercise within open environments increases the positive benefits of PA (World Cancer Report, 2020). It is wiser to prevent a disease than to face its consequences at a more advanced stage.

Prevention is seen in the European Health policies as the touchstone of a redesigned system focused on improving health outcomes. Prevention advocates have emphasised that it will save money, arguing that prevention is not only good for health but also a means to control spending. Economic value and cost effectiveness of cancer prevention is an important aspect that should be considered.

Statistics data and research presented in the World Cancer Report (World Cancer Report WHO, 2020) indicate that between 30% and 50% of cancer deaths could be prevented by two ways:

1) Modifying or avoiding key risk factors (among them: exercise regularly and maintaining health weight),
2) Implementing evidence-based prevention strategies (one of them is practicing Health Enhancing Physical Activity (HEPA).

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4. Introduction to the Practical Intervention Methodology

The Practical Intervention Methodology (PIM) on delivering physical activity exercises for cancer prevention for adults and senior citizens within public urban green spaces is the first core project deliverable that provides conceptual and methodological bases for the implementation of pilot CPPA actions for adults and senior citizens within PUGS, in accordance with emerging scientific research evidence on cancer prevention. This methodology is also strongly supported by the effective Health Enhancing Physical Activity (HEPA) methodologies, and the outputs and knowledge from the preparation phase.

The PIM will be used and implemented during the Pilot CPPA actions - defined as a combination of exercises (planned, structured, repetitive and intentional movements) aimed at prevention of cancer diseases - by physiotherapists and health professionals. They will be provided with recommendations and guidelines, the procedures to be followed during the Pilot actions and with the necessary characteristics of the UcanACT App, as well as indications on its structure and operation, so that the Pilot CPPA actions can be carried out.

The methodology consists of four interrelated chapters:

Chapter 1	•Recommendations for physiotherapists and other health care professionals on delivering CPPA exercises.
Chapter 2	•Description and illustration of CPPA exercises for adult and senior citizens that can be practised within PUGS.
Chapter 3	•Good practices of practising CPPA exercises by adults and senior citizens.
Chapter 4	•Training curriculum for delivering PIM for physiotherapists and other health professionals.

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First, the project methodology will be delivered to physiotherapists and health professionals via an online educational course called Massive Open Online Course. They will then participate in kick-off training sessions that will be implemented within a two days program. The sessions will take place prior to the Pilot CPPA actions in the three project pilot territories - namely Bologna (Italy), Kilkenny (Ireland), and Munich (Germany) - and will be coordinated and provided by professional physiotherapists from Irish Society of Chartered Physiotherapists and from the Italian Physiotherapy Association.
Physiotherapists and health professionals will have access to the Methodology throughout the project implementation activities to be able to expand on this information if they wish, and will be provided with a means of contact with the project partners in charge of the implementation of the Pilot CPPA actions so that they can resolve their doubts about the methodology of the project at any time.

From 2024, Pilot CPPA actions will be implemented within two rounds in Bologna, Kilkenny and Munich for about 12 weeks. The first Pilot round will be aimed at testing and validating PIM with a special focus on adjusting it to the three project pilot territories and PUGS, and will test the UcanACT App in terms of its functionality and target groups needs. Within the second Pilot round, the PIM and the App will be validated for their further use by other municipalities interested in promotion of physical activity for cancer prevention.

Between Round 1 and 2, it will start an evaluation period aimed at the evaluation of the application of the Practical Intervention Methodology and the UcanACT App. Using the results from this analysis, improvement strategies for the Pilot Round 2 will be designed.

Again, both rounds will be implemented by physiotherapists and health professionals, with the support of communication managers from the three pilot territories. They will be involved in the implementation of the Citizens Engagement Strategy, another core deliverable of the UcanACT projects aimed

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at improving opportunities to enable the project target groups (mainly adults and senior citizens) to actively take part in the cancer-preventive physical activity actions.

4.1 Introduction to the UcanACT App

As mentioned previously, the project is also structured around the creation of the UcanACT App. This second core project deliverable aimed to support adults and senior citizens engaged in CPPA exercises within PUGS. The main objective is that users do physical activity autonomously through the use of this Mobile App, with no physiotherapists and health professionals to guide them. The UcanACT App will therefore provide adults and senior citizens and other users (physiotherapists, health professionals, family members, caregivers…) with the following information and options:

- Video guidelines of CPPA exercises that can be practiced within PUGS (and if necessary, at home).
- A map, indicating PUGS, suitable for engaging in CPPA. Users will be able to identify the nearest available place.
- Communication chat service for easy connection with other App users and making appointments with them for practising PA exercises together.

The UcanACT App will be tested within Round 1 of the Pilot CPPA actions and improved based on the feedback received from the users. The App will be fully used within Round 2 of the Pilot CPPA actions implementation.

4.2 Introduction to the Massive Open Online Course (MOOC)

Prior to the implementation of the Pilot CPPA actions, the MOOC will be developed by the project consortium for physiotherapists and other health professionals to provide trainings on how to deliver the Practical Intervention

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Methodology and to ensure the quality of its implementation. The MOOC will be an online content based coursed and will include:

- Introduction to the project PIM,
- Video tutorials on providing CPPA exercises,
- Specificity of CPPA exercises for primary, secondary and tertiary prevention,
- Guidelines on providing safety conditions for practising CPPA exercises within PUGS.

The MOOC will refer to the chapter 4 of the present document, which consists of the training curriculum for delivering the PIM for physiotherapists and other health professionals.

Pilot CPPA actions will be conducted by physiotherapists and other health professionals who successfully complete the MOOC.

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5. Chapter 1

Recommendation for Physiotherapists and other healthcare professionals on delivering cancer prevention physical activity exercises

The purpose of this chapter is to detail the implementation of the exercise programme with reference to the published literature and the key considerations when performing exercise with this cohort of individuals to ensure safety and optimize outcomes. In this chapter we will describe the stepwise selection process that individuals will go through prior to commencing the programme, to ensure appropriate participation. The stepwise selection process includes:

- Screening,
- Stratification according to fitness levels, and
- Falls assessment process.

The stepwise selection process will facilitate the categorization of individuals to the appropriate level of exercises. The exercises are described in detail in Chapter 2.

Information is provided on safety monitoring for healthcare professionals who will be providing the exercises classes and details how to effectively manage adverse events.

The aim of Chapter 1:

- A detailed stepwise process for appropriate selection and stratification of individuals participating in UcanACT project.
- Safety monitoring during the exercise programme.

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5.1 Criteria for participation

As mentioned in the introduction, the UcanACT project targets adults and senior citizens over the age of 50 who never have suffered from cancer diseases (primary prevention), who were diagnosed with cancer (secondary prevention) or who are cancer survivors (tertiary prevention). For the smooth running of the UcanACT project and to meet its main objectives, a series of criteria were established. The criteria for participation in the project are as follows:

- Over 50 years of age,
- Individuals who have not been diagnosed with cancer,
- Individuals living with or beyond cancer,
- Medically cleared using the America College of Sports Medicine (ACSM) safety criteria for exercise.

On the other hand, the UcanACT consortium has agreed that participants that are unable to get to a PUGS will be excluded from participation in the project (McNeely et al., 2019, Rethorst et al., 2018, Irwin et al., 2017).

5.2 Screening participants

Participants will be screened to ensure safe participation in the project. Recruiters will perform the screening process.

5.2.1 Group 1 - Non-cancer participant

To be deemed eligible for inclusion in the exercise programme, participants will be screened using the ACMS questionnaire. Once deemed eligible, the participant will be stratified to the appropriate fitness levels using the International physical activity questionnaire- short form (IPAQ-SF) (Appendix 1).

There are three fitness levels and appropriate exercises which will be provided during the exercise sessions in the PUGS and in the UcanACT App. Participants

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will be asked for their history of falls and fear of falling. If the participant has a history on falls, they will be directed to a section of the App with information of falls prevention. Figure 1.1. Details the screening of non-cancer participants.

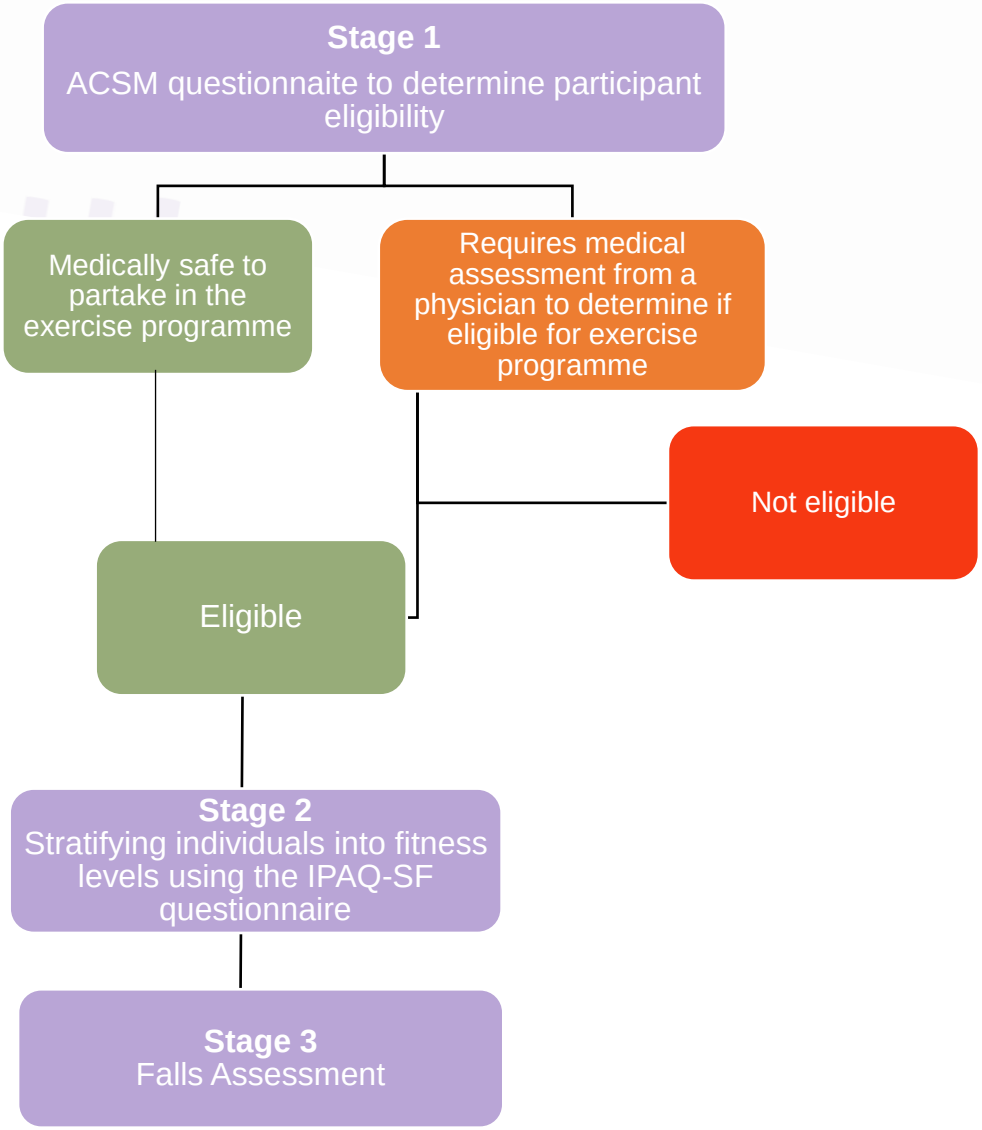

Figure 1.1. The stepwise process for screening and stratification of non-cancer participants

5.2.2 Group 2 - Cancer survivors/participants diagnosed with cancer

Participants will be screened using the ACSM screening algorithm to determine eligibility to commence exercise with or without medical screening. Once deemed eligible, participants with a history of cancer (cancer diagnosis or a cancer

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survivor), will be screened using the National Comprehensive Cancer Network (NCCN) Triage Approach Based on Risk of Exercise-Induced Adverse Events (Table 1).

An indication by the ACSM algorithm or in the NCCN assessment that further medical assessment is required participants will be directed to visit their GP/physician. Participants will be asked to contact the recruiter after their review with their GP/physician to determine if they can participate. Once medically cleared, the recruiter will stratify participants according to their fitness level using the IPAQ-SF.

There are three fitness levels and appropriate exercises which will be provided during the exercise sessions in the PUGS and in the UcanACT App. Participants will be asked for their history of falls and fear of falling. If the participant has a history of falls, they will be directed to a section of the App with information of falls prevention. Figure 1.2. Details the screening of individuals with a history of cancer (cancer diagnosis / cancer survivor).

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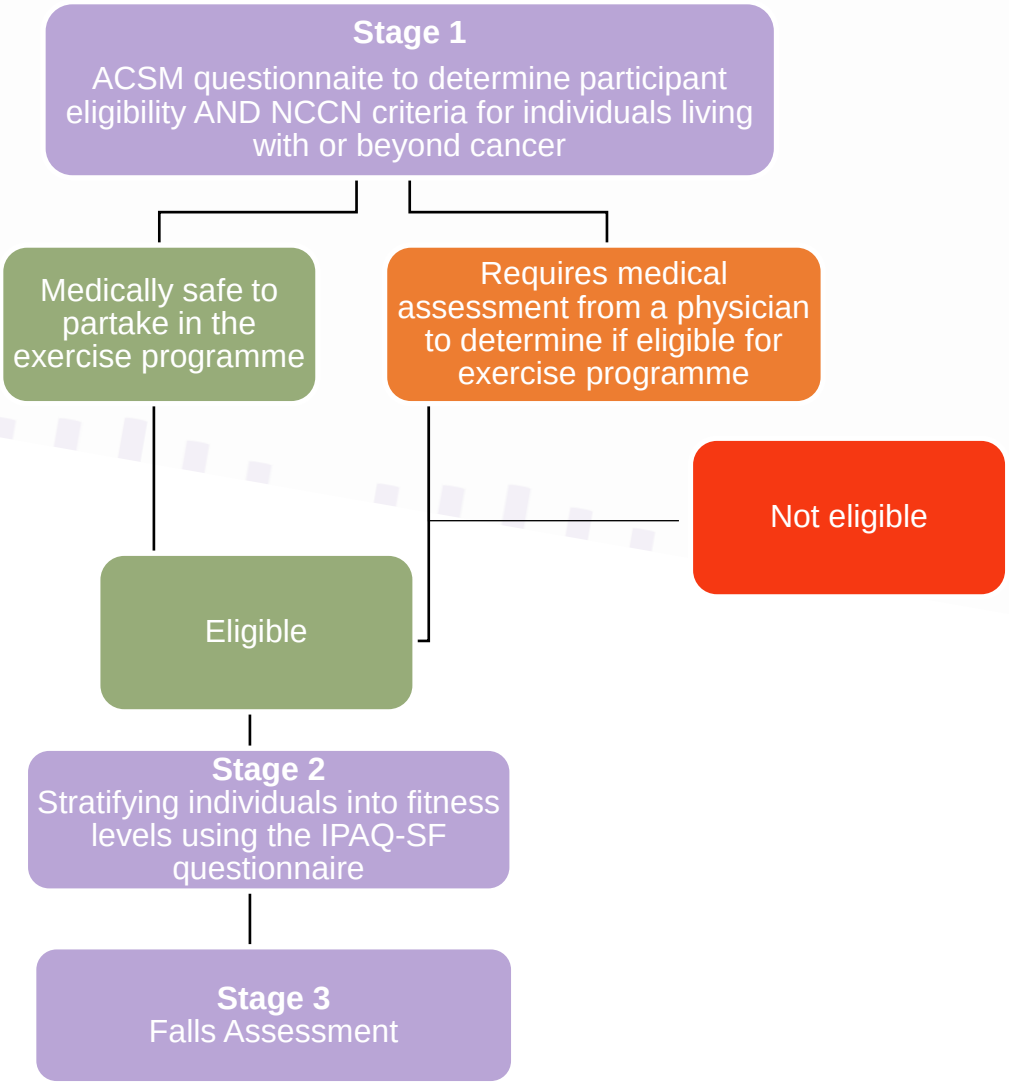

Figure 1.2. The stepwise process for screening and stratification of participants living with or beyond cancer

5.3 Medical clearance

The ACSM screening algorithm has been developed to help healthcare professionals assess whether medical clearance is needed before initiating or progressing an exercise programme (Whitfield et al., 2017).

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Before participating in the exercise programme, the recruiters will assess individuals using the algorithm to determine whether or not they require medical clearance to participate in the programme (as indicated in Figure 1.1 and 1.2). The recruiters will screen individuals using the algorithm (see Figure 1.1 and 1.2). Individuals will be included in the exercise programme if it is deemed that no further medical evaluation is required.

If the algorithm indicates that medical clearance is needed before participation, the recruiter will direct the individual to be assessed by their GP. The Doctor will determine if it is appropriate for the individual to participate in the exercise programme.

The screening algorithm provides recommendations for medical support based on the following:

- An individual's current physical activity level,
- Presence of signs or symptoms and known cardiovascular, metabolic, or renal disease,
- The anticipated or desired exercise intensity.

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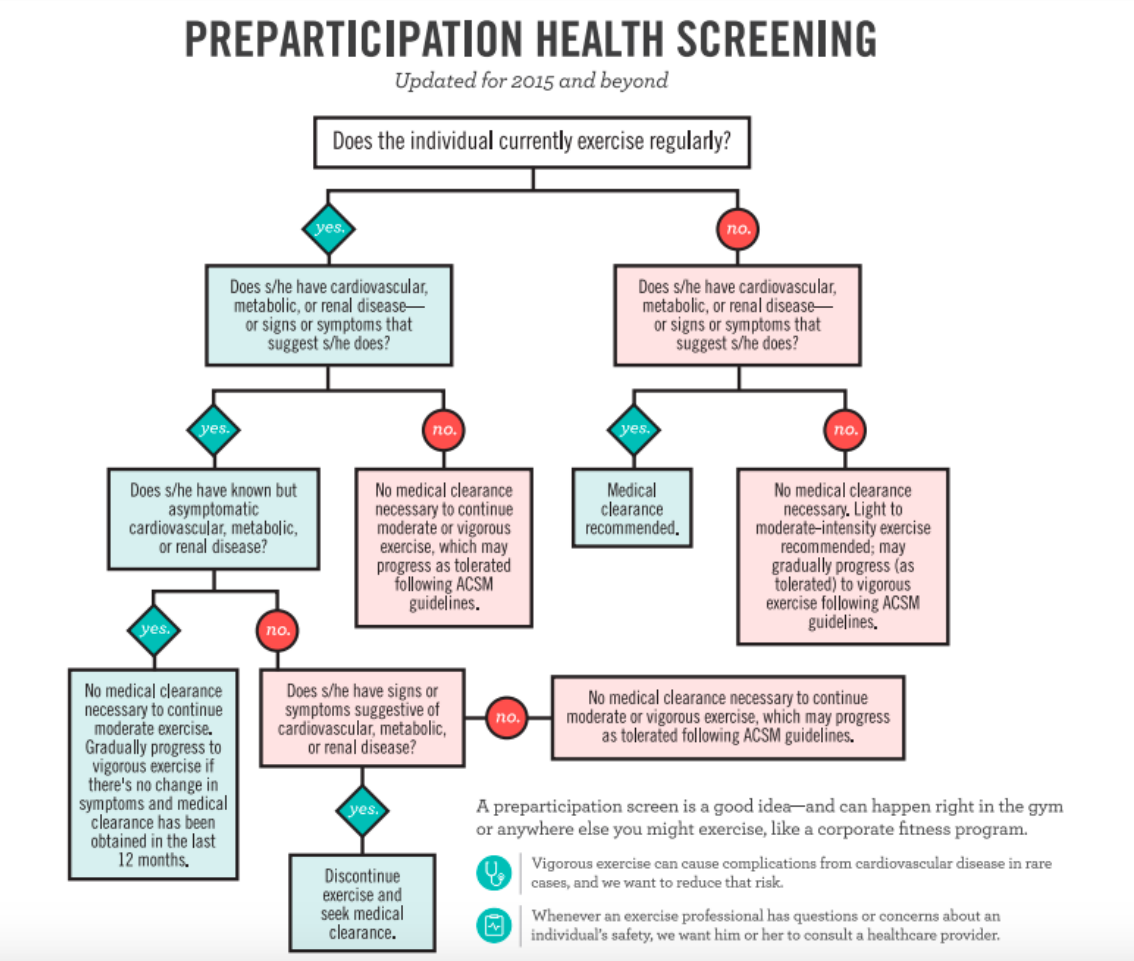

Figure 1.3. ACSM pre-participation health screening (American College of Sports Medicine

5.4 Medical clearance of individuals living with or beyond cancer

The ACSM pre-participation guidelines do not specifically address risks for adverse events and /or injury during exercise that are specific to the adverse effects of cancer treatment. Therefore, in addition to the ACSM screening algorithm, participants living with or beyond cancer will be screened according to the National Comprehensive Cancer Network (NCCN) Survivorship guidelines. These guidelines recommend the necessary steps for medical clearance and appropriate levels of supervision during exercise.

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Description of patients	• Screening, prescription and exercise recommendation
No comorbidities	• No further pre-exercise medical evaluation; • Follow general exercise recommendations
Peripheral neuropathy, arthritis/musculoskeletal issues, poor bone health, lymphedema	• Recommend pre-exercise medical evaluation • Modify general exercise recommendations based on assessment
Lung or abdominal surgery, ostomy, cardiopulmonary disease, ataxia, extreme fatigue, severe nutritional deficiencies, worsening/changing physical conditions, bone metastases	• Pre-exercise medical evaluation and clearance by a physician before exercise

Table 1.1. Adapted National Comprehensive Cancer Network Triage Approach Based on Risk of Exercise-Induced Adverse Events (Campbell et al., 2019)

Recommendations:

- Individuals are screened as per ACSM guidelines
- An individual living with or beyond cancer is or post cancer is additionally screened by using the NCCN criteria to determine who requires medical clearance before participating.

5.5 Stratification of participants according to fitness level

Once individuals are deemed medically safe to participate in the project, the individual will be stratified according to their fitness level. The International Physical Activity Questionnaire in short form (IPAQ-SF) questionnaire will be used to determine the individual's fitness level, and a suitable exercise programme will be assigned according to the participant's fitness level.

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The IPAQ-SF is widely used in research to determine an individual's physical activity levels. The questionnaire quantifies the total volume of activity and the number of days/sessions of physical activity. The short-form questionnaire asks participants about their seven days of physical activity recall (Craig et al., 2017). The short-form questionnaire records the activity of four intensity levels:

1) Vigorous-intensity activity such as aerobic
2) Moderate intensity activity such as leisure cycling
3) Walking
4) Sitting

The questionnaire categorizes into three domains: inactive, minimally active and Health Enhancing Physical Activity (HEPA) (Lee et al., 2011).

Participants will complete the IPAQ-SF at regular intervals of the programme. The IPAQ-SF is a validated self-reported questionnaire. This will be a good measure of the progress made by the participant engaging with the programme. Additionally, it can direct participants to progress onto the next level of exercise if indicated by the results.

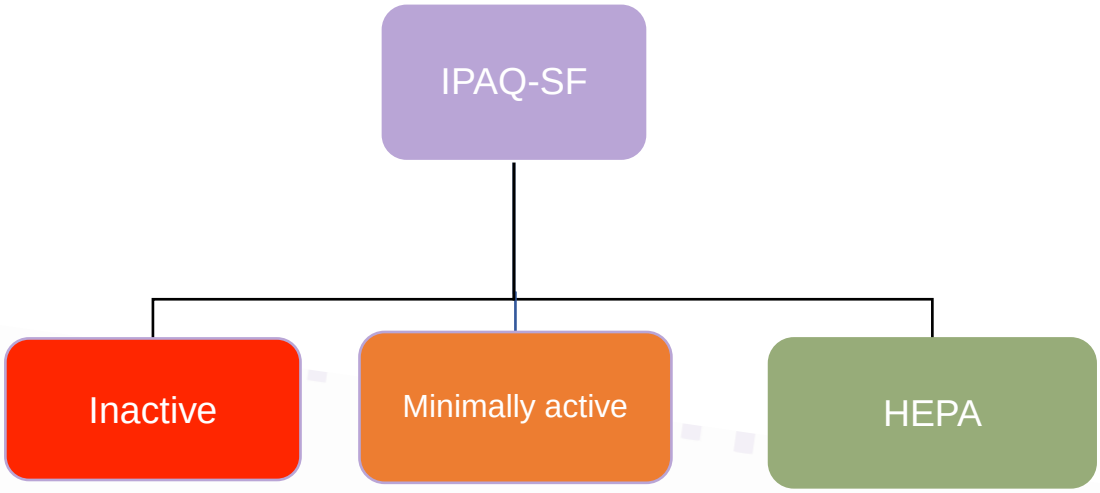

Figure 1.4. Stratification of physical activity levels using IPAQ-SF

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Level	Description
Category 1 - Inactive	• The lowest level of physical activity • Individuals who do not meet the criteria for categories 2 or 3 are considered insufficiently active
Category 2 - Minimally Active	• Considered sufficiently active and is engaged in any one of the following: ○ 3 or more days of vigorous activity of at least 20 minutes per day OR ○ 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day OR ○ 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities, achieving a minimum of at least 600 MET-min/week. Achieving one of the above criteria would be considered minimally active
Category 3 - HEPA	• Defined as an individual exceeding minimal physical activity recommendation. • Two criteria for classification: ○ Vigorous-intensity activity on at least 3 days achieving a minimum of at least 1500 MET-minutes/week OR ○ 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week.

Table 1.2. Description of the three physical activity levels (Bergman et al, 2009)

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5.6 Falls assessment

Participants will be assessed regarding their fall risk due to the age profile of the individuals partaking in this programme. The programme will aim to address this risk through exercise and education.

Individuals >65 years old have an increased risk of falling, leading to hospitalization and disability (Vaishya and Vaish, 2020). Cancer survivors who have undergone chemotherapy can develop chemotherapy-induced peripheral neuropathy, which causes changes in individuals' sensation in their peripheries and, consequently, postural instability. This increases their risk of falls (Duregon et al., 2018).

The self-rated fall risk questionnaire will be used for falls assessment. (See Appendix Fig. 2). It is a validated and reliable tool to evaluate fall risk in older adults. The self-rated fall risk questionnaire is a 12-item questionnaire to assess fall risk. The higher the score indicates the individual is at higher risk of falling. This questionnaire moderately- strongly correlates to Time up and Go, Berg balance scale and 5 time sit to stand test (Kitcharanant et al., 2020). Individuals will be directed to a section in the App (See Fig 1.5) that will provide different fall prevention strategies and education to reduce the risk of falling.

Preventing fall

Keep active and exercise

- Regularly physical activity improves your strength, balance and coordination
- Wear well-fitted sturdy shoes
- Start slow and gradually build you exercise tolerance up

Ask your GP to review your medication

- Certain medication can cause lightness or feeling faint which can cause you to fall. Your GP can provide you with advice.

Have you vision checked

- Poor eyesight can lead to an increased chance of falling. Regularly checking your eyesight is important to prevent this.

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Falls prevention in your home

- Floors
  - Ensure floor is clear for you to move around
  - Remove rugs you could slip on
  - Ensure wires or cords from lamps or phones are tied away

- Stairs & steps
  - Ensure steps/stairs are kept clear
  - Install handrail on both sides of the stairs
  - Ensure good lightening at the top and bottom of the stairs

- Kitchen
  - Keep items you use regularly easy to reach
  - Instead of using a chair or a stool place items on shelves you can reach

- Bedroom
  - Have a pendent alarm is on your person
  - Ensure good lightening from your bedroom to your bathroom
  - Place a lamp near your bed

- Bathroom
  - Install grab rail by your toilet, shower and bath
  - Use non-slip mats in the shower or bath

Information adapted from *Preventing falls and trips from the HSE* (HSE, 2023)

Figure 1.5. Information – Fall Prevention

5.7 Participant profile on the App

The profile of the participant on the App will include name, location of PUGS, medical clearance, fitness level according to IPAQ-SF, fall history, and any considerations when exercising. A drop-down list, including the considerations, is seen in Figure 6. The information on modification of exercises is detailed in chapter 2.

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Figure 1.6. Example of participant profile on the App

5.8 Safety monitoring

The physiotherapist leading the exercise programme will perform safety monitoring during the exercise training. All physiotherapists will have completed heart-saver training in line with local guidelines. Participants will be asked to report any issues, such as injuries or falls, before participating in the exercise programme.

Any adverse events will be documented on an incident report form (Appendix 3).

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Adjuvant therapies for treating breast cancer are linked with increased risks of heart disease, including arrhythmia, heart failure and ischemic heart disease (Yang et al., 2022).

Problem	Sign and symptoms	Action	Further action
Arrhythmias	Tachycardia starting heart rate A rapid increase in heart rate A rapid increase from initially high heart rate Bradycardia	Contraindication to exercising Adjust exercise prescription Keep aerobic activity low An individual feels faint, dizzy or lethargic New or uncontrolled, do not exercise	Refer to GP Monitor Refer to GP Refer to GP Refer to GP
Cardiac arrest	Absence of pulse and respiratory	Start CPR Send for help Assess AED Dial 112 or 999	Give paramedics detail of the incident
Myocardial infarction	Prolonged central chest pain	Dial 112 or 999	Give paramedics detail of the incident
Collapse	Sudden loss of consciousness Pale, sweaty, rapid pulse	If unconscious, put in the recovery position	Dial 112 or 999

Table 1.3. Protocol of adverse events

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6. Chapter 2

Description and on and illustration of Cancer Prevention Physical Activity Exercises for adults and senior citizens that can be practiced within the Public Urban Spaces

This chapter will focus on the evidence-based exercise programme including a variety of exercises which will be implemented in the PUGS.

The key considerations healthcare professionals need to employ when leading out the exercise programme will be detailed. This will help professionals to ensure correct modification of exercises and suitable precautions are followed. Furthermore, education packages are detailed that are targeted for participants that will be available on the App to enable individuals to be informed and take greater engagement and ownership of their health.

The aim of Chapter 2:

- To describe the components of the UcanACT exercise programme led by the physiotherapist in the PUGS.
- Identify key considerations when exercising with participants diagnosed with cancer / cancer survivors.
- List precautions regarding exercises for participants diagnosed with cancer / cancer survivors.

6.1 Recommendation for the exercise programme

Evidence indicates that higher physical activity levels are linked to a lower risk of developing several cancers (McTiernan et al., 2019).

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According to the literature, it is recommended that cancer survivors participate in a supervised exercise programme consisting of 2-3 sessions per week over a 10-12-week period (Newton et al., 2020). An average of a 1-hour session of aerobic, strengthening, balance and flexibility exercises should be included.

Cancer Council WA Life now (Australia)	• 12-week program • 2 sessions x 1 hr per week
ExMed Cancer (Australia)	• 12-week program • 3 sessions x 1 hour per week
Renew exercise program (Australia)	• 10-week program • 2 sessions x 1 hour per week
Cancer rehabilitation institute (USA)	• 12-week program • 2-3 session x 1 hour per week
YMCA exercise program (USA)	• 12-week program • 2 sessions x 90 minutes per week

Table 2.1. Summarizes different exercise programmes across Australia and the USA

6.1.1 Modified Borg Scale of perceived exertion

It is important to have a tool that can guide patients and professionals on how hard they should be working during aerobic and strengthening exercises. The modified Borg scale of perceived exercise can guide participants to use to inform them on how hard they should be working during aerobic and strengthening exercises.

For aerobic/strengthening exercises individuals should feel moderately to somewhat several breathless (4-5 on the scale) (Williams, 2017). If participants rate their work rate at a 3 on the Borg scale during strengthening or aerobic exercises it indicates that progressing onto the next levels of exercises is indicated.

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1-10 Borg Scale of Perceived Exertion	
0	Rest
1	Really Easy
2	Easy
3	Moderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really Hard
10	Maximal

Figure 2.1. The Modified Borg scale

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How hard should I be working?

For aerobic exercises you want to feel moderately to somewhat several severely breathless. Between 4-5 on the modified Borg scale seen below.

Similarly, with strengthening exercise you should be aiming for 4-5 on the scale.

When you are rating your activity at 3 or below this indicates that you should move onto the next fitness level of the exercise programme from the one you have been currently assigned to.

The Modified Borg Scale

1-10 Borg Scale of Perceived Exertion	
0	Rest
1	Really Easy
2	Easy
3	Moderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really Hard
10	Maximal

Figure 2.2. Page from the App detailing the Borg scale

6.1.2 Aerobic exercises

Aerobic training has demonstrated health benefits in older adults, including improved cardiovascular, functional, metabolic, cognitive and quality of life outcomes (Bouaziz et al., 2017).

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Aerobic training can positively affect cancer-related fatigue and improve overall quality of life in cancer survivors (Patel and Bhise, 2017, Dieli-Conwright et al., 2018).

Frequency	>5 days/week of moderate-intensity or >3 days/week of vigorous-intensity.
Intensity	The Modified Borg scale can be used to measure the rate of exertion for aerobic endurance. The target is between 4 and 5 'somewhat hard' (Seen Figure 1).
Type	• Walking • Jogging on the spot • Jogging over a short distance • Interval sprints • Climbing steps • Cycling
Time	30-60 minutes at a moderate intensity or 20-60 minutes at a vigorous intensity.

Table 2.2. ACSM Aerobic guidelines for adults and other adults

6.1.3 Strengthening

Muscle strengthening is recommended for all cancer survivors, leading to improved quality of life (Dieli-Conwright et al., 2018).

Resistance training in older adults positively affects muscle strength, power, muscle mass, energy expenditure and participation in daily activities (Hunter et al., 2004).

Frequency	Perform 2-3 times per week on non-consecutive days
Intensity	Using the Borg scale 4-5 or 'somewhat hard.'
Type	Muscles: chest, back, shoulder, bicep, triceps, quadriceps and hamstring, and core.
Time	It depends on the participant

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Repetitions	• 10-15 reps to improve strength in middle age to older adults • 8-12 repetitions to improve strength in adults • 15-20 reps to improve endurance and power in adults
Sets	Single-set training for novice or older adults • 2-4 sets for strength testing in adults • < 2 sets for endurance
Rest	2-3-minute rest in between multiple sets

Table 2.3. ACSM Strengthening guidelines for Adults & Older Adults

6.1.4 Balance

There is a high rate of falls in community-dwelling older adults. Hence, the importance of integrating a balance programme for this cohort to help prevent falls and, in turn, hospitalization (Power and Clifford, 2013).

Chemotherapy-induced peripheral neuropathy, which can arise as a side effect of certain chemotherapy treatments (e.g., taxanes) can lead to an altered sensation in the hands and feet, and consequently postural instability in cancer survivors. Posture control was improved with strengthening, endurance and static/dynamic balance training (Duregon et al., 2018).

Frequency	Perform x2-3 per week
Intensity	No consensus at this time
Type	• Sideways walking • Backwards walking • Walking and turning around • Tandem stance • Tandem walk • One leg stand • Heel walking • Toe walking • Heel-toe walking backwards

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Time	Exercise volume of at least 1 hour per week

Table 2.4. ACSM Balance guidelines for adults and older adults

6.1.5 Flexibility

Flexibility training should be used as an adjuvant to an exercise programme in older adults. It is noted that flexibility training may improve postural stability and balance when combined with resistance training is the ACSM recommends that flexibility should be performed after cardiorespiratory endurance or resistance training (Stathokostas et al., 2012).

Invasive breast cancer treatment involving surgical resection and radiotherapy can lead to a restriction in the shoulder and upper chest ROM. Exercise programmes must target this to reduce the risk of developing long term long-term functional ability (Richmond et al., 2018). Multifactorial physical therapy (strengthening & stretching) is safe and beneficial in improving symptom management and restoring shoulder function (Harder et al., 2017).

Frequency	>2-3 days/week of stretching the major muscles of the body
Intensity	To a feeling of muscles tightness
Type	• Calf stretches • Hamstring stretch • Quadricep stretch • Cross chest stretch • Trunk twist • Overhead side reach
Time	• 20-60 seconds of static strengthening hold in older adults • 10-30 seconds of static strengthening hold in adults

Table 2.5. ACSM Flexibility guidelines for adults and older adults

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6.2 Key considerations for exercises with participants

Physiotherapists and other health care professionals must clearly understand different conditions which may require modification of an exercise programme or education on safety measures.

As part of the MOOC training, appropriate training for physiotherapists and other health care professionals will be provided on the key considerations (Table 6,7 & 8). The App will contain general information on certain conditions and key considerations when exercising, including precautions. Additionally, for each exercise, there will be a notice under the exercise description if modifications or adjustments need to be made before performing the exercises. Participants are encouraged to read this prior to engaging in exercises.

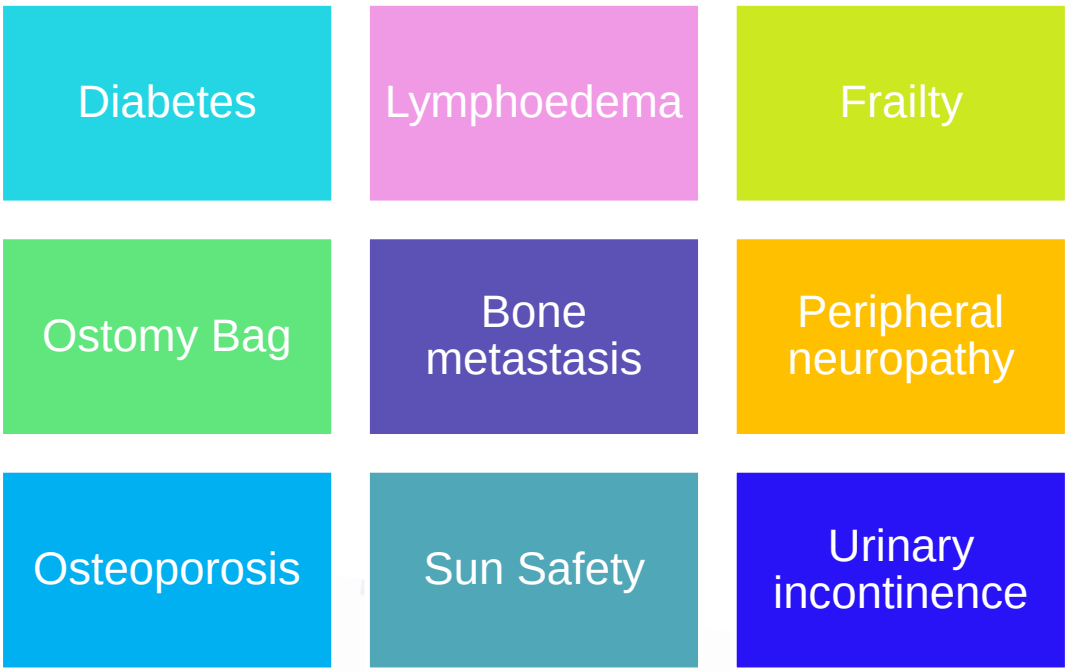

Figure 2.3. The screen on the App showing the key considerations for exercising with certain conditions.

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Table 2.6 details the key considerations when exercising with older adults and the modifications needed to ensure safety. It details how healthcare professionals can instruct participants to modify activities to optimize outcomes for different conditions.

Frailty	Begin with a lower resistance, and progress slowly. Start at 8-12 reps at 20-30%of 1RM and progress to 80% 1RM
Mobility limitation	Advising participants to use gait aid when participating in the exercise programme
Diabetes	• Monitor blood glucose before and after training the participants. • Special consideration associated with cardiovascular disease, nerve disease, kidney disease, eye disease and orthopaedic limitations
Osteoporosis	• Start at a lower intensity and work towards 2-3 sets of 8-12 reps of strengthening exercises • Ensure good exercise technique • Avoid excessive bending or twisting • Incorporate balance training into the exercise programme

Table 2.6. Consideration in older adults when performing strengthening exercises adapted from (Fragala et al., 2019)

Table 2.7 details the exercise considerations needed to be employed for cancer survivors prior to participating in the programme. Campbell et al. (2019) details the key points to consider prior to exercising and modifications required to maximize safety for participants effects by the conditions detailed below.

Bone metastasis	• Avoid movements placing excessive high load on fragile skeletal sites e,g. high-impact loads, hyperflexion or hyperextension of trunk flexion or extension of the trunk with added resistance and dynamic twisting motion. • Prevent falls in this cohort • Awareness of signs and symptoms of bone metastases in survivors is important. Survivors should be referred to the

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	medical team if bone pain is reported, as this can be an initial sign of skeletal metastases.
Lymphedema	• Compression garments can be worn when exercising. However, insufficient evidence supports or refutes the benefits of wearing a compression garment during exercise. Participants should be provided with this information and can decide their preferences. • When performing resistance training, a progressive programme targeting large muscles with the principle of 'start low, progress slow' is safe when supervised by a healthcare professional. • Aerobic exercising is deemed safe in this cohort.
Ostomy	• Participants should empty ostomy bags before exercising • Optimizing hydration during and after exercising is essential for those with an ileostomy. • Resistance exercises should be progressed slowly, starting with low resistance. A healthcare professional should direct this. • Core exercise that causes excessive intra-abdominal pressure should be modified for this cohort.
Peripheral neuropathy	Falls assessment needs to be completed by a physiotherapist before participation, as an individual's gait and stability can be affected.
Symptom cluster	• Disturbance in pain, sleep and fatigue can be side effects of cancer treatment. • In a section of the App, individuals can document their symptoms. If there are changes in their symptoms, it will prompt individuals to seek medical advice.
Sun safety	Participants should engage in sun protection practices when exercising outdoors, i.e., wearing sun cream, wearing a hat.

Table 2.7. Exercise programme considerations for cancer survivors adapted from (Campbell et al., 2019)

Galvao et al., (2018) detailed the consideration of certain exercises for individuals with a diagnosis of bone metastases according to its location. In the MOOC and

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in the UcanACT App certain exercises will be sign posted for participants to avoid if they are diagnosed with bone metastases.

	Resistance			Aerobic	Aerobic	Flexibility
Bone metastases site	Upper	Trunk	Lower	Weight-bearing	Non-weight bearing	Static
Pelvic	✓	✓	✓ [a]		✓	✓
Axial Skeleton (lumbar)	✓		✓		✓	✓ [b]
Axial Skeleton (thoracic/ribs)	✓ [c]		✓	✓	✓	✓ [b]
Proximal femur	✓	✓	✓ [a]		✓	✓
All regions	✓ [c]		✓ [a]		✓	✓ [b]

Table 2.8. Considerations when exercising with bone metastases according to location adapted from (Galvão et al., 2018)

[a] Exclusion of hip extension/flexion

[b] Exclusion of sine flexion/extension/rotation

[c] Exclusion of shoulder flexion/extension/abduction/adduction

6.3 Education pages for the participants to read and refer to when exercising

Each of the below pages will be displayed in the UcanACT App for participants to read and reference when exercising. Each condition will have details on key consideration when participants are exercising and when they should contact a healthcare professional if they have concerns.

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Diabetes

1 in 4 adults over >65 years old have diabetes in the US, type 2 diabetes is the most common form.

Type II diabetes causes the level of sugar in the blood to become too high.

Key consideration when exercising:

Individuals with diabetes may be vulnerable to episodes of hypoglycaemia during resistance exercise (glucose <70 mg.dl $^{-1.}$) therefore, it is important to check your glucose levels before and after exercising.

When to contact your healthcare professional:

If you have ongoing difficulties with your eyesight, balance or problems with your feet contact your GP.

(Fragala et al., 2019)

Figure 2.4. Information on Diabetes

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Lymphedema

Definition: Lymphedema is a swelling of a part of the body. It can be a result from some forms of cancers or their treatment.

First symptoms:

- A feeling of heaviness in the affected area
- Tightness, stiffness or aching in the affected area
- Tingling feeling in the area

Key consideration when exercising:

Compression garments are recommended to use when engaging with exercising.

Resistant exercising should be supervised by a healthcare profession with the principle of 'start low, progress slow'.

Aerobic exercise is safe to perform.

When to contact a healthcare professional:

Progression of symptoms.

(Campbell et al., 2019)

Figure 2.5. Information on Lymphedema

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Bone metastasis

Definition: cancer cells spread from their original site to the bone.

Key consideration when exercising:

Avoid movements placing excessive high load on fragile skeletal sites.

Click below on the exercise prescription based on location of bone metastases to avoid specific loading of the sites.

Pelvis | Lumbar spine | Thoracic spine/rib | Proximal femur | All regions

When to contact a healthcare professional:

If you experience by back pain, please contact your GP.

Additionally, if there are any changes to your symptoms is locations including femur, pelvis, spine, ribs, vertebrae please contact your GP.

(Campbell et al., 2019) (Galvão et al., 2018)

Figure 2.6. Information on Bone metastasis

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Pelvic metastasis

Resistance:
Upper: Safe
Trunk: Safe
Lower: Avoid hip flexion/extension

Aerobic:
Non-weight bearing i.e., cycling

Flexibility: Safe

(Galvão et al., 2018)

Figure 2.7. Pelvic metastasis

Lumbar spine metastasis

Resistance:
Upper: Safe
Trunk: Avoid
Lower: Safe

Aerobic:
Non-weight bearing i.e., cycling

Flexibility: Avoid trunk flexion/extension/rotation

(Galvão et al., 2018)

Figure 2.8. Information on Lumbar spine metastasis

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Thoracic spine/rib metastasis

Resistance:

Upper: Avoid shoulder flexion/extension/abduction/adduction

Trunk: Avoid

Lower: Safe

Aerobic:

Weight bearing activity

Flexibility: Avoid trunk flexion/extension/rotation

(Galvão et al., 2018)

Figure 2.9. Information on Thoracic spine/rib metastasis

Proximal femur metastasis

Resistance:

Upper: Safe

Trunk: Safe

Lower: Avoid hip flexion/extension

Aerobic:

Non-weight bearing i.e., cycling

Flexibility: Safe

(Galvão et al., 2018)

Figure 2.10. Information on Proximal femur metastasis

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All region metastasis

Resistance:

Upper: Avoid shoulder flexion/extension/abduction/adduction

Trunk: Avoid

Lower: Avoid hip flexion/extension

Aerobic: Non-weight bearing i.e., cycling

Flexibility: Avoid trunk flexion/extension/rotation

(Galvão et al., 2018)

Figure 2.11. Information - All region Metastasis

Frailty

Definition: age related process where multiple body systems lose their in-built reserves.

Key consideration when exercising:

When performing resistance (strengthening) exercising start with a lower resistance and progress slowly.

When to contact a healthcare professional:

Falls can be a consequence of becoming frail, important to contact a physiotherapist if you have experienced a fall or multiple falls recently to undergo a comprehensive falls assessment.

(Fragala et al., 2019)

Figure 2.12. Information on Frailty

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Osteoporosis

Definition: is a condition that effects the bones and causes them to become weakened. This makes them frail and more likely to break.

Key consideration when exercising:

- Start at a lower intensity and work towards 2-3 sets of 8-12 reps of strengthening exercises
- Avoid excessive bending or twisting
- Balance training is an important part of exercising.

When to contact a healthcare professional:

Falls prevention is an important part of osteoporosis treatment. If you have experienced falls/ multiple falls in the recent past. Contact your physiotherapist to undergo a comprehensive falls assessment.

(Fragala et al., 2019)

Figure 2.13. Information on Osteoporosis

Ostomy bag

Definition: A ostomy is a surgically procedure that creates a stoma. The stoma passes bodily waste into an external bag.

Key consideration when exercising:

- Participants should empty ostomy bags before exercising
- Optimizing hydration during and after exercising is essential for those with an ileostomy.
- Resistance exercises should be progressed slowly, starting with low resistance. A healthcare professional should direct this.
- Avoid core exercises that cause extensive intra-abdominal pressure.

When to contact a healthcare professional: if you experience complications contact your GP for further examination.

(Campbell et al., 2019)

Figure 2.14. Information on the Ostomy bag

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Peripheral neuropathy

Definition: nerves located outside the spine cord in the body's extremities are damaged. Symptoms can include pain, sensory loss and motor loss.

Key consideration when exercising:

- Rather than walking an alternative aerobic exercise such as stationary bike

During resistance training

- Monitor discomfort in hands when using weights
- Use dumbbells with rubber coating
- Consider resistance machines over free weights.

When to contact a healthcare professional:

If you experience peripheral neuropathy a fall assessment by a physiotherapist is indicated.

If experiencing significant pain contact your GP.

(Campbell et al., 2019)

Figure 2.15. Information on Peripheral Neuropathy

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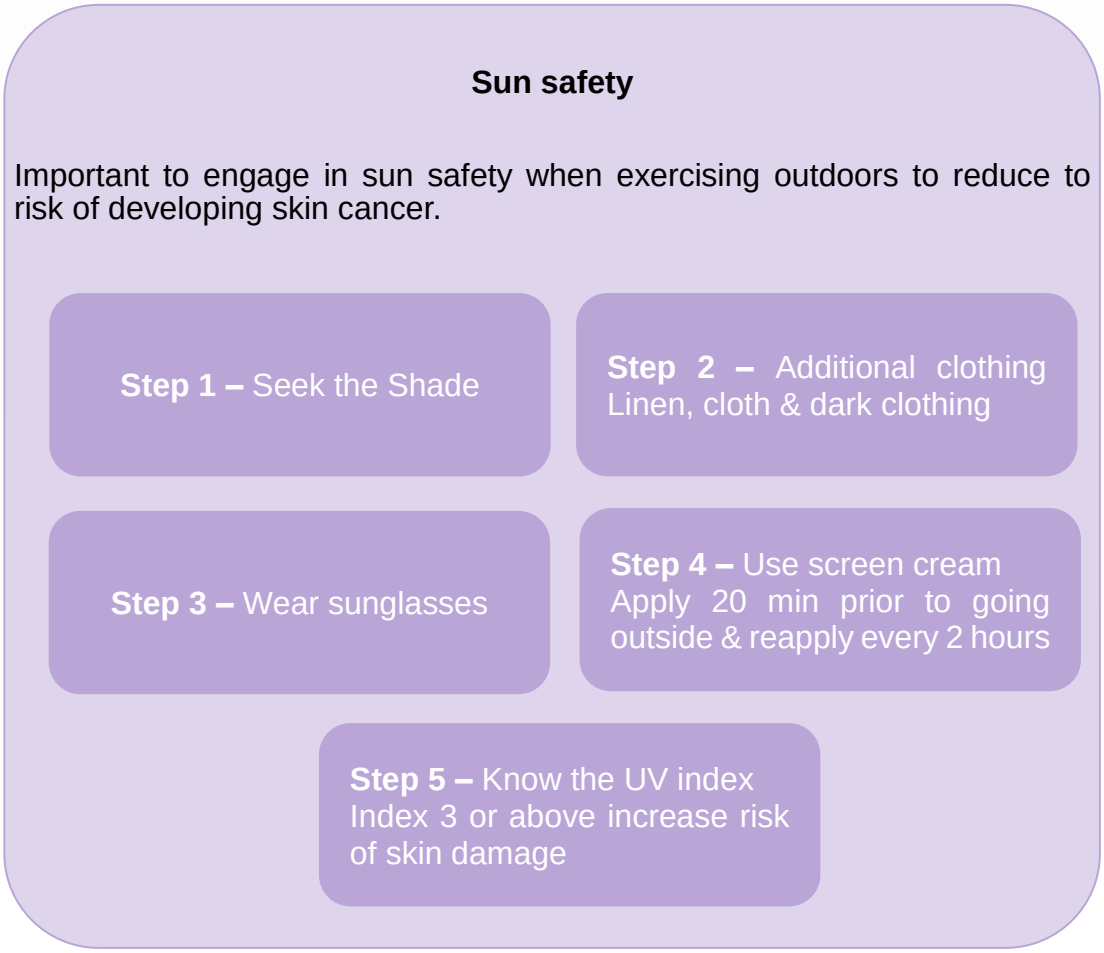

Figure 2.16. Page on sun safety

Information - Pelvic floor dysfunction

Bladder, anal, gynaecological, and prostate cancer can lead to individuals experiencing pelvic floor dysfunction. Surgical procedures and adjuvant therapies may impact the pelvic floor (Bernard et al., 2016, Rutledge et al., 2010). Additionally, it is estimated that 20-40% of older women can experience urinary incontinence (Rocha et al., 2018). This, in turn, is a barrier for individuals to engage in physical activity (Nygaard et al., 2005).

Pelvic floor exercises should be used for the prevention of symptoms. If the participant has any symptoms, they are guided to consult their physiotherapists or physician.

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Urinary incontinence

Definition: is the unintentional passing of urine. There are several different types including stress, overflow, urge and continuous.

Pelvic floor training is effecting is curing and improving symptoms. These exercises are described in the exercise sections of the app.

Lifestyle advice:

- Keeping a fluid diary
- Caffeine reduction
- Bladder training
- Distraction

When to contact a healthcare professional:

Ongoing issues with urinary incontinence contact a women's/men's health physiotherapist who will be able to provide a comprehensive assessment and tailored treatment programme.

(Dumoulin et al., 2018)

Figure 2.17. Information on urinary incontinence

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6.4 Components of the exercise programme

Warm-up phase (Duration 5-10 mins)

- Light aerobic activity i.e., marching on spot
- Light stretching, targeting muscles and joints involved in the training programme
- Range of motion (ROM) exercises i.e., targeting shoulder
- Diaphragmatic breathing

Specific phase

Aerobic exercises (Duration 30-60 mins)
Examples i.e., walking, cycle

- At 50-90% maximum heart rate or using the Borg scale 12-14 or 'somewhat hard'.
- Can be performed continuously or intermittently.

Resistance exercises
Exercises targeting upper and lower limb
8-10 different exercises with 2 mins rest in between
1-4 sets per muscle group at 50-80% 1-reptitions maximum (1RM)

Balance exercises
Examples i.e., single leg stance, tandem stances etc.
Perform 2-3 exercises

Flexibility exercises
Include upper and lower limb flexibility exercises
4 sets per major muscle group holds up to 60 seconds

Cool down phase

- Slow walking to reduce heart rate
- Diaphragmatic breathing

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Level	Description
Category 1: Inactive	The lowest level of physical activity Individuals who do not meet the criteria for categories 2 or 3 are considered insufficiently active
Category 2: Minimally Active	Considered sufficiently active and is any one of the following: • 3 or more days of vigorous activity of at least 20 minutes per day OR • 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day OR • 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities, achieving a minimum of at least 600 MET-min/week. Achieving one of the above criteria would be considered minimally active
Category 3: HEPA	It is defined as an individual exceeding minimal physical activity recommendation. Two criteria for classification: a) Vigorous-intensity activity on at least 3 days achieving a minimum of at least 1500 MET-minutes/week OR b) 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week

Table 2.9. Descriptions of the fitness levels determined by the IPAQ-SF questionnaire

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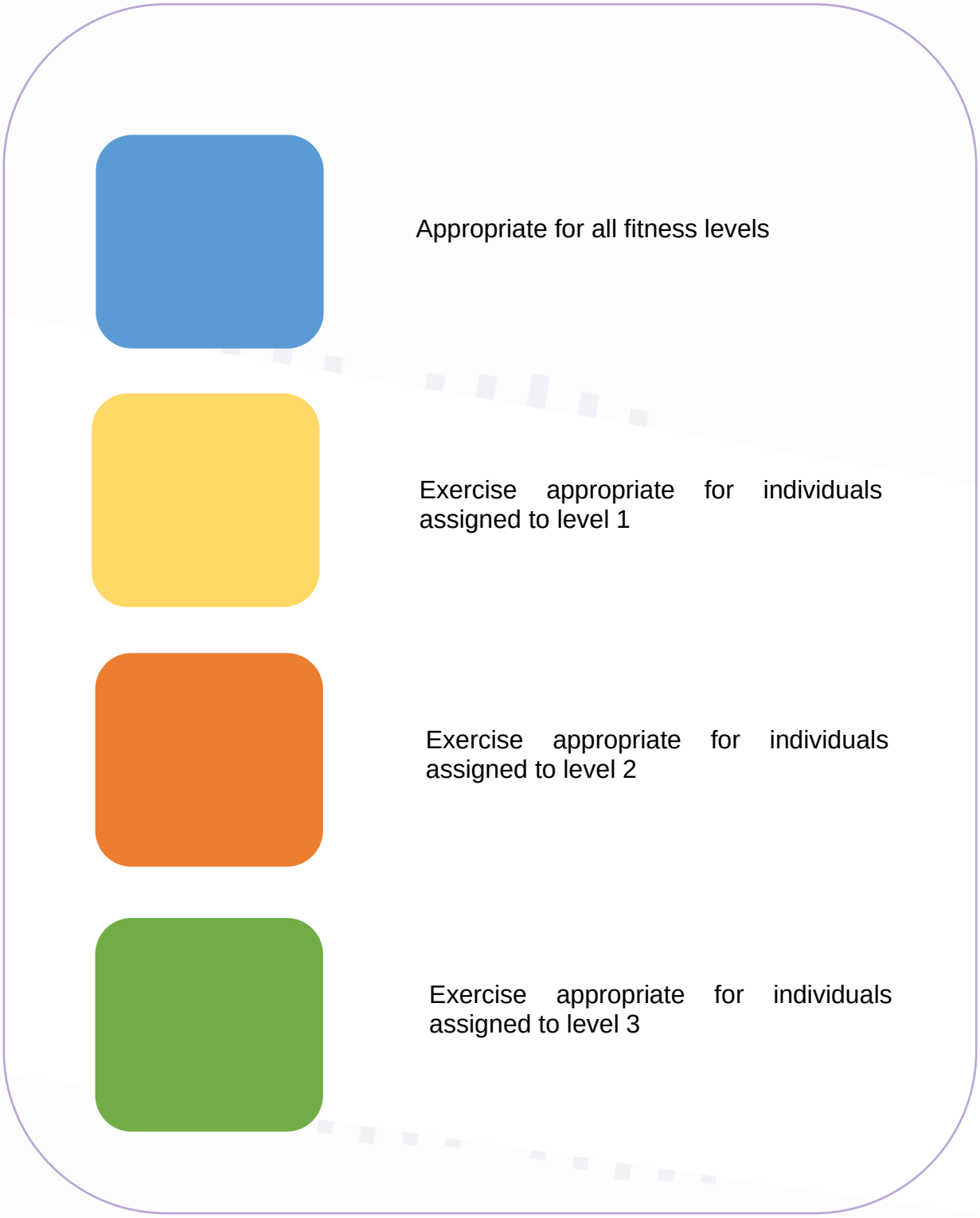

Figure 2.18. Three different fitness levels

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6.4.1 Warm-up phase

Range of motion (ROM) & stretching exercises

Shoulder shrugs

Perform: 3 times up and down

Instruction: Slowly lift your shoulder towards your ears then lower them down.

Shoulder circles

Perform: 3 times

Instruction: Move your shoulders round in a circular motion, then repeat movement in a forward direction.

Head turns

Perform: 3 times each side

Instruction: Turn your head to the right. Bring your head back to center, then turn to the left side.

Head side bends

Perform: 3 times each side

Instruction: Bend your head down to your right shoulder. Bring your head back to centre. Repeat to the left side.

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Ankle circles

Perform: 3 times each foot

Instruction: Lift left foot off ground or place tie-tops on ground and rotate your ankle in circles motion. Repeat using left foot.

Trunk twists

Perform: 3 times each side

Instruction: Turn your shoulders, arm and head around to the right-side twisting from the waist. Come back to centre. Repeat to left side.

Precaution: Individuals diagnosed with osteoporosis don't overly twist on each turn

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6.4.2 Aerobic exercises

Using the Modified Borg scale of perceived exertion (see Figure 2.1), targeting between 4 and 5.

Knee lifts

Perform: Up to 1 minute

Instruction: Lift one knee up to towards your chest. Repeat using the opposite knee.

Heel taps forwards

Perform: Up to 1 minute

Instruction: Tap one heel in front of you. Place foot back together and repeat with other leg.

Side-ways foot taps

Perform: Up to 1 minute

Instruction: Tap one foot out to the side. Place foot back together and repeat with other leg.

Toe taps behind

Perform: Up to 1 minute

Instruction: Tap one foot out behind and tap your foot on the floor. Bring your foot back to the middle and repeat with other leg.

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6.4.3 Specific phase

Aerobic exercises

Walking

- Aim to reach a walking pace that makes participants moderately out of breath using the Borg scale (Figure 2.1).
- Participants can take regular breaks if required.
- If participants use a walking aid, encourage them to use it during this phase of the session.

Precautions for participants engaging in walking diagnosed with pelvic, lumbar, proximal femur or all region metastases of the bone. Alternatives include cycling.

Instruction: Aim to walk briskly for 10 minutes at first	Instruction: Increase pace and distance achieved	Instruction: Increase pace and distance achieved

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Marching on spot

Precautions for participants engaging in marching on the spot diagnosed with pelvic, lumbar, proximal femur or all region metastases of the bone. Alternatives include cycling.

Instruction: March on the spot	Instruction: Add arm swings	Instruction: Increase the time spend marching OR Increase your speed when you march

Jumping jacks/ star-jacks

Precautions for participants engaging in jumping jacks/star-jacks diagnosed with pelvic, lumbar, proximal femur or all region metastases of the bone. Alternatives include cycling.

Instruction: Bring your right leg out to the side. Bring your leg back to the middle. Repeat with your left leg.	Instruction: Raise your right arm out to the side at the same time you bring your leg out. Bring your leg and arm back to the center and repeat on the opposite side.	Instruction: Raise both your arms and legs out to the side at the same time. Bring your legs and arms back to centre. Repeat.

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Jogging

Precautions for participants engaging in jogging diagnosed with pelvic, lumbar, proximal femur or all region metastases of the bone. Alternatives include cycling.

Not appropriate	Not appropriate	Instruction: Start with 10 minutes at first. Gradually increase time.

Lower limb strengthening exercises

Squats

Perform: 10-15 repetitions (reps) x 1 sets Instruction: Stand with feet slightly apart with your hands resting on a bench or perform with a partner and hold hands when performing exercise. Bend your knees with your back straight. Return to starting	Perform: 10-15 reps x 2 sets Instruction: Don't use support. Try to bend your knees deeper and hold to up to 5 seconds.	Perform: 8-12 reps x 3 sets Instruction: Use a weight when performing the exercise e.g., a water bottle. OR Hold up to 10 seconds.

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Hip abduction

Perform: 10-15 reps x 1 sets Instruction: Stand with your hands resting on bench or perform with a partner and hold hands when performing exercise. Lift one leg out to the side, don't rotate your hips, ensuring your toes are facing forward. Return to starting position. Repeat using opposite leg.	Perform: 10-15 reps x 2 sets Instruction: Doesn't require arm support, place hands on hips. Increase reps performed on each leg.	Perform: 8-12 reps x 3 sets Instruction: Doesn't require arm support, place hands on hips. Hold leg out to the side for up to 10 seconds.

Hip extension

Participants diagnosed with pelvic metastasis should avoid hip extension exercises, alternative exercises include knee flexion in standing following the same repetitions & sets.

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Perform: 10-15 reps x 1 sets Instruction: Stand with your hands resting on bench or perform with a partner and hold hands when performing exercise. Lift one leg behind keep body upright and leg straight. Return leg back down. Repeat using opposite leg	Perform: 10-15 reps x 2 sets Instruction: Doesn't require arm support, place hands on hips. Increase reps performed on each leg.	Perform: 8-12 reps x 3 sets Instruction: Doesn't require arm support, place hands on hips. Hold leg out to the side for up to 10 seconds.

Heel raises

Perform: 10-15 reps x 1 sets Instruction: Place hands on a bench or perform with a partner and hold hands when performing exercise. Rise up onto your tiptoes, the slowly lower down. Repeat.	Perform: 10-15 reps x 2 sets Instruction: Doesn't require arm support, place hands on hips. Increase reps perform on each leg.	Perform: 8-12 reps x 3 sets Instruction: Doesn't require arm support, place hands on hips. Stand on one leg at a time.

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Lunges

Perform: 10-15 reps x 1 sets Instruction: Stand with your feet hip width part, keeping your back straight, shoulders back and abdominal tight. Take a step forward and slowly bend both knees. Stand back up and repeat the movement. Complete exercise on opposite leg.	Perform: 10-15 reps x 2 sets Instruction: Using a weight or water bottle in arms when performing exercise	Perform: 8-12 reps x 3 sets Instruction: Using a weight & hold position for up to 10 secs when knees are bend.

Side way lunges

Perform: 10-15 reps x 1 sets Instruction: Stand with your feet hip width part. Step out to the side and transfer you weight to that leg. Use your lead foot to push you back to the starting position. Repeat exercise on opposite leg.	Perform: 10-15 reps x 2 sets Instruction: Using a weight or water bottle in arms when performing exercise	Perform: 8-12 reps x 3 sets Instruction: Using a weight & holding position for up to 10 secs when knees are bend.

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Standing leg curls

Perform: 10-15 reps x 1 sets Instruction: Stand with your feet hip width part. You can perform with a bench in front for support or hold hands with a partner. Bend your knee towards your buttom. Lower your leg back to the starting position. Repeat on the opposite leg	Perform: 10-15 reps x 2 sets Instruction: Perform exercise unsupported	Perform: 8-12 reps x 3 sets Instruction: Hold weights in both arms and perform exercise OR Hold leg in a bent position for up to 10 secs

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Bicep curls

Individuals diagnosed with lymphedema are recommended to wear compressing garments when performing upper limb exercises.

Perform: 10-15 reps x 1 sets Instruction: In standing position bend both elbows towards shoulders. Slowly straighten your arms. Repeat.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle OR Lower your arms in stages as you count up to five.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle OR Lower your arms in stages as you count to ten.

Bilateral triceps extension

Perform: 10-15 reps x 1 sets Instruction: In standing position with both elbows flexed. Fully extend elbows. Repeat.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle OR When returning elbows to a flexed position count up to five.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle OR When returning elbows to a flexed position count up to ten.

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Unilateral triceps extension (overhead)

Perform: 10-15 reps x 1 sets Instruction: In standing position with shoulder and elbow flexed. Fully extend the elbow. Repeat exercise on opposite arm.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle.

Upright rows

Participants diagnosed with thoracic spine, rib bone or all region metastasis should avoid shoulder abductions. Alternative exercises include triceps extensions or bicep curls.

Perform: 10-15 reps x 1 sets Instruction: In standing position bend elbows out to the side, raise both your arms up to your shoulders and down again. Repeat.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle OR Lower your arms in stages as you count to four.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle OR Lower your arms in stages as you count up to ten.

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Arm punches

Participants diagnosed with thoracic spine, rib bone or all region metastasis should avoid shoulder flexion. Alternative exercises include triceps extensions or bicep curls.

Perform: 10-15 reps x 1 sets

Instruction: In standing position. Straighten arms out in front of you. Bring your hand back to your chest.

Repeat.

Perform: 10-15 reps x 2 sets

Instruction: Using a weight e.g., water bottle.

Perform: 8-12 reps x 3 sets

Instruction: Using a weight e.g., water bottle.

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Arm circles

Participants diagnosed with thoracic spine, rib bone or all region metastasis should avoid shoulder abduction. Alternative exercises include triceps extensions or bicep curls.

Perform: 10-15 reps in each direction x 1 sets Instruction: In a standing position bring your arms out to the side in line with your shoulders. Circle your arms in a backward direction. Repeat the exercise bringing your arms in a froward direction.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle.

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Lateral arm raises

Participants diagnosed with thoracic spine, rib bone or all region metastasis should avoid shoulder abduction. Alternative exercises include triceps extensions or bicep curls.

Perform: 10-15 reps in each direction x 1 sets

Instruction: In a standing position, maintaining head and neck position. Abduct both shoulders until horizontal (with thumbs pointing up).

Return to starting position.

Repeat.

Perform: 10-15 reps x 2 sets

Instruction: Using a weight e.g., water bottle

OR

Lower your arms in stages as you count up to five.

Perform: 8-12 reps x 3 sets

Instruction: Using a weight e.g., water bottle

OR

Lower your arms in stages as you count up to ten.

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Forward arm raises

Participants diagnosed with thoracic spine, rib bone or all region metastasis should avoid shoulder flexion. Alternative exercises include triceps extensions or bicep curls.

Perform: 10-15 reps in each direction x 1 sets

Instruction: In a standing position, maintaining head and neck position. Abduct both shoulders until horizontal (with thumbs pointing up).

Repeat.

Perform: 10-15 reps x 2 sets

Instruction: Using a weight e.g., water bottle

OR

Lower your arms in stages as you count up to five.

Perform: 8-12 reps x 3 sets

Instruction: Using a weight e.g., water bottle

OR

Lower your arms in stages as you count up to ten.

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Push up using wall or bench

Participants diagnosed with thoracic spine, rib bone or all region metastasis should avoid shoulder flexion. Alternative exercises include triceps extensions or bicep curls.

Perform: 10-15 reps in each direction x 1 sets Instruction: In a standing position, feet shoulder width apart. Leaning slightly against the wall with outstretched arms. Move the body slowly towards the wall, bending the arms and elbows and push out the body. Repeat.	Perform: 10-15 reps x 2 sets Instruction: Returning to the starting position on a count of 5 secs.	Perform: 8-12 reps x 3 sets Instruction: Returning to the starting position on a count of 10 secs.

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Core strengthening exercises

Participants diagnosed with spinal metastasis should avoid spinal flexion, extension and rotation.

Standing crunches (knee to elbow)

Perform: 10-15 reps in each direction x 1 sets Instruction: In a standing position with feet hip width apart & place your hands behind your head. Crunch your left elbow down towards the left side of your body while bringing your left knee towards your elbow. Repeat on the opposite side.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle.

Modification for participants diagnosed with thoracic spine, rib bone or all region metastasis that should avoid shoulder flexion or abduction should perform the exercise with arms on their hips.

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Bicycle crunches

Perform: 10-15 reps in each direction x 1 sets Instruction: In a standing position, with feet hip width apart & place your hands behind your head. With your shoulders abducted and elbows flexed. Bend you left knee and bring it to meet your left elbow, twisting at the core. Alternate sides, crunching your right elbow towards your left knee. Repeat.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle.

Modification for participants diagnosed with thoracic spine, rib bone or all region metastasis that should avoid shoulder flexion or abduction should perform the exercise with arms on their hips.

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Standing side reaches

Perform: 10-15 reps in each direction x 1 sets Instruction: In a standing position with feet shoulder width apart. Place your right hand on the back of your head. Start with moving your torso down towards the left, resulting in your right elbow reaching up towards the sky, while your left hand reaches down towards the ground. Repeat exercise on opposite side.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle.

Modification for participants diagnosed with thoracic spine, rib bone or all region metastasis that should avoid shoulder flexion or abduction should perform the exercise with arms on their hips.

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Woodchopper

Perform: 10-15 reps in each direction x 1 sets Instruction: In a standing position, with feet shoulder width apart. Slightly bend your knee. Rotate your torso to the left, raises your arms towards the sky. Then squat and rotate your torso to the right and bring your arms across your torso down to the ground. Repeat exercise on opposite side.	Perform: 10-15 reps x 2 sets Instruction: Using a weight e.g., water bottle OR Lower your arms in stages as you count to four.	Perform: 8-12 reps x 3 sets Instruction: Using a weight e.g., water bottle OR Lower your arms in stages as you count to ten.

Modification for participants diagnosed with thoracic spine, rib bone or all region metastasis that should avoid shoulder flexion or abduction should perform the exercise with arms on their hips.

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Progressing strengthening exercises

A resistance training program for older adults should be individualized and aiming to achieve 2-3 sets of 1-2 multi-joint exercises per major muscle group. The intensities of each exercise should achieve 70-85% of 1 RM, 2-3 times per week (Fragala et al., 2019).

The physiotherapist can progress the exercises by altering different variants:

- Sets: Beginners shoulder perform 1 set and progress to multiple sets per exercise.
- Reps: Beginners shoulder perform 10-15 reps at a lower resistance. Healthy older adults should be aiming to perform 6-12 reps.
- Intensity: Start with intensities that individuals can tolerate and gradually progress to 70-85% of 1RM.
- Exercise selection: Should be aiming to perform 8-10 exercises that targets multi-joint movements.
- Frequency: Aim to perform strengthening exercise 2-3 times per week on non-consecutive day per week.

The ASCM guidelines have detailed how to progress strengthening exercises effectively detailed in Table 2.7.

	Novice	Intermediate	Advanced
Exercise selection	Single & multiple-joint	Single & multiple-joint	Single & multiple-joint with multi-emphasis
Exercise order	Large < small muscles Multi < single High < low intensity	Large < small muscles Multi < single High < low intensity	Large < small muscles Multi < single High < low intensity
Loading	60-70% 1 RM	70-80% 1 RM	70-100% 1 RM
Volume	1-3 x 8-12 reps	Multi sets x 6-12 reps	Multi sets 1-12 reps

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Rest intervals	1-2 min	2-3 min for core 1-2 min for others	~ 3 mins for core 1-2 min for other
Velocity	Slow to moderate	Moderate	Slow to fast
Frequency	2-3 d.wk $^{-1}$	2-4 d.wk $^{-1}$	4-6 d.wk $^{-1}$

Table 2.10. ACSM recommendation for progression of strength exercises

< indicates the preceding exercise is to be performed before the next exercise. (Kraemer and Ratamess, 2004).

Balance and coordination exercises

Backwards walking

Perform: 10 steps x 5 reps

Instruction: In a standing position using a bench for support or a partner to hold hands for support. Walk backwards for 10 steps, turn and walk backwards to the beginning.

Repeat.

Perform: 10 steps x 5 reps

Instruction: In a standing position perform without arm support.

Perform: 10 steps x 5 reps

Instruction: In a standing position perform without arm support.

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Tandem walking (forwards and backwards)

Perform: 10 steps x 5 reps Instruction: In a standing position using a bench for support or a partner to hold hands for support. Place one foot in front of the other foot in a straight line. Take 10 step forward. Repeat exercise walking backwards.	Perform: 10 steps x 5 reps Instruction: In a standing position perform without arm support.	Perform: 10 steps x 5 reps Instruction: In a standing position perform without arm support.

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One leg stance

Perform: 10 seconds on each leg x 5 reps Instruction: In a standing position using a bench for support or a partner to hold hands for support. Stand on one leg. Try to hold this position for 10 seconds. Repeat.	Perform: 10 seconds on each leg x 5 reps Instruction: In a standing position perform without arm support. Stand on one leg. Try to hold position for 10 seconds. Repeat.	Perform: 15 seconds on each leg x 5 reps Instruction: In a standing position perform without arm support. Try to hold position for 15 seconds. Repeat.

Heel walking

Perform: 10 steps x 5 reps Instruction: In a standing position using a bench for support or a partner to hold hands for support. Come up onto your heels. Walk 10 steps. Lower your toes to the ground and turn around. Repeat.	Perform: 10 steps x 5 reps Instruction: In a standing position perform without arm support.	Perform: 10 steps x 5 reps Instruction: In a standing position perform without arm support.

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Tip Toe walking

Perform: 10 steps x 5 reps Instruction: In a standing position using a bench for support or a partner to hold hands for support. Come up onto your toes. Walk 10 steps. Lower your heels to the ground and turn around. Repeat.	Perform: 10 steps x 5 reps Instruction: In a standing position perform without arm support.	Perform: 10 steps x 5 reps Instruction: In a standing position perform without arm support.

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6.4.4 Cool down phase

Flexibility exercises

Side stretch

Perform: Hold position up to 30 seconds

Instruction: Stand with feet apart. Reach your right arm up to the ceiling and lean over to the left side. Return to the starting position and repeat with left arm.

Triceps/ shoulder stretch

Perform: Hold position up to 30 seconds

Instruction: Bring your right arm out in front of you then bring it across your body at shoulder height. Use your left arm to squeeze your right arm towards you.

Repeat with left arm.

Chest stretch

Perform: Hold position up to 30 seconds

Instruction: Place hands on lower part of backs. Pull your shoulder back and squeeze your elbows together behind you.

Hamstring stretch

Perform: Hold position up to 30 seconds

Instruction: Place right leg in front of the left leg. The right leg is in a straighten position, the left is in a bent position. Lend your trunk forward.

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Calf stretch

Perform: Hold position up to 30 seconds

Instruction: Place your right leg in front of your left leg in a split stance position. The front leg should be bent while the back leg is in a straighten position.

Quadricep stretch

Perform: Hold position up to 30 seconds

Instruction: If a bench is available move your bottom so your left cheek is one the chair and slide right leg back behind you and your knee is pointing down to the floor.

Repeat with the other leg.

Perform: Hold position up to 30 seconds

Instruction: In a standing position. Use a wall or bench or a partner for support. Bend your right leg up behind you and hold your right ankle with your right hand. Stand in an upright position and hold.

Repeat with the other leg.

Perform: Hold position up to 30 seconds
Instruction: In a standing position with no supports. Bend your right leg up behind you and hold your right ankle with your right hand.

Stand in an upright position and hold.

Repeat with the other leg.

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6.4.5 Additional exercises

Pelvic floor exercises

Bladder, anal, gynaecological, and prostate cancer can lead to individuals experiencing pelvic floor dysfunction. Surgical procedures and adjuvant therapies may also adversely impact the pelvic floor (Bernard et al., 2016, Rutledge et al., 2010).

Additionally, it is estimated that 20-40% of older women can experience urinary incontinence (Rocha et al., 2018). This, in turn, is a barrier for individuals to engage in physical activity (Nygaard et al., 2005).

Pelvic floor muscle training has been deemed effective in curing or improving symptoms of all types of urinary incontinence (Dumoulin et al., 2018).

If participants are experiencing symptoms, it would be recommended that they are advised to attend a physiotherapist with specialized training in pelvic floor health.

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Slow pelvic floor muscle exercise

Perform: 5 second holds
x 10 reps
3 times per week

Instruction: Breathe all the way out before starting.
Tighten your muscles of the back passage (as if to stop passing wind)
Now tighten and lift the muscles at the front (as if to stop passing urine)
Hold both squeezes for 5 second squeezes.
Progress to squeeze for 10 seconds.
After each squeeze, relax for the same amount of time as the squeeze.

Repeat the exercise

Quick holds

Perform: Up to x 20 reps
3 times per week

Instruction: Breath all the way out before you start

Quickly, pull up the front and back passages in a strong and quick lift.

Relax and repeat the squeeze up to 20 times.

Diaphragmatic breathing

Deep diaphragmatic breathing is an effective treatment tool for all types of lymphedemas. This encourages lymph to flow back into the blood system (Zuther).

Deep diaphragmatic breathing in combination with progressive resistance training as an effective treatment for individuals with lymphedema (McClure et

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al., 2010). Diaphragmatic breathing exercises can be performed before and after exercising.

Perform: x 5 reps

Instruction: Place one hand on your tummy below your ribs.
Relax your shoulder.
Take slow, deep, comfortable breaths in through your nose, feeling your hand rise as your tummy raises.
Then slowly breathe out through your mouth.

Repeat.

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7. Chapter 3

Good practices of practicing CPPA exercises by adults and senior citizens within PUGS.

Physical inactivity is responsible for over 5 million premature deaths every year. Around 20% of adults and 80% of adolescents are insufficiently physically active. Women are less active than men, and inactivity is higher in older age groups and in high-income countries (Hallal et al., 2012).

There has been clear evidence for the benefits of physical activity for health for decades, but few countries have been successful at increasing population levels of activity, and physical inactivity is still a leading risk factor for premature mortality worldwide. Achieving a breakthrough requires a systems approach that combines individual-level behaviour change approaches with upstream policy actions to focus on populations, the drivers of physical activity and inactivity and the interactions between them across complex systems (Kohl et al., 2012).

Physical inactivity is a global challenge and, recognizing this, World Health Organization has specified priority areas for Member States to increase population physical activity in the Global Action Plan for Physical Activity[1], which was launched in 2018 and followed the development of a Physical Activity Strategy for the WHO European Region in 2015 (Organization, n.d.). Within the EU, an expert group developed the EU Physical Activity Guidelines in 2008 (Andersen et al., 2008) which led to the official adoption of the Council of EU Recommendation on promoting health-enhancing physical activity across sectors in 2013 (Council, 2014). In the Recommendation, the Council recognized the need for more data related to HEPA to support policy making across the region

[1] World Health Organization, “Global action plan on physical activity 2018–2030: more active people for a healthier world”, World Health Organization, 1 June 2018, https://www.who.int/publications/i/item/9789241514187

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and proposed a monitoring framework based on the EU PA guidelines that included 23 indicators covering different themes relevant to HEPA promotion in the EU context. Useful data on the status of art of many indicators in Europe can be found on the European Health Information Gateway (who.int)[2].

The 23 indicators of the HEPA monitoring framework.

Thematic areas	Indicators	
International PA recommendations and guidelines	Indicator 1	National recommendations on physical activity for health
	Indicator 2	Adults reaching the minimum WHO recommendation on physical activity for health
	Indicator 3	Children and adolescents reaching the minimum WHO recommendation on physical activity for health
Cross-sectoral approach	Indicator 4	National government coordination mechanism and leadership on HEPA promotion
	Indicator 5	Funding allocated specifically to HEPA promotion
Sport	Indicator 6	National Sport for All policy or action plan
	Indicator 7	Sport Clubs for Health Programme
	Indicator 8	Framework to support offers to increase access to exercise facilities for socially disadvantaged groups
	Indicator 9	Target groups addressed by the national HEPA policy
Health	Indicator 10	Monitoring and surveillance of physical activity
	Indicator 11	Counselling on physical activity
	Indicator 12	Training on physical activity in the curriculum of health professionals
Education	Indicator 13	Physical education in primary and secondary schools
	Indicator 14	Schemes for school-related physical activity promotion
	Indicator 15	HEPA in training of physical education teachers
	Indicator 16	Schemes promoting active travel to school
Environment, urban planning, and public safety	Indicator 17	Level of cycling and walking
	Indicator 18	European guidelines for improving infrastructure for leisure-time physical activity
Working environment	Indicator 19	Schemes to promote active travel to work
	Indicator 20	Schemes to promote physical activity at the workplace
Senior citizens	Indicator 21	Schemes for community interventions to promote physical activity in older adults
Indicators evaluation	Indicator 22	National HEPA policies that include a plan for evaluation
Public awareness	Indicator 23	National awareness raising campaign on physical activity

PA: physical activity; WHO: World Health organization; HEPA: health-enhancing physical activity.

Figure 3.1. The 23 indicators of the HEPA monitoring framework

The aim of Chapter 3:

- Describe effective HEPA methodologies and physiotherapist practices for cancer prevention implemented within PUGS.

7.1 Health enhancing physical activity

HEPA stands for 'Health Enhancing Physical Activity' and simply refers to any physical activity that aims to promote lifelong engagement with different practices that develop health. Physical activity can be described as any bodily movement produced by skeletal muscles that requires energy expenditure (WHO, 2017). As

[2] World Health Organization European Region, "Health-enhancing physical activity", World Health Organization European Region, 31 January 2023, https://gateway.euro.who.int/en/datasets/hepa/

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such, physical activity incorporates both exercise and sport. Therefore, examples of HEPA range from gardening to playing table tennis, from hiking to open water swimming, and from a brisk walk to running 5K. Health can generally be described as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1948).

7.1.1 HEPA research across the history

One of the very first attempts in history to consider PA as therapeutic was made by an Indian physician, Sushruta in 600 BC, who was the first to prescribe exercise for health. He referred patients to exercise because "it made the body stout, strong, firm, compact, and light, enhanced the growth of limbs and muscles, improved digestion and complexion, prevented laziness, and reduced senility". Later, Hippocrates from 460 to 370 BCE said "eating alone will not keep a man well, he must also take exercise."

Historically, patients with cancer were recommended to rest and avoid strenuous activity following their diagnosis. Ewing in 1911 noted that the poor people did not develop cancer, which tended to victimize wealthy individuals. The main causes were found to be in two main differences between poor and rich people lifestyle: food and sedentary life which both led to obesity. Siversten and Dahlstrom in 1921 noted: "Human carcinoma may be the reaction to and result of chronic irritation of adult epithelial tissue bathed in body fluids altered by certain metabolic products as a result of deficient muscular activity."

The rest in cancer dogma has changed markedly over the last 20 years as exercise intervention studies and physical activity initiatives have gained widespread acceptance and popularity. Indeed, it was not until the mid-to-late 1980s that Mary MacVicar and Maryl Winningham conducted the pioneering work comprising the first randomized trial in patients with breast cancer exploring exercise training as a supportive care strategy during chemotherapy (MacVicar,

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1989), and this work is today considered the origin of the modern exercise oncology research field.

Today we can consider three main sources for the modern approach to PA in Cancer and these are the papers:

- Exercise Is Medicine in Oncology: Engaging Clinicians to Help Patients Move Through Cancer (Schmitz et al., 2019);
- American College of Sports Medicine Roundtable Report on Physical Activity, Sedentary Behavior, and Cancer Prevention and Control (Patel et al., 2019);
- Exercise Guidelines for Cancer Survivors: Consensus Statement from International Multidisciplinary Roundtable (Campbell et al., 2019).

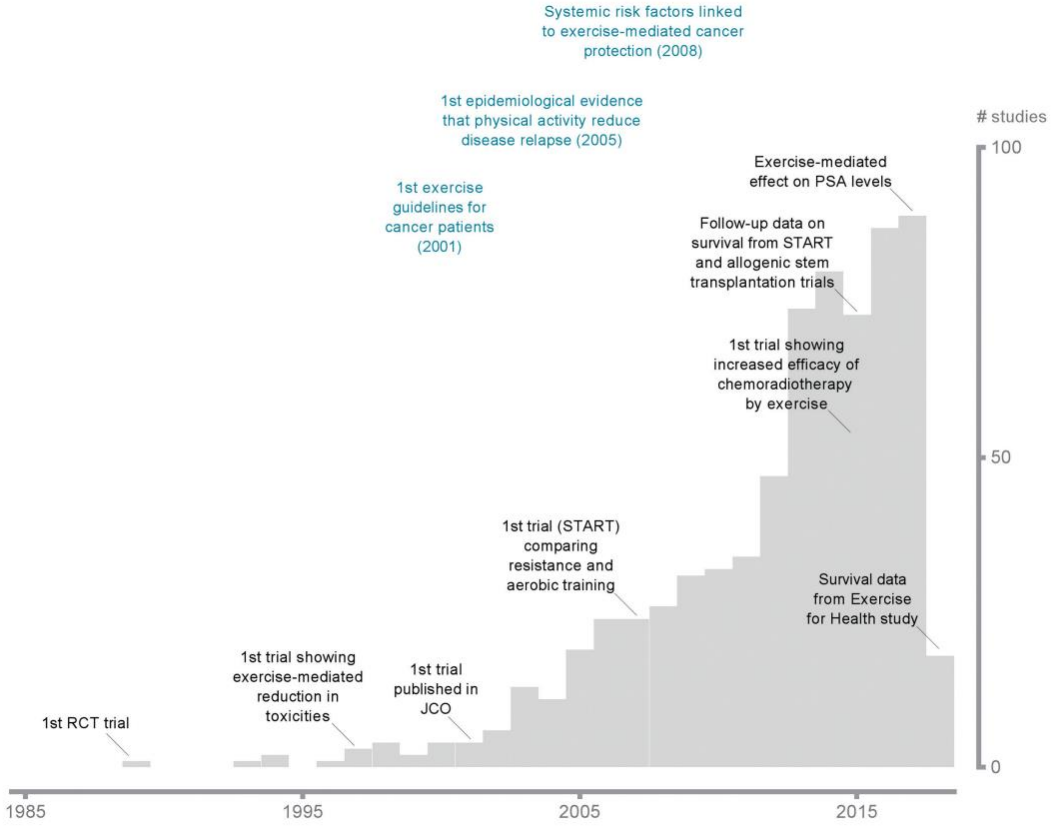

Figure 3.2. Historic overview of exercise intervention studies in cancer patients.

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7.1.2 HEPA effects on health

There are many well documented benefits for the overall population associated with HEPA, many of them specifically benefit the domain of cancer, from prevention to advanced stage of the illness. In our research we found also important the correlation between HEPA and Public Urban Green Spaces.

Exercise volume often decreases during cancer treatment and may not return to prediagnosis volume after completing treatment (Chung et al., 2013; Ferriolli et al., 2012). In a nationally representative sample of cancer survivors, only 8% engaged in 150 min · wk−1 of moderate-to-vigorous intensity exercise (Thraen-Borowski et al., 2017). A similar study demonstrated that breast cancer survivors engaged in a daily average of 1 min of moderate-to vigorous intensity exercise, spending most of their day in sedentary (66%) or light intensity activities (33%) (Lynch et al., 2010). Consequently, there are significant opportunities to utilise exercise as a therapeutic modality to improve numerous outcomes in cancer survivors (Brown & Ligibel, 2017). Also, more than 60% of cancer survivors are ≥65 years (Bluethmann et al., 2016) and will often have other preexisting health conditions, such as cardiovascular diseases (CDV), type 2 diabetes mellitus (T2DM), arthritis, and obesity (Greenlee et al., 2016).

The combined result of cancer-related side effects, ageing, and other health conditions often manifest as impaired cardiovascular fitness, functional limitations, and reduced quality of life in cancer survivors (Petrick et al., 2014). Therefore, promoting exercise without creating unnecessary barriers to participation is of critical importance in cancer survivors (Franklin, 2014; Kenjale et al., 2014). Exercise is safe for almost everyone, including most cancer survivors, and the health benefits of exercise outweigh the risks for most people (Piercy et al., 2018).

Cancer survivors derive a variety of physiological and quality of life benefits from exercise. Meta-analyses and systematic reviews of exercise intervention trials in

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individuals with cancer during and after treatment demonstrate that aerobic exercise during and after cancer treatment increases cardiovascular fitness (Scott et al., 2018), and resistance exercise during and after cancer treatment increases upper and lower extremity muscular strength, and increases lean body mass (Strasser et al., 2013), with data suggesting that supervised exercise improves these outcomes more than unsupervised exercise (Sweegers et al., 2019). Additionally, more limited evidence suggests that combined resistance and higher impact (e.g., jumping, hopping, skipping) activities may have a subtle osteogenic effect on bone mineral density (BMD) of the lumbar spine (Dalla Via et al., 2018).

Many studies have also evaluated the effect of exercise on quality of life and related outcomes in cancer survivors. Meta-analyses have demonstrated that exercise interventions reduce fatigue and depression during and after cancer treatment and also improve quality of life and reduce sleep disturbance after cancer treatment (Cramp & Byron-Daniel, 2012; Mishra et al., 2012).

Again, studies suggest that both supervised and unsupervised interventions can be effective. However, supervised tends to yield greater improvements (Brown et al., 2012; Buffart et al., 2017) and also show that higher levels of baseline fatigue and other symptoms predict larger benefits from exercise interventions (Buffart et al., 2017; Sweegers et al., 2019). Here a synthesis of the such benefits (Piercy et al., 2018):

- Lower the risk of all-cause mortality,
- Lower the risk of cardiovascular disease mortality,
- Lower the risk of cardiovascular disease (including heart disease and stroke),
- Lower the risk of hypertension,
- Lower the risk of type 2 diabetes,
- Lower the risk of adverse blood lipid profile,
- Lower the risk of cancer of the bladder, breast, endometrium, oesophagus, kidney, lung and stomach,

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- Improves cognition,
- Reduced risks of dementia (Alzheimer included),
- Improved quality of life,
- Reduced Anxiety,
- Reduced risks of depression,
- Improved sleep,
- Slowed or reduced weight gain,
- Weight loss (in particular if combined with reduced calories intake),
- Prevention of weight regain following initial weight loss,
- Improved bone health,
- Improved physical functions,
- Lower risks of falls (older adults),
- Lower risks of fall-related injuries (older adults),
- For pregnant women, reduced risk of excessive weight gain, gestational diabetes, and post-partum depression,
- For people with various chronic medical conditions, reduced risks of all-cause and disease-specific mortality, improved physical functions and improved quality of life.

Speaking about PUGS, it is demonstrated that the use of them is beneficial to people's health, physically, socially, and mentally. "Urban green spaces" (UGS) are considered as urban spaces covered by vegetation of any kind. This includes smaller green space features (such as street trees and roadside vegetation); green spaces not available for public access or recreational use (such as green roofs and facades, or green space on private grounds); and larger green spaces that provide various social and recreational functions (such as parks, playgrounds, or greenways) (World Health Organization Regional Office for Europe. Urban Green Space Interventions and Health; WHO Regional Office for Europe: Copenhagen, Denmark, 2017).

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There are areas with lack of PUGS since the urbanisation causes a decrease in per capita space and thereby a loss of per capita UGS (James et al., 2009), which furthermore causes a decrease in daily exposure to more natural environments (Barton and Pretty, 2010). Reducing the use of natural environments is often associated with a number of lifestyle diseases such as obesity, diabetes II, osteoporosis and stress-related illnesses such as depression, heart diseases and mental fatigue (Ulrich, 2006; Mitchell and Popham, 2008). In urban areas, where nearly 55% of the world's population is now concentrated, the search for protective factors linked to the living environment is an important issue and green spaces could provide an answer because they have many qualities that enable them to have a positive and convincing effect on people's health. These protective effects have been demonstrated for different types of health outcomes, cancer included.

Also, social contact is to be considered as a mechanism behind the relationship between green space and health (Maas et al., 2009). Based on these findings, UGS is thought to contribute to health, as defined by the World Health Organisation as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO, 2017). The WHO, therefore, encourages local administrators to increase the provision of UGS. However, providing more PUGS is challenging in increasingly dense cities and therefore finding space for new PUGS is often difficult and expensive, especially for larger areas.

Several studies report significant differences in the use of PUGS for different population segments. In a recent review (Hunter, Ruth F et al., 2014), age, gender, education level and health status were found to be significantly associated with differences in use of PUGS. Furthermore, the same study also found that size and distance from the home are associated with differences in use of PUGS; with larger areas closer to home being used more frequently.

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7.1.3 Types of physical activity

It is important to know which type and at what extent cancer patients should exercise, beside this it is less important to differentiate PA exercise by cancer type. In fact, the Consensus Statement from International Multidisciplinary Roundtable (Campbell et al., 2019) stated that the exercise prescriptions could not be further specified by tumour type, phase of treatment or type of treatment due to the lack of sufficient evidence.

The different types of physical activity are the following:

- Aerobic Activity,
- Muscle-Strengthening Activity,
- Bone-Strengthening,
- Balance Activity,
- Multicomponent Physical Activity,
- Absolute Intensity,
- Relative Intensity.

Duration and frequency

Adults with chronic conditions or disabilities, who are able, should do at least 150 minutes (2 hours and 30 minutes) to 300 minutes (5 hours) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) to 150 minutes (2 hours and 30 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Preferably, aerobic activity should be spread throughout the week.

Adults with chronic conditions or disabilities, who are able, should also do muscle-strengthening activities of moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these activities provide additional health benefits.

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When adults with chronic conditions or disabilities are not able to meet the above key guidelines, they should engage in regular physical activity according to their abilities and should avoid inactivity. Adults with chronic conditions or symptoms should be under the care of a health care practitioner. People with chronic conditions can consult a healthcare professional or physical activity specialist about the types and amounts of activity appropriate for their abilities and chronic conditions.

Intensity

The key guidelines discussed in the next section focus on 2 levels of intensity: moderate-intensity activity and vigorous-intensity activity. The intensity of aerobic activity can be tracked in 2 ways–absolute intensity and relative intensity. Absolute intensity is the amount of energy expended during the activity, without considering a person's cardiorespiratory fitness or aerobic capacity. Absolute intensity is expressed in the metabolic equivalent of task (MET) units; 1 MET is equivalent to the resting metabolic rate or the energy expenditure while awake and sitting quietly. Moderate-intensity activities have a MET value of 3 to 5.9 METs; vigorous-intensity activities have a MET value of 6 or greater.

Examples of moderate-intensity activities (defined using absolute intensity)	Examples of vigorous intensity activities
• Walking briskly at 2.5 to 4.0 mph • Playing volleyball • Raking the yard	• Jogging • Running • Carrying heavy groceries • Participating in a strenuous fitness class

Table 3.1. Examples of moderate-intensity and of vigorous intensity activities

Some activities, such as swimming or riding a bicycle, can be either moderate or vigorous intensity, depending on the effort. Light-intensity physical activity, such as walking slowly at 2 mph or less or doing light household chores, may also

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provide some health benefits, especially if a person replaces sedentary behaviour with light-intensity activity. However, the greatest benefit occurs when sedentary behaviour is replaced with moderate-to-vigorous physical activity.

In contrast to absolute intensity, relative intensity is the level of effort required to do an activity compared with a person's capacity. For an activity of a given absolute intensity, relative intensity will be higher for a person with lower aerobic capacity than for a person who is more fit. Relative intensity can be estimated using a scale of 0 to 10, where sitting is 0 and the highest level of effort possible is 10. On this scale, moderate-intensity activity is a 5 or 6; vigorous-intensity activity begins at a level of 7 or 8.

When describing physical activity to an individual (such as a patient), the "talk test" is helpful to determine whether an activity is moderate or vigorous intensity. Generally, a person doing moderate-intensity aerobic activity can talk, but not sing, during the activity. A person doing vigorous-intensity activity generally cannot say more than a few words without pausing for a breath.

It takes less time to obtain the same benefit from vigorous-intensity activities than from moderate-intensity activities. For adults, a general rule is that 2 minutes of moderate intensity activity counts the same as 1 minute of vigorous-intensity activity. For example, 30 minutes of moderate-intensity (3-4 METs) activity is roughly the same as 15 minutes of vigorous-intensity (6-8 METs) activity.

Either absolute or relative intensity can be used to monitor progress in meeting the key guidelines described below. Aerobic capacity changes with age, peaking in young adulthood. Because older adults generally have a decreased aerobic capacity compared with younger adults, relative intensity is a better guide for older adults than absolute intensity. Certain activities, such as some types of yoga or tai chi, that are considered light intensity on an absolute scale may be perceived as moderate or vigorous intensity for older adults. Children and adults

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who are inactive or have low fitness levels can also use relative intensity to help determine their level of effort.

Progression and overload

Whether absolute or relative intensity is used to assess level of effort, for anyone beginning physical activity, walking is usually a good first activity because it does not require special skills or equipment and can generally be done indoors or outside. Over time, physical activity will get easier as the body adapts to performing physical activity that is greater in amount or intensity than usual. People should be encouraged to progress to higher levels of physical activity as they become more fit. People can work toward meeting the key guidelines by increasing the amount of time they perform an activity, the intensity of the activity, or the number of times a week they are physically active. Small, progressive changes in activity level and amount help the body adapt to the additional stresses while minimizing the risk of injury. A health professional or physical activity specialist can help tailor physical activity to meet the needs and goals of individuals

Outcome	Aerobic Only	Resistance Only	Combination (Aerobic + Resistance)
Strong Evidence	Dose	Dose	Dose
Cancer-related fatigue	**3x**/week for **30** min per session of moderate intensity	**2x**/week of **2** sets of **12-15** reps for major muscle groups at moderate intensity	**3x**/week for **30** min per session of moderate aerobic exercise, plus **2x**/week of resistance training **2** sets of **12-15** reps for major muscle groups at moderate intensity
Health-related quality of life	**2-3x**/week for **30-60** min per session of moderate to vigorous	**2x**/week of **2** sets of **8-15** reps for major muscle groups at a moderate to vigorous intensity	**2-3x**/week for **20-30** min per session of moderate aerobic exercise plus **2x**/week of resistance training **2** sets of **8-15** reps for major muscle groups at moderate to vigorous intensity
Physical Function	**3x**/week for **30-60** min per session of moderate to vigorous	**2-3x**/week of **2** sets of **8-12** reps for major muscle groups at moderate to vigorous intensity	**3x**/week for **20-40** min per session of moderate to vigorous aerobic exercise, plus **2-3x**/week of resistance training **2** sets of **8-12** reps for major muscle group at moderate to vigorous intensity
Anxiety	**3x**/week for **30-60** min per session of moderate to vigorous	Insufficient evidence	**2-3x**/week for **20-40** min of moderate to vigorous aerobic exercise plus **2x**/week of resistance training of **2** sets, **8-12** reps for major muscle groups at moderate to vigorous intensity
Depression	**3x**/week for **30-60** min per session of moderate to vigorous	Insufficient evidence	**2-3x**/week for **20-40** min of moderate to vigorous aerobic exercise plus **2x**/week of resistance training of **2** sets, **8-12** reps for major muscle groups at moderate to vigorous intensity
Lymphedema	Insufficient evidence	**2-3x**/week of progressive, supervised, program for major muscle groups does not exacerbate lymphedema	Insufficient evidence

Figure 3.3. Outcome of Exercise on Health-Related Outcomes in Those with Cancer

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NOTES: Moderate intensity (40%-59% heart rate reserve or VO2R) to vigorous intensity (60%-89% heart rate reserve or VO2R) is recommended.

Safety good practice

To do physical activity safely and reduce risk of injuries and other adverse events, people should understand the risks, yet be confident that physical activity can be safe for almost everyone. They should:

- Choose types of physical activity appropriate for their current fitness level and health goals, because some activities are safer than others,
- Increase physical activity gradually over time to meet key guidelines or health goals,
- Inactive people should “start low and go slow” by starting with lower-intensity activities and gradually increasing how often and how long activities are done,
- Protect themselves by using appropriate gear and sports equipment, choosing safe environments, following rules and policies, and making sensible choices about when, where, and how to be active,
- Be under the care of a health care practitioner if they have chronic conditions or symptoms. People with chronic conditions and symptoms can consult a health care professional or physical activity specialist about the types and amounts of activity appropriate for them.

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Considerations	Recommendations
Bone loss/bone metastases:	• Avoid contraindicated movements that place an excessively high load on fragile skeletal sites. These include the following: high-impact loads, hyperflexion or hyperextension of the trunk, flexion or extension of the trunk with added resistance, and dynamic twisting motion • Specific guidance on how to modify exercise programs based on the site of bony lesions is provided elsewhere (88,111) • Preventing falls must also be a goal of therapy, since falls play an important role in fracture etiology (112). • Be aware of signs and symptoms of bone metastases in survivors, as well as common locations where these occur (i.e., spinal vertebrae, ribs, humerus, femur, pelvis). Bone pain can be an initial sign of skeletal metastases thus, exercise trainers should refer survivors who report pain back to the medical team for clinical evaluation before continuing exercise
Lymphedema	• To date, there is insufficient evidence to support or refute this clinical advice to wear a compression garment during exercise to prevent or reduce symptoms of breast cancer-related upper body lymphedema. Therefore, it is recommended that exercise professionals provide this information as part of client education and defer to an individual client's preference regarding use of a compression sleeve. • Being overweight or deconditioned have been associated with a higher risk of developing cancer-related lymphedema in observational studies, at this time there is insufficient evidence that weight loss or improving aerobic fitness can lower the risk of developing cancer-related lymphedema (113).
Older adults	• Physical problems reported by cancer survivors, such as cognitive difficulty, neuropathy, sarcopenia, muscle weakness, slowing, and fatigue, may be similar to those of older people without cancer, but cancer treatment can accelerate these declines (114–116) • Exercise professionals will need to combine ACSM guidelines on exercise programming for older adults (117) with the recommendations in this publication. • Integrate fitness and functional assessments before beginning an exercise program to more accurately determine baseline functional abilities.
Ostomy	• Empty ostomy bag before starting exercise • Weight lifting/resistance exercises should start with low resistance and progress slowly under the guidance of trained exercise professionals. People with an ostomy may be at an increased risk of parastomal hernia. To regulate intra-abdominal pressure, correct lifting technique and good form is required. Avoid use of a Valsalva maneuver (118,119). • Modify any core exercises which cause excessive intra-abdominal pressure, namely a feeling of pressure or observed bulging of the abdomen. • Those with an ileostomy are at increased risk of dehydration. Get medical advice on ways to maintain optimum hydration prior, during and after exercise. • Those doing contact sports or where there is a risk of a blow to the ostomy may wish to wear an ostomy protector/shield.
Peripheral neuropathy	• Stability, balance, and gait should be assessed before engaging in exercise; consider balance training as indicated • Consider alternative aerobic exercise (stationary biking, water exercise) rather than walking if neuropathy affects stability or use treadmill with safety handrails • Resistance training recommendations: ○ Monitor discomfort in hands when using hand-held weights ○ Consider using dumbbells with soft/rubber coating, and/or wear padded gloves ○ Consider resistance machines over free weights (120)
Stem cell transplantation	• Home-based exercise encouraged • A full recovery of the immune system recommended before return to gym facilities with the general public • Start with light intensity, short durations but high frequency and progress slowly (121) • Exercise volume (intensity and duration) should be adapted on a daily basis based on the individual's presentation
Symptom clusters	• Symptoms and side effects of cancer treatment rarely appear in isolation; rather, symptom clusters are the norm (i.e., fatigue, pain, sleep disturbance), especially during cancer treatment and in those with advanced disease (122). • Exercise professionals must be aware of this complexity and be prepared to refer clients/patients back to the medical team (i.e., rehabilitation or oncology physician, general practitioner, or nurse) for review and management of symptoms when safety concerns develop or when target symptom (e.g., fatigue) is not responding as expected.
Sun safety	• In addition to melanoma survivors (123), survivors of cancer at other primary sites may be at increased risk for secondary skin cancers (124) • Exercise professionals should recommend that cancer survivors engage in sun protective practices when exercising outdoors (125).

Figure 3.4. Special considerations and recommendations for HEPA in cancer patients

7.2 Good practice for patients self-exercise program

7.2.1 Before treatment

Becoming more active or staying at your current level of physical activity before treatment may help you handle and recover from your treatment more easily. Research shows that being as active as possible may reduce complications from surgery and may help you handle treatment better. Also, physical activity may help you deal with distress and anxiety, have more energy, and sleep better as you begin treatment.

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Many people find that as they start treatment, the ability to be active may be harder. So, starting out in better physical shape means you can tolerate more activity during and after treatment.

7.2.2 During treatment

Certain things can affect your ability to exercise during treatment, such as:

- The type and stage of cancer you have,
- Your cancer treatment,
- Your stamina, strength, and fitness level before and during treatment.

If you exercised before treatment, you might need to exercise less or at a lower intensity during treatment. The goal is to stay as active as you can. People who were very sedentary (inactive) before cancer treatment may need to start with short, low-intensity activity, such as short slow walks. Talk with your cancer care team about exercising during treatment and whether there are any limits to what you can do.

7.2.3 Recovering from treatment

Most people are able to slowly increase exercise time and intensity as their side effects lessen. What may be a low- or moderate-intensity activity for a healthy person may seem like a high-intensity activity for some cancer survivors. Take your time and be patient with yourself as you gradually increase your activity. Remember – the most important thing is to move as much as you can.

7.2.4 When you are living disease-free or with stable disease

During this time, physical activity is important to your overall health and quality of life. Research shows that getting to and staying at a healthy weight, eating right, and being physically active may help reduce the risk of other serious chronic diseases, as well as the risk of a second cancer.

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A healthy lifestyle might also decrease the risk of some cancers coming back. A growing number of studies have looked at the impact of physical activity on cancer recurrence - cancer that comes back after treatment - and long-term survival. Exercise has been shown to improve cardiovascular fitness, muscle strength, body composition, fatigue, anxiety, depression, self-esteem, happiness, and several quality-of-life factors in cancer survivors. Studies of people with breast, colorectal, and prostate cancers suggest that physically active cancer survivors have a lower risk of cancer recurrence and improved survival compared with those who are inactive.

7.2.5 Living with advanced cancer

Physical activity may also help people whose cancer has spread or has become advanced and cannot be cured. Exercise may improve physical function, decrease fatigue, and improve quality of life. Whether you can tolerate more physical activity will depend on your type and stage of cancer, side effects you might have, your current physical ability, and any other health problems. Before starting new activities and being more active, check with your cancer care team about whether it is safe for you to do so.

7.2.6 Planning to be more active

Always check with your health care team before starting any exercise program, especially if you have any of the following:

- Heart or lung disease,
- Ostomy,
- Severe fatigue,
- Unsteadiness on your feet or balance problems,
- Weak bones or bone metastases (cancer that has spread to the bones).

Also ask whether any of the medicines you take might affect how physically active you can be.

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Some people can safely begin or maintain their own exercise program, but many will have better results with the help of an exercise specialist, physical therapist, or exercise physiologist. Be sure to get your doctor's OK first and be sure that the person working with you knows about your cancer diagnosis and any limitations you have. Specially trained professionals can help you find the type of exercise that's right and safe for you. They can also help you figure out how often and how long you should exercise.

Whether you're just starting to exercise or continuing to do so, be sure to talk with your health care team about what you can and can't do. Keep your cancer team informed on how you're doing in regard to your activity level and exercise throughout and after your treatment.

When starting to get active or becoming more active, there are some important things to think about:

- Stay away from uneven surfaces that could make you fall,
- If you plan to exercise outside, find someplace safe and well-lit,
- If you are more at risk for infection, you may need to stay away from public gyms and crowds until your risk returns to normal,
- If you want to swim while getting radiation therapy, check with your radiation therapy team. If you don't have any skin irritation or sores, you should be able to swim. Be sure to rinse off after getting out of a pool to lower the chance of skin irritation,
- Take someone with you when you exercise or make sure someone knows where you are in case you have trouble. It can also help to carry a mobile phone.

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Start slowly

- Even if you can only be active for a few minutes a day it will help you. Increase slowly how often and how long you exercise. Your muscles will tell you when you need to slow down and rest or can do more.
- Exercise as you are able. Don't push yourself while you are in treatment. Listen to your body and rest when you need to. If you feel very tired you can try doing 10 minutes of light exercises each day and build up.
- Do not exercise if you feel dizzy or are unsteady on your feet.
- Try short periods of exercise with frequent rest breaks. For example, walk briskly for a few minutes, slow down, and walk briskly again, until you have done 30 minutes of brisk activity. You can also divide your activity into three 10-minute sessions. You'll still get the benefit of the exercise.
- Do not exercise above a moderate level of exertion without talking with your doctor. Moderate exertion is about as much effort as a brisk walk.
- Avoid any activity that puts you at risk for falls or injury. If you notice swelling, pain, dizziness, or blurred vision, call your doctor right away.
- If you have numbness in your feet or problems with balance, you are at higher risk for falls. Ask about devices that might help you.

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Try more than one kind of exercise

- Try to include physical activity that uses large muscle groups such as your thighs, abdomen (belly), chest, and back. Strength, stretching, and aerobic fitness are all important parts of a good exercise program.
- Try to include some exercises that will help you keep lean muscle mass and bone strength, like exercising with a resistance band or light weights.
- You might want to include exercises that will increase your flexibility and keep the range of motion in your joints.
- Always start with warm-up exercises for 2 to 3 minutes. Examples of warm-up exercises are shoulder shrugs, lifting arms overhead, toe tapping, marching, and knee lifts.
- End your exercise session with stretching or flexibility exercises. Hold a stretch for about 15 to 30 seconds and relax. Examples of stretching are reaching overhead, deep breathing, and bending over to touch your toes so that you relax all the muscle groups.

Special issues

- Drink plenty of fluids unless you've been told not to.
- If you have a catheter or feeding tube, avoid pool, lake, or ocean water and other exposures that may cause infections. Do not play contact sports. Also, do not do resistance training that uses muscles in the area of the catheter to keep it from dislodging. Talk with your cancer team about what's safe for you.
- Do not use heavy weights or do exercises that puts too much stress on your bones if you have osteoporosis, cancer that has spread to the bone, arthritis, nerve damage, poor vision, poor balance, or weakness. You may be more likely to hurt yourself or break a bone.

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Keep exercise easy and fun

- How much you should exercise is different for each person. We don't know the best level of exercise for someone with cancer. The goal is to have your exercise program help you keep up your muscle strength and keep you able to do the things you want and need to do. The more active you are, the better you will be able to exercise and function. But even if planned exercise stops, it is good to keep being active by doing your normal activities as much as you can. The key to staying active is to keep your exercise program simple and fun. Exercise and relaxation techniques are great ways to relieve stress. Reducing stress is an important part of getting well and staying well.

Tips to help you stick to your exercise program

- Set short-term and long-term goals.
- Focus on having fun.
- Do something different to keep it fresh. Try yoga, dancing, or tai chi.
- Ask for support from others, or get friends, family, and co-workers to exercise with you.
- Use charts or a fitness tracker to record your exercise progress.
- Recognize and reward your achievements.
- Starting an exercise program can be a big task, even for a healthy person. It may be even harder if you have a chronic illness, especially if you weren't used to exercising before your diagnosis. Start slowly and build up as you are able. If you were exercising regularly before you were diagnosed with cancer, you may need to reduce the intensity and length of your exercise sessions for a while. But you can build back up when you feel up to it.

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Add physical activity to your daily routine

- There are ways to add physical activity to the things you do every day. Remember, only do what you feel up to doing:

  - Take a walk after dinner
  - Ride your bike
  - Mow the grass or rake the leaves instead of using a blower
  - Scrub your bathroom
  - Wash and wax your car
  - Play active games with kids, like freeze tag, jump rope, and other games you played when you were a kid
  - Walk a dog (one that can be controlled so that you don't trip or get pulled off balance)
  - Weed your garden
  - Bust a move (dance) in your living room
  - Use an exercise bike or treadmill, or do arm curls, squats, lunges, and crunches while watching TV
  - Walk to lunch
  - Park your car in the farthest parking space at work and walk to the building
  - Use the stairs instead of the elevator or escalator
  - Get off the bus several stops early and walk the rest of the way
  - Make appointments for yourself in your daily planner for 10 minute walking breaks
  - Form a walking club of co-workers to help you stay motivated to walk during the workday
  - Use a fitness tracker to try to increase your daily steps

Cancer survivors may need to exercise less intensely and increase their workout at a slower rate than people who haven't had cancer. Remember, the goal is to be as active as possible. Keep it safe, keep it fun, and make it work for you.

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7.3 Good practice to develop a HEPA promotion plan (Foster, 2000)

Today it is very hard to achieve goals to enhance PA in countries, therefore there are many indications to approach the problem in a systematic way involving a lot of stakeholders and resources. The following table is an example of good practice for HEPA promotion as a suggestion to approach the mission to enhance HEPA in projects:

STAGE	KEYPOINTS	RATIONALE
PREPARING	Identify potential stakeholders in HEPA	Ensure wide acceptance of HEPA and the recognition of its contribution to political and social agendas. This stage precedes any recruitment of support for the actual design and delivery of HEPA promotion. Without conceptual understanding, key stakeholder support and commitment, and public recognition of the contribution of HEPA within existing or new political policies, any HEPA programme faces an uncertain future.
	Use a variety of sources of evidence to present benefits of HEPA	
	Use the evidence to develop political justification, support and funding	
	Place the contribution of HEPA within existing national and local strategy and policy documents	
DEVELOPING	Explore and resolve the potential relationship between Sport and HEPA - Health professionals and HEPA	The aim of stage 2 is to collect further information to aid the design of the programme. Although there is some overlap between the preparation and design stages, each of the four national programmes identified several activities to consider prior to programme design.
	Cultivate and recruit other potential HEPA organisations	
	Identify or create and use any pilot project work	
	Conduct a good practice audit	

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	Have a clear programme name and identity	
DESIGNING	Use experts', stakeholders' and users' input to help design the HEPA programme	The aim of stage 3 is to design the strategic and implementation plans for the programme. The design phase followed several common steps across all four of the example HEPA programmes. Evaluation design is covered in Stage 5
	Develop a strategy to drive and sustain the HEPA programme	
	Design the theoretical framework for the HEPA programme	
	Design the HEPA programme aims, objectives and indicators	
	Design the HEPA message	
IMPLEMENTING	Develop the organisational structure of the HEPA programme	The aim of stage 4 is to translate the plans for the HEPA programme into action. The key points relate to examples of good practice, found in addition to basic project management and monitoring. All the programmes shared common operational programme management procedures, including monitoring of the progress toward meeting objectives with specific indicators. The key points of the evaluation are covered in Stage 5
	Establish programme ownership with all participants	
	Cultivate and tend the network	
	Coordinate national and local activity	
	Monitor response and participation	
EVALUATING	Commit to evaluating the programme	The purpose of stage 5 is to integrate the opportunity for learning that exists as part of the programme design and implementation. Evaluation was considered a key component of all four programmes, and its elements were found across all stages of the programmes. Although evaluation was considered to be a process rather
	Create an evaluation design for the programme	
	Use existing surveillance methods in the programme	
	Set up an independent evaluation mechanism for the programme	
	Support others in the evaluation of their activities	

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	Learn from programme weaknesses	than a concrete stage in itself, for the purpose of these guidelines, examples of a range of evaluation types and methods are presented
	Plan for the dissemination of the results of the programme evaluation	

Table 3.2. Good practice for HEPA promotion as a suggestion to approach the mission to enhance HEPA in projects

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8. Chapter 4

Training curriculum for delivering Practical Intervention Methodology for physiotherapists and other health professionals.

8.1 Physical activity and cancer prevention

It is important to know, for all the healthcare practitioners involved to the project, that even if there is a lack of practical guidelines to provide cancer-prevention PA sessions, we do have a track to follow to be more evidence-based possible in our approach in evaluating patients and delivering them tailored exercise while monitoring risks and opportunity. In fact, there is a growing number of scientific research proving that PA is becoming an essential tool for cancer prevention and rehabilitation (World Cancer Report, WHO 2020).

Practicing PA within open nature environments increases the positive effects of cancer prevention, however existing recommendations on how to provide PA for cancer prevention are mainly done under clinical conditions (hospitals, rehabilitation centres) (Thompson Coon et al, 2011). PA within natural environments provides opportunities for social inclusion of cancer survivors and has a positive influence on mental health and lifestyle (Siqueira et al, 2007).

In this chapter healthcare practitioners will be able to understand the state of art of the evidence-based approach to CPPA and will receive practical tools to manage the sessions with patients.

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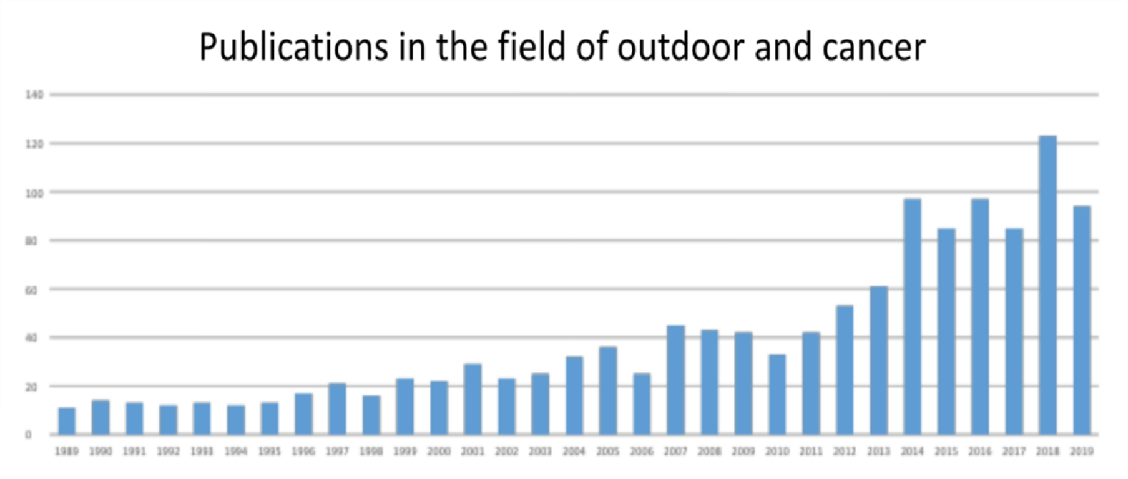

Figure 4.1. Publications in the field of outdoor and cancer

The aim of Chapter 4:

- Provide a training curriculum for delivering Practical Intervention Methodology for physiotherapists and other health professionals,
- Provide a training curriculum to support the implementation of Pilot CPPA actions.

8.2 Evidence of physical activity for cancer prevention

Our Practical Intervention Methodology is aimed at cancer prevention by practicing PA. WHO defines prevention as a “specific, population-based and individual-based interventions, aiming to minimize the burden of particular disease and associated risk factors”. Cancer prevention can be seen in different levels: primary, secondary and tertiary:

- **Primary prevention** aims to prevent the onset of disease by altering cancer risk behaviours (e.g., physical inactivity),
- **Secondary prevention** aims to slow or stop cancer progression once it is diagnosed,

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- **Tertiary prevention** aims to prevent recurrence or progression of established cancers.

The project methodology embraces three levels of cancer prevention. That means that CPPA sessions will be designed for cancer survivors (tertiary prevention), people who were diagnosed with cancer (secondary prevention) and those who never have suffered from this disease (primary prevention). The methodology has a set of PA exercises, adapted to people's needs & abilities and facilities of public urban green spaces. It is very important to mention that people diagnosed with cancer (secondary prevention) and cancer survivors (tertiary prevention) willing to participate in PA cancer prevention sessions need to consult with their oncologists about this possibility.

8.2.1 Primary prevention evidence

Increased physical activity is an effective primary care cancer prevention, and it is recommended to implement community-wide public education and awareness campaigns for physical activity (WHO World Cancer Report 2020). PA lowers the risk of seven types of cancers: bladder, breast, colon, endometrium, kidney, oesophageal adenocarcinoma and stomach cancer. There is moderate evidence for lower lung cancer risk (Physical activity guidelines advisory committee scientific report, 2018). Obesity is associated with increased risk of developing as many as 13 types of cancer, therefore physical activity can be used as a measure to mediate these risks (Kerr J, Anderson C, Lippman SM. 201 Physical activity, sedentary behaviour, diet and cancer: an update and emerging new evidence). Substantial reduction in tumour growth in response to PA has been demonstrated in preclinical studies with some studies citing reductions ranging between 31% and 67% (Roundtable report 2019). There are plausible biological mechanisms that may explain the benefits of PA in cancer prevention and control (Roundtable report on physical activity, sedentary behaviour and cancer prevention and control, American College of Sports Medicine).

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It is known that the current WHO recommendation of physical activity can result in an overall 7% reduction, which is mainly due to its protective role against breast cancer and colorectal cancer. Furthermore, the two-fold American College of Sports Medicine recommendation for better health is considered to be the point of saturated protection against cancer (Liu et al., 2015).

8.2.2 Secondary prevention evidence

According to the definition of Prevention, secondary prevention is defined as actions to detect a health problem at an early stage in an individual or a population, facilitating cure, or reducing or preventing spread, or reducing or preventing its long-term effects (WHO, 2011; APTA, 2001) (See Glossary section).

Although the benefits of physical activity in cancer patients have been demonstrated throughout the entire cancer patient pathway and in the prevention of its appearance (Europe Region, World Physiotherapy, 2022), in the case of secondary prevention there are few studies focused on it, due to the above definition, since physical activity will not be used to detect either this health problem or the adverse effects that may arise from it and its treatments. On the other hand, it has a relevant role in their approach and treatment, as shown in the following section and corresponding to tertiary prevention (WHO, 2011; APTA, 2001).

8.2.3 Tertiary prevention evidence

Two different stages of the patient's cancer pathway:

1. Physical activity during cancer treatment to prevent side effects
2. Physical activity after cancer treatment and survivors for monitoring and treatment of long side-effects.

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Pharmacological interventions for cancer: side effects of chemotherapy and radiotherapy

Chemotherapy is a commonly used therapy for advanced cancer, when the management of symptoms, quality of life and survival are prioritized. Higher doses and longer exposures of neurotoxic chemotherapy are associated with greater risk and severity of chemotherapy-induced peripheral neuropathy (CIPN) (Crichton et al., 2021). In the most recent clinical practice guidelines, no recommendations have been made for preventing CIPN, but certain pharmacological options, such as duloxetine, the only drug which has been widely supported by scientific evidence. Others (gabapentin, tricyclic antidepressants, opioids or lidocaine), despite the scarcity of evidence, are beginning to be used to manage symptoms. In addition to the limited efficacy, these drugs lead to numerous side effects, like nausea, dizziness and drowsiness. Due to the occurrence of these side effects, non-pharmacological interventions are emerging as an alternative to drugs to cope with the consequences of chemotherapy.

Non-pharmacological therapies: physical activity for tertiary prevention during cancer treatment

Bruinsma et al (2021) proved in a meta-analysis that exercise interventions and combined exercise and diet interventions had little effect on circulating inflammatory mediators. However, exercise had a significant effect on leptin levels in breast cancer survivors suggesting that leptin may be a possible mediator of exercise–induced changes in breast cancer recurrence.

There is strong evidence for the role of exercise prescription to manage the following side effects: anxiety, depressive symptoms, fatigue, health related quality of life, lymphoedema and physical function. There is moderate evidence for the role of exercise in the management of bone health and sleep in patients living with cancer (Campbell et al., 2019).

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Not only can physical activity reduce those symptoms, but the combination of exercising with other healthy lifestyle habits may also help reduce cancer mortality risk (Molina et al., 2021).

After treatment: survivors

Cancer survivors are almost three times more likely to report fair or poor health after cancer treatment and also, they are twice more likely to have psychosocial disabilities and physical and functional limitations in comparison with persons without cancer (Hewitt et al, 2003). The most common side effects of cancer disease and cancer treatment are fatigue, poor quality of life and emotional distress (Siegel et al, 2019), also some of the problems or adverse effects as a consequence of the treatments received, such as functional limitation, dyspnoea and risk of recurrence and even death, can continue.

8.3 Evidence of safety during the practice of CPPA

Historically, clinicians advised cancer patients to rest and to avoid activity. However, emerging research on exercise has challenged this recommendation. The advice to "avoid inactivity," even in cancer patients with existing disease or undergoing difficult treatments, is likely helpful. Physical activity is safe before, during and after cancer treatments and results in improvements in preventing cancer and improving physical functioning, quality of life, and cancer-related fatigue in several cancer survivor groups. In the last two decades, it has become clear that exercise plays a vital role in cancer prevention and control.

Recently, the American College of Sports Medicine has updated its exercise guidance for cancer prevention as well as for the prevention and treatment of a variety of cancer health-related outcomes (e.g., fatigue, anxiety, depression,

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function, and quality of life). The expert panel affirm that there is sufficient evidence to support the efficacy of specific doses of exercise training to address cancer-related health outcomes, including fatigue, quality of life, physical function, anxiety, and depressive symptoms (Campbell, Kristin L et al., 2019).

A summary of this evidence is provided in the following table:

LEVEL OF EVIDENCE Benefits of exercise in cancer patients		
STRONG	MODERATE	INSUFFICIENT
Anxiety reduction	Sleep	Cardiotoxicity
Fewer depressive symptoms	Bone health (Not for metastases)	Chemotherapy-induced peripheral neuropathy
Reduce fatigue		Cognitive functions
Better Quality of Life (Qol)		Falls
Perceived physical function improvement		Nausea
No risk for upper extremity lymphedema exacerbation		Pain
		Sexual function
		Treatment tolerance

Table 4.1. Level of evidence: benefits of exercise in cancer patients

Despite these guidelines, the majority of people living with and beyond cancer are not regularly physically active. Reports indicate that 60-70% of people with cancer do not meet aerobic exercise guidelines and it is estimated that 80-90% do not meet resistance exercise guidelines (Eakin, Elizabeth G et al, 2007). Among the reasons for this is a lack of clarity on the part of those who work in oncology clinical settings of their role in assessing, advising, and referring patients to exercise (Schmitz, Kathryn H et al., 2019). To do this will require care coordination with appropriate professionals as well as change in the behaviours

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of clinicians, patients, and those who deliver the rehabilitation and exercise programming. Behaviour change is one of many challenges to enacting the proposed practice changes. Other implementation challenges include capacity for triage and referral, the need for a program registry, costs and compensation, and workforce development. In conclusion, there is a call to action for key stakeholders to create the infrastructure and cultural adaptations needed so that all people living with and beyond cancer can be as active as is possible for them. Despite the numerous benefits of physical activity for patients with cancer, many cancer survivors report challenges to participating in PA. The barriers could be a lot and depending on patients, on environment and other internal or external factors. Romero, Sally A D et al., 2018 in a survey involving 662 patients found the following evidence, putting Fatigue and Pain on the top list of barriers:

Barriers	Endorsing %
Busy/No Time	29.1
Low Motivation	67.2
Low Discipline	65.2
Lack of safe environment	10.5
Lack of financial resources	20.1
Nausea	35
Fatigue	77.6
Pain	71
Sadness	31.8
Treatment side effects	50.7
Surgical complications	21.2
Doctor saying not to exercise	6.4

Table 4.2. Barriers for participation in physical activity

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8.4 Good Practice for Physical Activity sessions

It is important to have insight and understanding of efficient ways of engagement and motivational factors that may determine adults and senior citizen participation in physical activity, as senior citizens may have low activity levels and face a number of unique barriers.

8.4.1 Internal Motivators

An internal motivator or strategy may be described as an individual's own internal thoughts about physical activity or strategies that encourage participation (Opezzo et al, 2022). Examples include positively reinforcing past experiences or celebrating success with exercise to motivate continued participation.

A large cohort of 4108 older women, aged 70-99, investigating motivators to be physically active when they did not feel like being active, identified both internal strategies (occurring inside the head) and external strategies (using the world as a prop) to motivate activity.

8.4.2 Influence on physical activity

Physical activity fits in with transition events in ageing	Awareness of the body getting older may be triggered by major life events. Negative feelings may be compounded by societal attitudes, stereotypes, and the expectations of others. Continuing with patterns of physical activity can assist in the transition and create motivation to maintain energy levels, look after the body and maintain independence.
The role of physical activity in older adults' sense of purpose and self-belief	Physical activity contributes to an older adult's role identity and sense of purpose viewed as a personal responsibility which requires discipline. Physical activity provides a sense of personal achievement and satisfaction by maintaining or learning a new activity, despite getting older, and provides a sense of personal gratification and a reason to get up and out of the home.

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Physical activity effects physical, emotional and cognitive health	The benefits of physical activity contribute to a feeling of positive wellbeing through laughter, fun and enjoyment, and helps maintain an active mind. Enriching and aesthetic components which include music and nature have been identified by older adults as important benefits of participating in physical activity
Creates and strengthen the feeling of togetherness, community and belonging	Physical activity provides access to others and social contacts. This can build a sense of belonging to a group, a feeling of togetherness and of community, and through this enhance self-esteem.
Barriers to physical activity	Older adults experience external and logistical barriers to physical activity. These can be overcome with support from others including family. Fear of injury and pain is an internal barrier. Support from a healthcare professional may be helpful.

Table 4.3. Influence on physical activity (Morgan et al, 2019)

8.4.3 External Motivators

An external strategy may be described as an individual making use of the world to aid motivation (Opezzo et al, 2022), and examples of external motivators may include social connections, within a setting that instils confidence and safety (Lynch et al, 2022).

In a systematic review which examined the motivators and barriers to physical activity, in adults over 60 years of age, the most important interpersonal motivator to participating in physical activity was being social. This included communication and exercise with friends and others, support from peers and others, social coherence, and companions for walking. The second most important interpersonal motivator identified was supervision by a health professional (Yarmohammadi et al, 2019).

8.4.4 Barriers and facilitators

In the framework of the UcanACT project, barriers and facilitators to practice physical activity in PUGS for adults and senior citizens were explored through

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interviews and a quantitative survey in two European communities; an urban community in Italy (Bologna) and a rural community in Ireland (Kilkenny). The two data sources were integrated to establish a matrix of barriers and facilitators.
A total of 65 subjects have implemented the quantitative survey. The mean age of the participants was 69 years and 87.7% of the respondents were females. A total of 38.5% of the participants (33.9% Kilkenny, 50% Bologna) were currently living with cancer or were cancer survivors.

	Total	Kilkenny	Bologna
Participants (n)	65	59	6
Male (n)	8	7	1
Female (n)	57	52	5
Age (mean) Min-max	69 (51-91)	63,5	74
Treatment for diseases (n)	37	35	2
Cancer (n)	25	22	3

Table 4.4. Participant´s characteristics

In the urban area, other barriers such as physical impairments or insects were informed. In the rural area, the weather and a lack of infrastructures, speed of traffic and insufficient personal safety were mentioned as barriers.

Our study identified multiple barriers and facilitators for physical activity of general and community specific barriers and facilitators. People interviewed answered questions to better identify their perception on barriers and facilitators. The most important barriers for exercise in green spaces were pain (64.5%), fatigue (59.4%), health status (55.9%) and nausea or cramps (40.8%, respectively).

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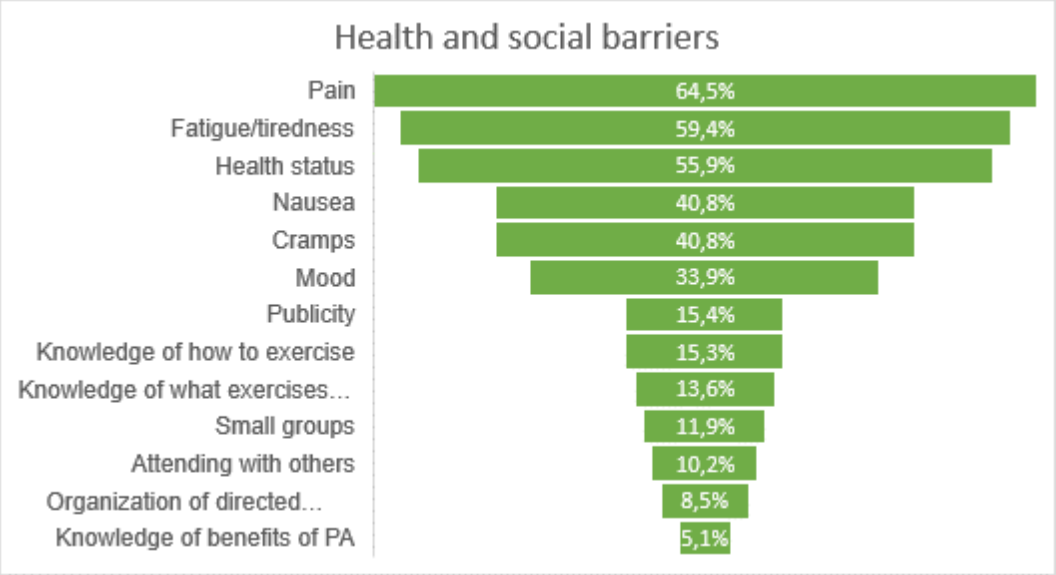

Figure 4.2. To what extent, do the following health & wellbeing and social factors limit (barriers) participation in physical activity/exercise in green spaces?

On the other hand, the most important facilitators for encouraging physical activity/exercise in PUGS were the knowledge of the benefits of PA (71.2%), the knowledge of what exercises to do and how (57.6% and 54.2%, respectively) and the organization of directed activities and the possibility to attending with others (50.4%, respectively).

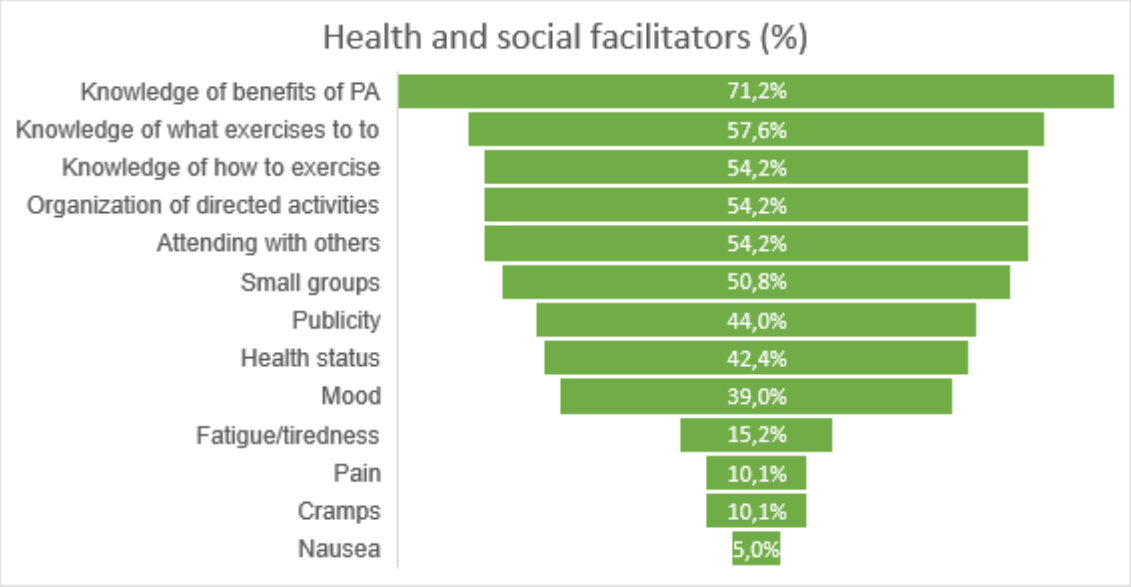

Figure 4.3. To what extent, do the following health & wellbeing and social factors facilitate/encourage participation in physical activity/exercise in green spaces?

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Concerning environmental factors, the most important barriers to PA in PUGS were the distance and noise to green spaces (35.6%), the maintenance of PUGS (32.2%) and the safety (28.9%).

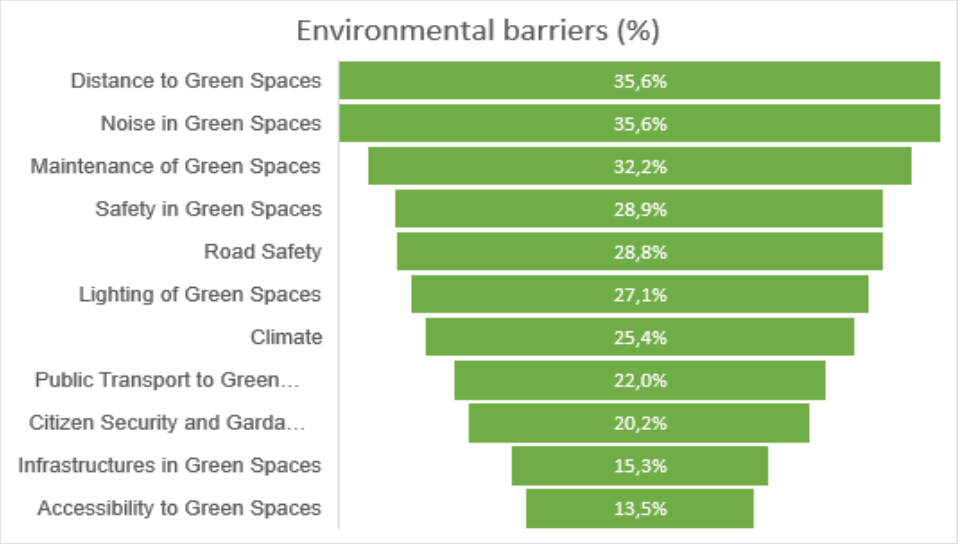

Figure 4.4. To what extent, do the following Environmental factors limit (barriers) participation in physical activity/exercise in green spaces?

Among the facilitators to PA in PUGS it must be highlighted the accessibility to PUGS (69.5%), the infrastructures (54.2%) and citizen security (51%).

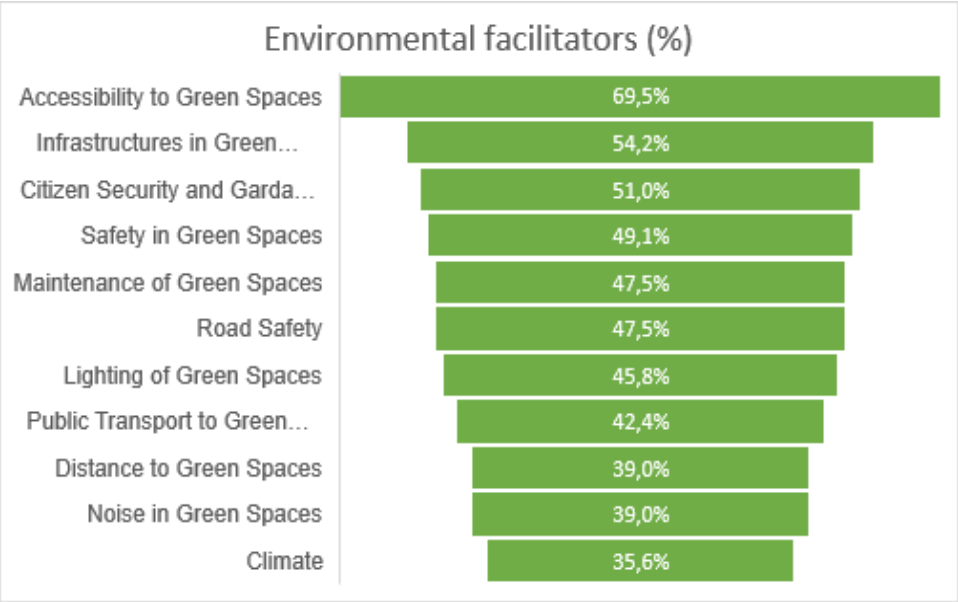

Figure 4.5. To what extent do the following Environmental factors facilitate/encourage participation in physical activity/exercise in green spaces?

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The results from both the focus group and the survey show different health/social and environmental barriers and facilitators for physical activities in PUGS. The most important health/social barriers for exercise in green spaces were pain, fatigue, health status and nausea. Contrary, the most important health/social facilitators were the knowledge of the benefits of PA (71.2%), the knowledge of what exercises to do and how and the organization of directed activities, and the possibility of attending with others.

The most important environmental factors perceived as barriers were distance and noise to green spaces, the maintenance of PUGS and personal safety. Among the facilitators the accessibility to PUGS, the infrastructures and citizen security were the most relevant for the participants.

8.5 Training curriculum for delivering Practical Intervention Methodology

This section summarizes general information for delivering Practical Intervention Methodology for physiotherapists and health professionals involved in the Pilot CPPA implementation. The first part is dedicated to the screening, assessment and clustering of group patients, the second part focuses on the treatment and recommendation for exercise programme.

8.5.1 Screening participants

Before putting the patient to work it is fundamental to screen participants and, if needed, have a medical clearance to exercise. Once the patients are ready to work, the following step will be to stratify the groups according to their fitness level, keeping in mind all the risk related, especially the fall one. Participants should also be educated on the use of the App and how it can help their exercise sessions.

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The recruiters will perform the screening process in the different public urban green spaces (PUGS). The inclusion/exclusion criteria for the UcanACT project are as follows

Inclusion criteria

- Over 50 years old
    - Who are not/or have not been diagnosed with cancer (Group 1)
    - Who were diagnosed with cancer (Group 2)
    - Cancer survivors (Group 2)

- Medically cleared using the America College of sports medicine (ACSM) safety criteria for exercise

Exclusion criteria

- Unable to get to Public Urban Green spaces (PUGS)

(McNeely et al., 2019, Rethorst et al., 2018, Irwin et al., 2017)

8.5.2 Group 1 – Non-cancer participants

The recruiter will contact participants via phone call for stage 1 i.e., to undertake medical clearance.

- Non-cancer participants will be screened using the ACMS questionnaire to be deemed eligible to participate in the exercise programme.
- If considered eligible to move to stage 2 the recruiter will stratify into appropriate fitness levels using the International physical activity questionnaire- short form (IPAQ-SF) (Appendix Fig. 1). There are three different fitness levels and appropriate exercises will be provided during the exercise sessions in the PUGs and in the App.

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- Lastly, the recruiter will ask individuals of their falls history and fear or falling. If it is indicated that the participant has a history of falls, they will be directed to a section of the pp with information of falls prevention.

8.5.3 Group 2 – Cancer survivors/participants diagnosed with cancer

The recruiter will contact participants via phone call for stage 1 i.e., to undertake medical clearance.

- As seen in Figure 1.3, participants either diagnosed with cancer or cancer survivors will be screened using the ACMS questionnaire to be deemed eligible to participate in the exercise programme.
- Additionally, for individuals with a history of a cancer diagnosis or a cancer survivor, the recruiter will administer the National Comprehensive Cancer Network Triage Approach Based on Risk of Exercise-Induced Adverse Events (Table 1.1). Individuals cleared will be able to move to stage 2 on the flowchart.
- An indication by the ACSM algorithm or in the NCCN assessment that further medical assessment is required individuals will be directed to visit their GP/physician. Individuals will be asked to contact the recruiter after their review with their GP/physician to see if they can participate.
- Once medically cleared, the recruiter will stratify participants according to their fitness level using the IPAQ-SF. There are three different fitness levels and appropriate exercises will be provided during the exercise sessions in the PUGs and in the App.
- Lastly, the recruiter will ask individuals of their falls history and fear or falling. If it is indicated that the participant has a history, they will be directed to a section of the App with information of falls prevention.

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8.5.4 Medical clearance

The ACSM screening algorithm has been developed to help healthcare professionals assess whether medical clearance is needed before initiating or progressing an exercise programme (Whitfield et al., 2017).

Before participating in the exercise programme, the recruiters will assess individuals using the algorithm to determine whether or not they require medical clearance to participate in the programme (as indicated in Figure 1.1 and 1.2). The recruiters will screen individuals using the algorithm (see Figure 1.1 and 1.2). Individuals will be included in the exercise programme if it is deemed that no further medical evaluation is required.

If the algorithm indicates that medical clearance is needed before participation, the recruiter will direct the individual to be assessed by their GP. The Doctor will determine if it is appropriate for the individual to participate in the exercise programme.

The screening algorithm provides recommendations for medical support based on the following:

- An individual's current physical activity level,
- Presence of signs or symptoms and known cardiovascular, metabolic, or renal disease,
- The anticipated or desired exercise intensity.

In addition to the ACSM screening algorithm, participants living with or beyond cancer will be screened according to the National Comprehensive Cancer Network (NCCN) Survivorship guidelines. These guidelines recommend the necessary steps for medical clearance and appropriate levels of supervision during exercise (see Table 1.1).

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8.5.5 Stratification of participants according to fitness level

Once individuals are deemed medically safe to participate in the project, stage 2, the stratification of participants will happen. The recruiter will use the IPAQ-SF questionnaire to determine the individual's fitness level, and a suitable exercise programme will be assigned according to the participant's fitness level.

The International Physical Activity Questionnaire in short form (IPAQ-SF) (See Appendix Figure 1) is widely used in research to determine an individual's physical activity levels. This questionnaire quantifies the total volumes and the number of days/sessions of physical activity. The short-form questionnaire asks participants about their seven days of physical activity recall (Craig et al., 2017).

The short-form questionnaire records the activity of four intensity levels: 1. Vigorous-intensity activity such as aerobic, 2. Moderate intensity activity such as leisure cycling, 3. Walking, and 4. Sitting. The questionnaire categorizes into three domains: inactive, minimally active and Health Enhancing Physical Activity (HEPA) (Lee et al., 2011).

Once the fitness level is determined, the recruiter will inform the participants of their fitness level. It will be important for participants to know this when using the App. Participants can then input their fitness level into their profile on the App.

Participants will be directed to complete the IPAQ-SF after 4, 8 and 12 weeks of the programme which is a validated self-reported questionnaire. The participants will complete the questionnaire on the UcanACT App at the three different time points noted above. This will be a good measure of the progress made by the participant engaging with the programme. Additionally, it can direct participants to progress onto the next level of exercises provided on the App if indicated by the results (See Figure 4 and Table 1.2).

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The three levels of Physical Activity (Bergman et al, 2009) as described in Table 1.2 are:

1. Inactive
2. Minimally Active
3. HEPA

.

8.5.6 Falls assessment

Individuals <65 years old have an increased risk of falling, leading to hospitalization and disability (Vaishya and Vaish, 2020). Cancer survivors who underwent chemotherapy can develop chemotherapy-induced peripheral neuropathy, which causes changes in individuals' sensation in their peripheries and, consequently, postural instability. This increases their risk of falls (Duregon et al., 2018).

For this reason, participants will be assessed regarding their fall risk due to the age profile of the individuals partaking in this programme. The programme will aim to address this risk through exercise and education.
The self-rated fall risk questionnaire will be used for falls assessment. (See Appendix Fig. 2). It is a validated and reliable tool to evaluate fall risk in older adults.

The self-rated fall risk questionnaire is a 12-item questionnaire to assess fall risk. The higher the score indicates the individual is at higher risk of falling. This questionnaire moderately- strongly correlates to Time up and Go, Berg balance scale and 5 time sit to stand test (Kitcharanant et al., 2020). Individuals will be directed to a section in the App (See Fig 1.5) that will provide different fall prevention strategies and education to reduce the risk of falling.

8.5.7 Participant profile on the App

Once the screening and stratification process is complete, the recruiter will direct participants to fill out the appropriate information on their profile page on the App.

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This will include name, location of PUGS, medical clearance, fitness level according to IPAQ-SF, fall history, and any considerations when exercising.

8.5.8 Key considerations for exercises with participants

Physiotherapists and other health care professionals must clearly understand different conditions which may require modification of an exercise programme or education on safety measures.

As part of the MOOC training, appropriate training for physiotherapists and other health care professionals will be provided on the key considerations (See Table 2.6 and 2.7).

Galvao et al., detailed the consideration of certain exercises for individuals with a diagnosis of bone metastases according to its location. In the MOCA and on the App certain exercises will be sign posted for participants to avoid if they are diagnosed with bone metastases. Table 6 details these considerations and certain exercises whether be resistance, aerobic or flexibility for this cohort to avoid (See table 2.8).

8.5.9 Safety monitoring

The physiotherapist leading the exercise programme will perform safety monitoring during the exercise training. All physiotherapists will have completed heart-saver training in line with local guidelines. Participants will be asked to report any issues, such as injuries or falls, before participating in the exercise programme. Any adverse events will be documented (See Table 1.3).

Adjuvant therapies for treating breast cancer are linked with increased risks of heart disease, including arrhythmia, heart failure and ischemic heart disease (Yang et al., 2022).

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8.5.10 Recommendations for the exercise

Basic guidelines for exercise programme

The UcanACT project aims to engage individuals in an exercise programme working on four-keys dimensions of PA. The four-key aspects of physical activity are recommended by the ACSM guidelines and consist in:

- aerobic exercises,
- strengthening,
- flexibility,
- balance.

Keep in mind that, if the weather is good enough, all the sessions will be outdoors in Public Urban Green Spaces. Physiotherapists will lead the sessions with the help of other healthcare practitioners and the use of an App developed for individuals to perform the exercises themselves in their own time to reach their recommended physical activity levels.

According to the literature, it is recommended that cancer survivors participate in a supervised exercise programme consisting of 2-3 sessions per week over a 10-12-week period (Newton et al., 2020). An average of 1 hour per session of aerobic, strengthening, balance and flexibility exercises should be included. Different exercise programmes exist across Australia and the USA.

Cancer Council WA Life now (Australia)	• 12-week program • 2 sessions x 1 hr per week
ExMed Cancer (Australia)	• 12-week program • 3 sessions x 1 hour per week
Renew exercise program (Australia)	• 10-week program • 2 sessions x 1 hour per week
Cancer rehabilitation institute (USA)	• 12-week program • 2-3 session x 1 hour per week

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YMCA exercise program (USA)	• 12-week program • 2 sessions x 90 minutes per week

Table 2.1. Summarizes different exercise programmes across Australia and the USA

Modified Borg scale of perceived exertion

It is important to have a tool that can guide patients and professionals on how hard they should be working during aerobic and strengthening exercises.

For aerobic/strengthening exercises individuals should feel moderately to somewhat several breathless (4-5 on the scale seen in Figure 2.1) (Williams, 2017). When you are rating your activity at 3 or below this indicates that you should move onto the next fitness level of the exercise programme from the one you have been currently assigned to. Modified Borg scale, in fact, could be also a useful tool to decide when the patient should move to the next level of exercise. If participants rate their work rate at a 3 on the Borg scale during strengthening or aerobic exercises it indicates that progressing onto the next levels of exercises is indicated.

1-10 Borg Scale of Perceived Exertion	
0	Rest
1	Really Easy
2	Easy
3	Moderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really Hard
10	Maximal

Figure 2.1. The Modified Borg scale

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Aerobic exercises

Aerobic training has demonstrated health benefits in older adults, including improved cardiovascular, functional, metabolic, cognitive and quality of life outcomes (Bouaziz et al., 2017).

Aerobic training can positively affect cancer-related fatigue and improve overall quality of life in cancer survivors (Patel and Bhise, 2017, Dieli-Conwright et al., 2018) (see Table 2.2).

Strengthening

Muscle strengthening is recommended for all cancer survivors, leading to improved quality of life (Dieli-Conwright et al., 2018). Resistance training in older adults positively affects muscle strength, power, muscle mass, energy expenditure and participation in daily activities (Hunter et al., 2004) (see Table 2.3).

Balance

There is a high rate of falls in community-dwelling older adults. Hence, the importance of integrating a balance programme for this cohort to help prevent falls and, in turn, hospitalization (Power and Clifford, 2013).

Chemotherapy-induced peripheral neuropathy, which can arise as a side effect of certain chemotherapy treatments (e.g., taxanes) can lead to an altered sensation in the hands and feet, and consequently postural instability in cancer survivors. Posture control was improved with strengthening, endurance, and static/dynamic balance training (Duregon et al., 2018) (see Table 2.4).

Flexibility

Flexibility training should be used as an adjuvant to an exercise programme in older adults. It is noted that flexibility training may improve postural stability and balance when combined with resistance training is the ACSM recommends that

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flexibility should be performed after cardiorespiratory endurance or resistance training (Stathokostas et al., 2012).

Invasive breast cancer treatment involving surgical resection and radiotherapy can lead to a restriction in the shoulder and upper chest ROM. Exercise programmes must target this to reduce the risk of developing long term long-term functional ability (Richmond et al., 2018). Multifactorial physical therapy (strengthening & stretching) is safe and beneficial in improving symptom management and restoring shoulder function (Harder et al., 2017) (see Table 2.5).

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Components of the exercise programme

Warm-up phase (Duration 5-10 mins)

- Light aerobic activity i.e., marching on spot
- Light stretching, targeting muscles and joints involved in the training programme
- Range of motion (ROM) exercises i.e., targeting shoulder
- Diaphragmatic breathing

Specific phase

Aerobic exercises (Duration 30-60 mins)
Examples i.e., walking, cycle

- At 50-90% maximum heart rate or using the Borg scale 12-14 or 'somewhat hard'.
- Can be performed continuously or intermittently.

Resistance exercises
Exercises targeting upper and lower limb
8-10 different exercises with 2 mins rest in between
1-4 sets per muscle group at 50-80% 1-reptitions maximum (1RM)

Balance exercises
Examples i.e., single leg stance, tandem stances etc.
Perform 2-3 exercises

Flexibility exercises
Include upper and lower limb flexibility exercises
4 sets per major muscle group holds up to 60 seconds

Cool down phase
Slow walking

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10. Appendix 1: IPAQ-SF questionnaire

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

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4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

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11. Appendix 2: Self-rated fall risk questionnaire

Supplementary table

Reliability of the self-rated fall risk questionnaire

self-rated FRQ	retest-self-rated FRQ		Test-retest reliability (Kappa statistics)	*p* value
	yes	no		
I have fallen in the past year.				
- yes	8 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	22 (100.0)		
I use or have been advised to use a cane or walker to get around safely.				
- yes	15 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	15 (100.0)		
Sometimes I feel unsteady when I am walking.				
- yes	17 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	13 (100.0)		
I steady myself by holding onto furniture when walking at home.				
- yes	12 (100.0)	1 (5.6)	0.932	< 0.001
- no	0 (0.0)	17 (94.4)		
I am worried about falling.				
- yes	16 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	14 (100.0)		
I need to push with my hands to stand up from a chair.				
- yes	16 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	14 (100.0)		
I have some trouble stepping up onto a curb.				
- yes	16 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	14 (100.0)		
I often have to rush to the toilet.				
- yes	14 (100.0)	3 (18.8)	0.802	< 0.001
- no	0 (0.0)	13 (81.3)		
I have lost some feeling in my feet.				
- yes	7 (100.0)	1 (4.3)	0.911	< 0.001
- no	0 (0.0)	22 (95.7)		
I take medicine that sometimes makes me feel light-headed or more tired than usual.				
- yes	2 (100.0)	1 (3.6)	0.783	< 0.001
- no	0 (0.0)	27 (96.4)		
I take medicine to help me sleep or improve my mood.				
- yes	7 (100.0)	2 (8.7)	0.831	< 0.001

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self-rated FRQ	retest-self-rated FRQ		Test-retest reliability (Kappa statistics)	*p* value
	yes	no		
- no	0 (0.0)	21 (91.3)		
I often feel sad or depressed.				
- yes	5 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	25 (100.0)		
Total score				
- yes	19 (100.0)	0 (0.0)	1.000	< 0.001
- no	0 (0.0)	11 (100.0)		

Abbreviations: *p* value = Kappa statistics
p value < 0.05 indicates statistical significance
self-rated FRQ self-rated Fall Risk Questionnaire

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12. Appendix 3: Incidence report form

DETAIL OF LEAD TRAINER	
Name	
Address	
Telephone	
Email	

DETAIL OF THE PUGS	
Location	

CIRCLE THE TYPE OF EVENT		
Fall/ slip	Life-threatening	Hospitalization
Other		

CIRCUMSTANCES OF INCIDENT	
Date of the serious incident	
Location	
Describe the circumstances of the incident	
What is your assessment of the implication, if any, for the safety of the participants in the exercise class and how will these be addressed?	

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DECLARATION	
Signature of the lead physiotherapist	
Print name	
Date of submission	

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