Physical Activity and Cancer:

Mapping the evidence base to inform recommendations for Surrey

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1. Background

1.1. Physical activity in England

In 2019, the UK's Chief Medical Officer stated that 'if physical activity were a drug, we would refer to it as a miracle cure due to the great many illnesses it can prevent and help treat' (Department of Health & Social Care, 2019). Evidence highlights the effectiveness of regular physical activity in the primary and secondary prevention of many chronic illnesses, including cancer, as well as all-cause mortality (Warburton et al., 2006).

Despite these benefits, 36.3% of England's adult population are considered physically inactive and are not achieving the Chief Medical Officer's guidelines of 150 minutes of moderate or 75 minutes of vigorous intensity physical activity per week (Sport England, 2025). Whilst slightly above the national level for the percentage of adults who are physically active, 30.7% of Surrey's adult population do meet the physical activity guidelines, with 18.9% doing less than 30 minutes of physical activity per week (Sport England, 2025). The UK is 20% less active than it was in the 1960s and, if trends continue, will be 35% less active by 2030 (Department of Health & Social Care, 2022).

It is estimated that physical inactivity and the related outcomes cost the UK government approximately £7.4 billion annually, with £900 million from the NHS alone (Department of Health & Social Care, 2022). This highlights the need to establish effective and sustainable ways of embedding physical activity as part of government strategy. Indeed, references to physical activity are embedded throughout the 10 Year Health Plan, which included plans to move to a place-based approach to physical activity through: £250 million of investment into 100 places by Sport England; at least £400 million of investment into local community sport facilities; new partnerships on school sport, and local health plans.

1.2. Physical activity and cancer

Cancer is the leading cause of death in England and Surrey (Office for National Statistics, 2023), accounting for approximately a quarter of all deaths each year. It is estimated that 40% of cancers could be prevented through lifestyle changes such as eating healthily, being active, maintaining a healthy weight and not smoking (World Cancer Research Fund, 2020). Keeping active can help maintain a healthy weight, which reduces the risks of 13 different types of cancer (Cancer Research UK, 2023). Scientists are also investigating other potential mechanisms through which exercise can reduce cancer risk, including reducing levels of oestrogen and insulin (linked to breast cancer risk), reducing inflammation and helping immune system function (Cancer Research UK, 2023).

Alongside evidence supporting the role of exercise in preventing cancer, research has also found that keeping active during and after treatment can improve survival for people

diagnosed with cancer. Recently, the potential for exercise to prevent and reduce risk of dying from cancer has received widespread research attention, with the positive results garnering national media coverage. For instance, a global trial conducted over ten years published in 2025, found that people with colon cancer who took part in a structured exercise regime with the help of a personal trainer or health coach after completing treatment had a 37% lower risk of death, and a 28% lower risk of their cancer coming back, or a new cancer developing, compared to patients who received health advice alone (Courneya et al., 2025). Physical activity can also boost wellbeing for people living with and beyond cancer, by reducing fatigue, anxiety and depression, reducing the risk of other diseases, supporting the immune system and preventing or improving lymphoedema (World Cancer Research Fund, 2025).

International guidelines recommend physical activity both to prevent cancer, and to support wellbeing during and after treatment (Cancer Research UK, 2025). Recommendations from the World Cancer Research Fund state adults, including people with cancer should try to be physically active every day. Cancer Research UK recommend a combination of moderate and vigorous activity (150 minutes per week), strength/resistance training twice per week, and balance/flexibility training twice per week, as well as reducing the amount of time spent being sedentary. However, everyone is different and exercise should be tailored to the individual, taking into account fitness, diagnosis and other factors that could affect safety (Cancer Reserach UK, 2025).

Indeed, there are multiple barriers to capitalising on the potential of exercise to reduce cancer incidence and improve outcomes. Less than a third of Surrey's adult population meet the physical activity guidelines, and many people living with cancer face complex physical, psychological, practical and financial barriers to exercising before, during and after treatment. Some of these barriers restricting access to and engagement with physical activity are systematic, unfair and avoidable, and thus contribute to inequalities in cancer incidence and outcomes.

1.3. Review aims and research questions

This review aims to identify and narratively synthesise evidence related to the impact of physical activity on cancer incidence and outcomes. Insights from the review will be used to inform the strategic development of physical activity programmes to reduce cancer risk and improve outcomes for people with cancer in Surrey.

The review addresses these objectives by answering the following key questions:

1. **What role does physical activity play in the prevention of cancer?**
2. **What impact does physical activity have on outcomes for people diagnosed with cancer?**
3. **What are the barriers and facilitators to physical activity for people with cancer?**

4. **What health inequalities exist in relation to physical activity and cancer?**
5. **What are the characteristics of effective physical activity interventions and programmes for people with cancer?**
6. **What factors influence the implementation of physical activity interventions for people with cancer?**
7. **What programmes and initiatives already exist to support people with cancer nationally and in Surrey?**

2. What role does physical activity play in the prevention of cancer?

McTiernan et al's systematic review (2019) explored evidence on the association between physical activity engagement and risk for various forms of cancer. **Table 1** summarises the evidence grade, approximate relative risk reduction and dose-response rates. A more detailed overview of the evidence for each cancer type is provided in **Appendix 1**.

TOP-LINE INSIGHT SUMMARY

- There is compelling evidence that physical activity reduces the risk of multiple cancer types, with strong evidence of a dose-response for breast and colon cancers
- There is limited data investigating differences in the effect of physical activity on cancer risk by population sub-group (eg, socioeconomic position, ethnicity)

2.1. Cancer type

There is strong evidence showing physical activity reduces risk of bladder, breast, colon, endometrial, ooesophageal, gastric and renal cancers. There is moderate evidence that it reduces lung cancer risk, and limited evidence it reduces haematological, head and neck, ovarian, pancreatic and prostate cancers.

2.2. Dose-Response Level

A dose-response relationship between physical activity and specific cancer risk was evident for several cancers as shown in **Table 1**. However, due to the inconsistent methods of measuring and categorising physical activity levels in the various studies, meta-analyses, and pooled analyses, it was not possible to determine exact levels of physical activity that provide the given levels of effect.

2.3. Population Sub-Groups

Effects of physical activity on specific cancer risk were seen for both women and men for colon and renal cancers, while for other cancers such as bladder, oesophageal, gastric, lung, and pancreatic, differences by sex could not be ruled out.

Little information was available on differences in the effect of physical activity on cancer risk by age, socioeconomic status, or ethnicity. Weight status affected the association between physical activity and risk of several cancers, including breast, endometrial, lung, ovarian, and thyroid, and possibly for oesophageal, adenocarcinoma and gastric cardia cancers (McTiernan et al., 2019). The authors stated the data in meta-analyses were not consistent enough or

classified with sufficient precision for the PAGAC to determine the exact nature of physical activity-cancer relationships by population subgroups (for example, by age, race/ethnicity, socioeconomic status, or weight status). But stated that, where data were available, they pointed to likely benefit of physical activity across a wide range of population groups.

Table 1. Evidence on relationship between physical activity and the risk of developing different forms of cancer (McTiernan et al., 2019)

Cancer	Overall Evidence Grade	Approximate % Relative Risk Reduction	Dose-response? Grade
Bladder	Strong	15%	Yes, moderate
Breast	Strong	12 – 21%	Yes, strong
Colon	Strong	19%	Yes, strong
Endometrium	Strong	20%	Yes, moderate
Oesophagus (adenocarcinoma)	Strong	21%	No, limited
Gastric	Strong	19%	Yes, moderate
Renal	Strong	12%	Yes, limited
Lung	Moderate	21 – 25%	Yes, limited
Hematologic	Limited	Variable effect sizes	Not assignable
Head & Neck	Limited	Variable effect sizes	Not assignable
Ovary	Limited	8%	Yes, limited
Pancreas	Limited	11%	No, limited
Prostate	Limited	Variable effect sizes	Not assignable
Brain	Grade not assignable	Variable effect sizes	Not assignable
Thyroid	Limited	0	Not assignable
Rectal	Limited	0	Not assignable

3. What impact does physical activity have on outcomes for people with cancer?

Several reviews explore associations between physical activity engagement levels and health outcomes among those diagnosed with the four most common types of cancer: breast, colorectal, prostate and lung (McTiernan et al., 2019; Filis et al., 2025; Bai et al., 2025). Summary tables are provided below. Narrative descriptions are provided in **Appendix 2**.

TOP-LINE INSIGHT SUMMARY

- There is moderate evidence that physical activity reduces cancer-specific mortality for breast, colorectal and prostate cancer
- There is emerging evidence demonstrating the impact of physical activity on multiple health and wellbeing outcomes across common cancer types, including reduced risk of recurrence (breast), fatigue (breast, colorectal), mental health (breast, colorectal), sleep (breast, colorectal, prostate), pain (breast, lung), quality of life (breast, lung, colorectal, prostate).

3.1. Impact on all-cause and cancer-specific mortality

Table 2 summarises the relative risk reduction and evidence grade for breast, colorectal and prostate cancer.

There is moderate evidence that physical activity reduces cancer-specific mortality for breast, colorectal and prostate cancer.

McTiernan et al's review (2019) graded the evidence relating to all-cause and cancer-specific mortality across breast, colorectal and prostate cancers as moderate because of the "considerable chance of reverse causation" (i,e. individuals who have cancer may feel more fatigue and therefore be less physically active).

Table 2. Evidence on relationship between physical activity and mortality risk in cancer survivors (McTiernan et al., 2019)

All-cause Mortality		
Cancer	**Evidence Grade**	**Approximate % Relative Risk Reduction**
Breast	Moderate	48%
Colorectal	Moderate	42%
Prostate	Limited	37-49%
Cancer-specific Mortality		
Breast	Moderate	38%
Colorectal	Moderate	38%
Prostate	Moderate	38%

3.2. Impact on other outcomes

Table 3 summarises the impacts of physical activity reported by reviews in addition to reductions in mortality, which include evidence of reduced risk of recurrence, fatigue and pain, and improvements in quality of life, sleep and mental wellbeing.

Table 3. Impact of physical activity on health and wellbeing of people with cancer

Cancer	Outcomes
Breast	• Reduce risk of recurrence (Miyamoto et al., 2022) • Reduce cancer-related fatigue (Brown et al., 2011; Andersen et al., 2022) • Improve mental health (Aune et al., 2022; Andersen et al., 2022) • Reduce short-term sleep problems (Cramer et al., 2017) and improve health-related quality of life (yoga specific) and improved health-related quality of life (Machado et al., 2021). • Reduce pain (Filis et al., 2025) • Improve aerobic capacity (Andersen et al., 2022)
Colorectal	• Improve quality of life (Singh et al. 2020) • Reduce fatigue (Singh et al. 2020) • Improve aerobic fitness (Singh et al. 2020) • Improve Strength (Singh et al. 2020) • Reduce Depression (Singh et al. 2020) • Improve Sleep (Singh et al. 2020) • Reduce Body fat percentage (Singh et al. 2020)
Prostate	• Improved cardiovascular fitness (Andersen et al., 2022)

	• Improved cancer related quality of life (Ussing et al., 2022) • Reduced levels of reported fatigue (Vashistha et al., 2016) • Reductions in body fat among prostate cancer survivors (Shao et al., 2022).
Lung	• Reduced length of hospital stay following lung cancer surgery (Wang et al., 2022; Pu et al., 2021). • Mind–body physical activity improved cognitive function (Sun et al., 2023) • Improve health-related quality of life quality of life (Machado et al., 2021) • Reduce pain (Chen et al., 2020).

4. What are the barriers and facilitators to physical activity for people with cancer?

Gildea and colleagues' systematic review (2023) examined barriers, facilitators, perceptions and preferences influencing physical activity participation among people with cancer. The review compared treatment stages and cancer-type. Key conclusions are summarised below and in **Figure 4**. References and links to full articles can be found within the original review if any area or point is of particular interest.

TOP-LINE INSIGHT SUMMARY

Barriers: Treatment and disease-related side effects, time-pressures and low mood, self-efficacy and motivation are common barriers to physical activity for people with cancer. 50% studies reported inaccessibility of an appropriate service as a barrier for people during cancer treatment.

Facilitators: Social support and guidance, having access to tailored services, and perceiving the benefits of physical activity were the most commonly cited facilitators of physical activity for people with cancer.

Perceptions of benefit: 'Better state of mind' was the most commonly reported perceived benefit of physical activity for people with cancer. Benefits related to promoting health and recovery were reported in around three quarters of studies, and 50-60% reported benefits associated with fitness, energy, self-esteem, socialisation and stress-relief. Fewer studies reported perceived benefits associated with sleep, survival, recurrence, risk of injury or pain.

Preferences:

- **Mode:** Walking was identified as a preferred mode of exercise in 100% of studies across all cancer types and treatment stage.
- **Setting:** Physical activity within a home/private setting, and within clinics were the most commonly reported preferences across cancer types.
- **Delivery:** Advice from allied health professionals or oncologists was the preferred information in 70% and 60% of studies (across all cancer types), respectively.
- **Group:** A preference for exercising alone, with family members or with other people with cancer were more commonly reported than exercising in group-based settings.

4.1. Barriers to physical activity

There were multiple barriers to physical activity identified in the review across 15 cancer types. The most commonly identified barriers, irrespective of cancer type, were **treatment and disease-related side-effects** (physiological; identified in 84% of studies), **time pressures** (psychosocial and cultural; identified in 62% of studies), and **low mood, self-efficacy and motivation** (psychosocial and cultural; identified in 59% of studies).

Notable differences between cancer types included the presence of comorbidities as a barrier. This was more commonly identified in studies involving multiple myeloma (50%), and head and neck (67%) cancers, compared with breast (4%), colorectal (12%), and prostate (25%) cancers. Low physical capacity was more commonly reported as a barrier in colorectal (62%),

head and neck (67%), lung (80%), prostate (87%), and kidney (100%) cancers, compared with breast (22%) and ovarian cancer (25%). Time pressures was less commonly reported in studies involving lung cancer (20%) compared with all other cancers (>50% of studies).

With respect to differences by treatment stage, treatment and disease-related side-effects, time pressures and low mood, self-efficacy and motivation were also commonly identified barriers (consistent with the barriers identified across cancer types). Low physical capacity and time pressures more commonly identified as a barrier in studies assessing the post-treatment phase (49% and 76% of studies, respectively) compared with the during-treatment phase (23% and 52% of studies, respectively).

Figure 1 shows reported barriers and facilitators to physical activity during-and post-treatment for breast cancer specifically across 19 studies. Access to appropriate physical activity services were identified more commonly as a barrier during-treatment (50% of studies) compared with post-treatment (22% of studies) in women with breast cancer. The proportion of studies that identified all other reported barriers were similar across studies evaluating during and post-treatment phases.

4.2. Facilitators to physical activity

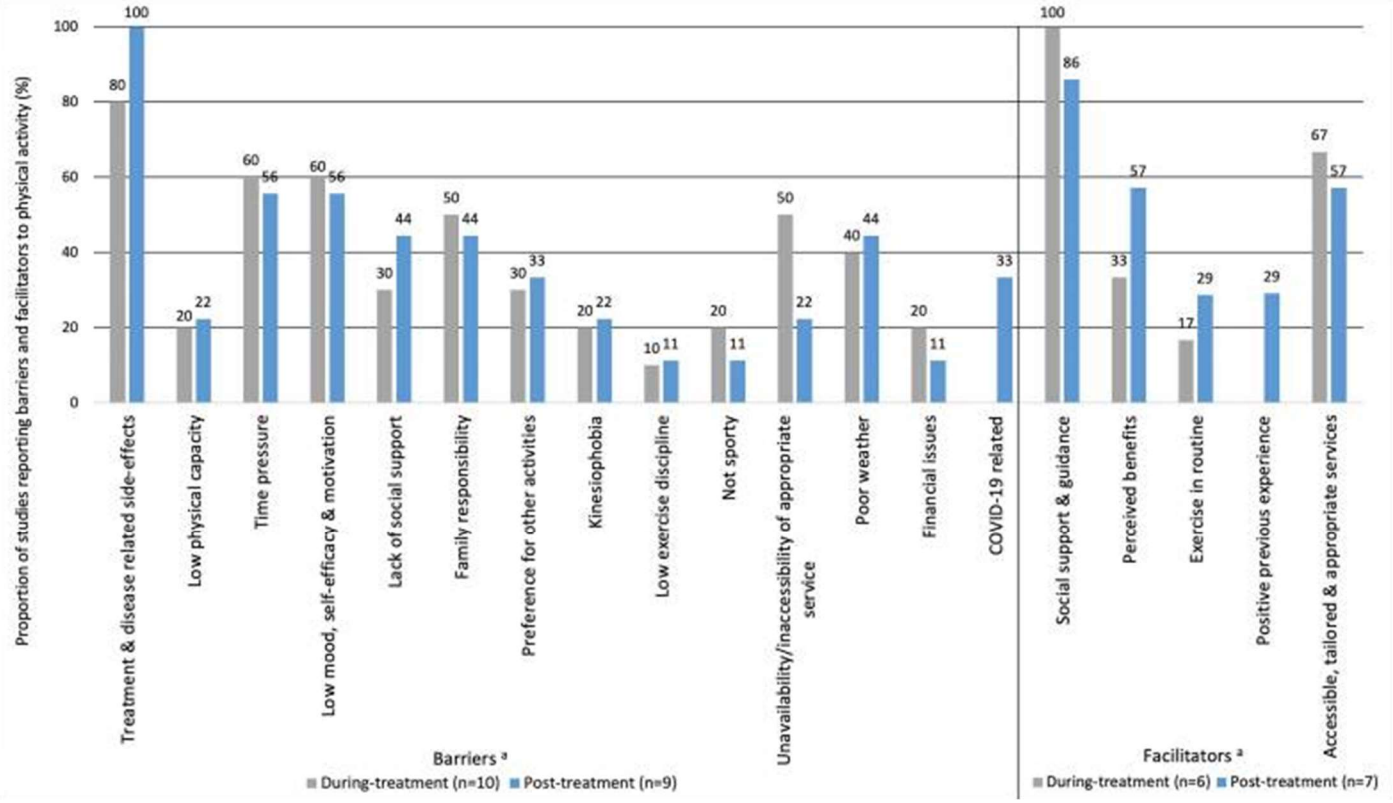
The most commonly identified facilitator was **social support and guidance**. This included receiving support from family, friends, and healthcare professionals, either in the form of company during physical activity or advice given about physical activity. This psychosocial and cultural facilitator was identified in 93% of studies when studies across all cancer types were included. Other commonly identified facilitators across 12 cancer types included **perceived benefits** associated with participating in physical activity (identified in 50% of studies) and having **access to tailored services** (identified in 64% of studies).

Differences in facilitators between cancer types included: feeling well (identified as a facilitator in 60% of studies involving colorectal cancer but not identified in 36 studies across 10 other cancer types); symptom management (identified as a facilitator in 80% of studies involving people with colorectal cancer, two studies (25%) involving men with prostate cancer, and one study involving women with ovarian cancer (50%) but was not identified in studies involving other cancer types). There were no notable differences in facilitators between studies that explored during-treatment versus post-treatment.

Within studies involving women with breast cancer, only one study was conducted pre-treatment and highlighted social support and guidance, and accessible, tailored, and appropriate services to be facilitators of physical activity. Figure 1 shows reported barriers and facilitators to physical activity during-and post-treatment for breast cancer specifically. Previous positive physical activity experiences and perceived benefits associated with participating in physical activity were more commonly identified as a facilitator for women

with breast cancer post-treatment (29% and 57% of studies respectively) versus during-treatment (0% and 33% of studies, respectively).

Figure 1. Barriers and facilitators of physical activity during- and post-treatment for people diagnosed with breast cancer (Gildea et al., 2023).



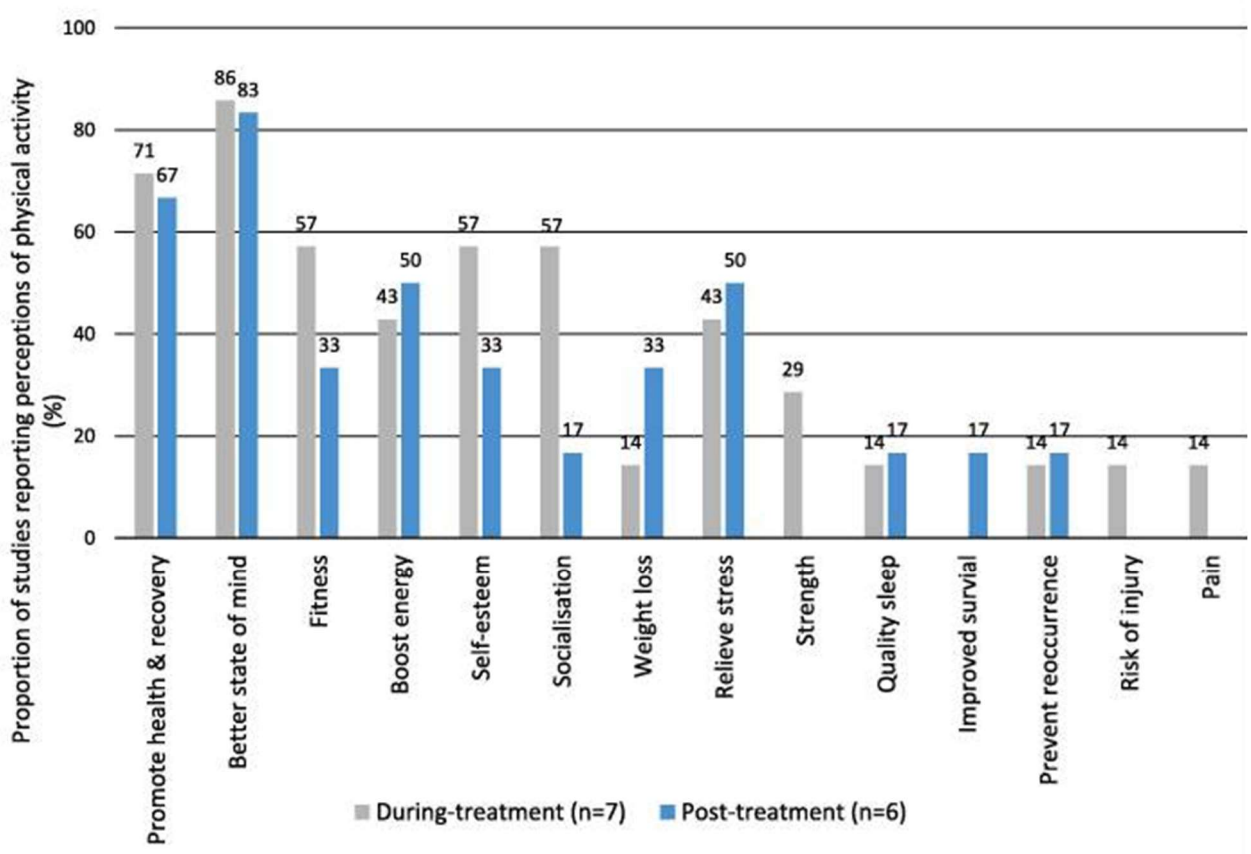
4.3. Perceptions

The most commonly identified perceived benefits were that physical activity promotes health and recovery (identified as a perception in 83% of studies across all cancer types), and a better state of mind (identified in 70% of studies across all cancer types).

All other perceived benefits across cancer types were identified in 8–51% of studies exploring perceptions. Potential for survival benefits was identified as a perceived benefit in less than 20% of breast, prostate and colorectal cancer studies and not identified in studies involving other cancer types. Weight loss was a perceived benefit identified in studies involving people with ovarian, colorectal, kidney, brain and head and neck cancer (identified in > 66% of studies for these cancer types), and less so for studies in breast and prostate cancer (identified as a perceived benefit in 17% and 37% of studies, respectively).

Regarding treatment stage, the belief that physical activity promotes health and recovery was also a commonly identified perception (consistent with perceptions identified across cancer types). However, differences emerged between studies exploring during versus the post-treatment phase, whereby physical strength and socialisation were more commonly identified as perceived benefits during-treatment (58% and 63%, respectively), compared to post-treatment (24% and 34%, respectively). Similar to other cancer types, the one study which involved women with breast cancer and evaluated perceptions during the pre-treatment period found that perceived benefits of physical activity included promoting health and recovery, and better state of mind (Brahmbhatt et al., 2020). Improved fitness, strength, self-esteem and socialisation were more commonly identified as perceived benefits associated with physical activity during-treatment (as identified in 57%, 29%, 57% and 57% of studies, respectively), compared with post-treatment (33%, 0%, 33% and 17%, respectively). When assessing perceptions of risks associated with physical activity, less than 15% of studies across all cancer types and stages of treatment identified perceived risks, with identified risks including fatigue, pain, risk of injury or other (labelled as 'negative perceptions and misinformation'). Figure 2 shows reported perceptions of physical activity during-and post-treatment among those with breast cancer specifically.

Figure 2. Perceptions of physical activity during- and post-treatment for people diagnosed with breast cancer (Gildea et al., 2023).



4.4. Preferences

In Gildea et al's review (2023), preferred modes of physical activity were explored among nine cancer types, from which 15 different modes of physical activity were identified.

Figure 3 shows the preferred modes of physical activity by cancer type. Walking was identified as a preferred mode in 100% of studies across all cancer types and treatment stage. Undertaking physical activity within a home/private setting (identified in 88% of studies) and within clinics (e.g., fitness centres, community clinics, university clinics; identified in 65%) were most commonly identified as preferred settings for physical activity across cancer types. Receiving physical activity advice from allied health professionals or oncologists was identified as the preferred source of information in 70% and 60% of studies (across all cancer types), respectively.

However, receiving advice from an oncologist was commonly identified as the preferred source of information during-treatment (100% of studies) versus post-treatment (60% of studies). Participating in physical activity in group-based settings was less commonly identified as a preference (identified in 22% of studies assessing the outcome according to

cancer type) compared to participating in physical activity alone, with family members, or other people with cancer (identified as preferences in > 65% of studies). There was no evidence highlighting clear preferences related to timing of physical activity (e.g., morning, afternoon, evening) across cancer types or treatment stage, or within women with breast cancer.

Figure 3. Proportions of papers reporting preferable modes of physical activity by cancer type (Gildea et al., 2023).

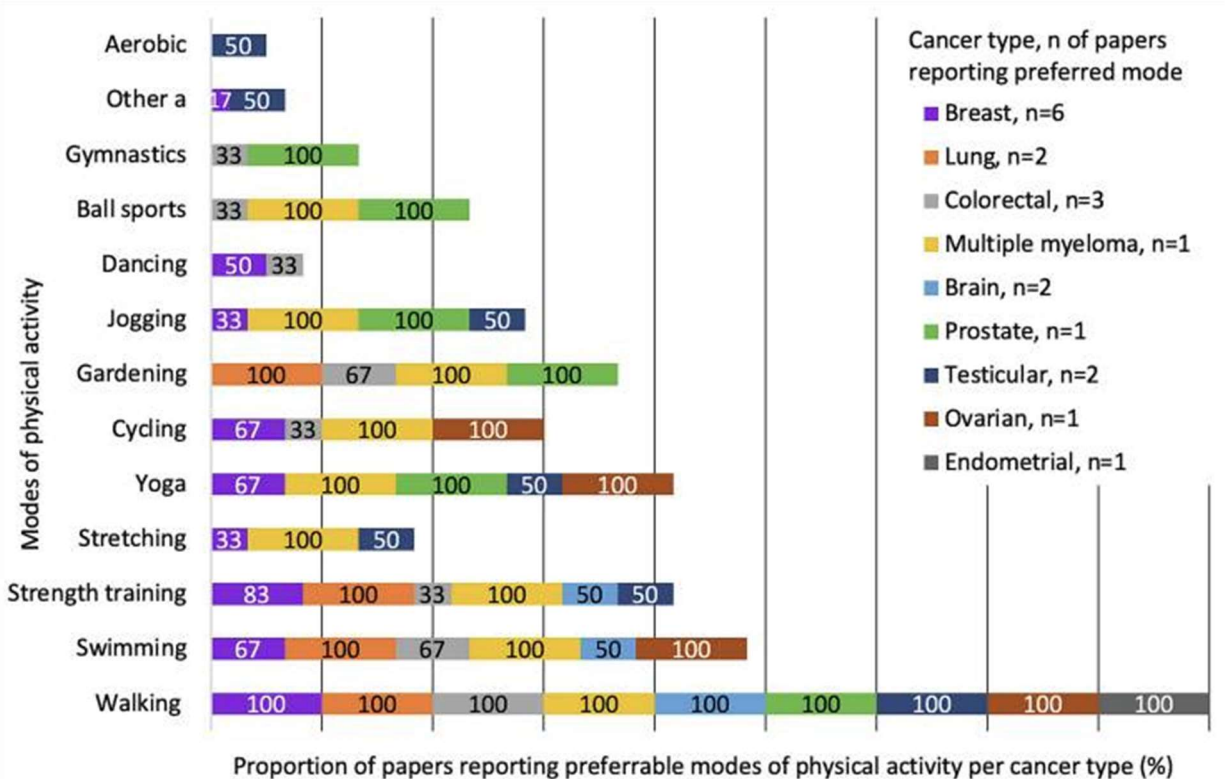
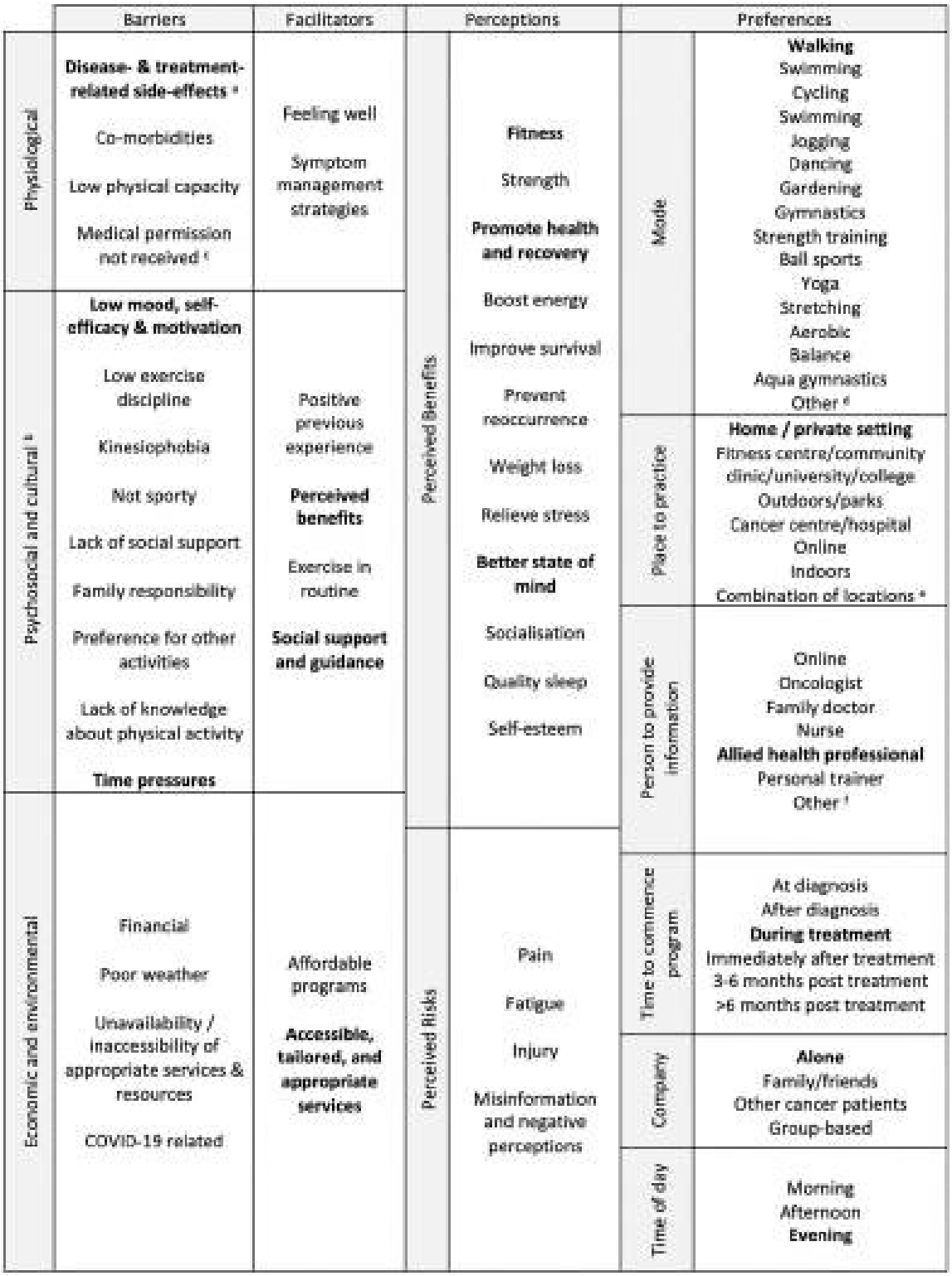


Figure 4. Barriers, facilitators, perceptions and preferences organised into subgroups and categories underpinned by the Social -Ecological model (barriers and facilitators), Health Belief Model (perceptions) and pragmatic approach (preferences).



5. What health inequalities exist in relation to physical activity and cancer?

Inequalities are defined by the Kings Fund as unfair, systematic and avoidable differences in health outcomes. Inequalities occur across the cancer continuum, from primary prevention, to screening and early diagnosis, access to and engagement with treatment, and living well with and beyond cancer. Inequalities are seen in relation to multiple factors. For example, people experiencing deprivation are more likely to get cancer, more likely to be diagnosed at a late stage when outcomes are poorer, and more likely to die from cancer. Other inequalities exist in relation to factors such as ethnicity, geography (eg, variations by place, or by rural or urban setting), sex, age and socially excluded groups (sometimes known as inclusion health groups). The Surrey Cancer Inequalities Plan identifies key inequalities across the cancer pathway for people living in Surrey.

As explored earlier in this review, physical activity is a protective factor against multiple cancer types; can improve wellbeing; and reduce mortality. However, inequalities in access to and engagement with physical activity are well documented outside of the cancer pathway, with emerging evidence suggesting these persist within cancer pathways.

TOP-LINE INSIGHT SUMMARY

Outside cancer pathway:

- **National data:** There are enduring and significant inequalities in the proportion of active adults by gender (men more active than women), socio-economic position (more affluent more active than more deprived), age (activity decreases with age), sexual orientation (gay and bisexual men more active than heterosexual adults), ethnicity (people of white or mixed ethnicity more active than those of Chinese, black and other Asian ethnicity) and disability and long-term condition status (adults without a disability of LTC are more likely to be active than those with).
- **Surrey:** The proportion of physically active adults (aged 19+, 2023/24) varies in Surrey by area, with the lowest proportions of adults meeting minimum recommended activity levels in **Spelthorne** (58%), Woking (64%), Runnymede (66%) Reigate and Banstead (67%) and Surrey Heath (67%%), vs 69% Surrey CC average. There is also regional variation in the proportion of children and young people meeting the physical activity guidelines(academic year 2024/25), with the lowest values in Guildford (47%), Mole Valley (48%) and Reigate and Banstead (50%) (Surrey CC value 64%).

Within cancer pathway:

- **Prehabilitation:** Is designed to improve functional capacity, physical and mental wellbeing before major interventions, but risks creating intervention-generated inequalities based on evidence suggesting people with lower health literacy, from minority ethnic groups and socio-economically disadvantaged backgrounds, are less likely to engage.
- **Early-stage cancer survivors:** People with lower income, minoritised ethnic groups, those with non-University educated backgrounds, those affected by overweight or who have a high number of comorbidities are less likely to be active.
- **People with advanced cancer:** Most people with advanced cancer do not meet the physical activity guidelines, but the proportion is lowest for those above retirement age, males, those not-working, with no educational qualifications, with more than 3 comorbidities, minoritised ethnic groups and people with obesity.

Exercise as a tool to reduce inequalities:

- Integrated exercise oncology services delivering physical activity programmes can directly improve inequalities in health outcomes, and indirectly by disseminating additional information about cancer to groups who may otherwise be missed.
- Tailoring programmes for cultural preferences (eg, type of exercise, exercise in women's only group, language) and accessibility (eg, home based) is key to tackling inequalities.

5.1. Overview of inequalities and variation in physical activity outside cancer pathway in England

There is a well-established evidence base documenting inequalities in physical activity. The latest data from Sports England's Active Lives Adult Survey Report for 2023/24 highlights the following as 'enduring and significant' inequalities in the proportion of active adults (defined as 150+ minutes per week):

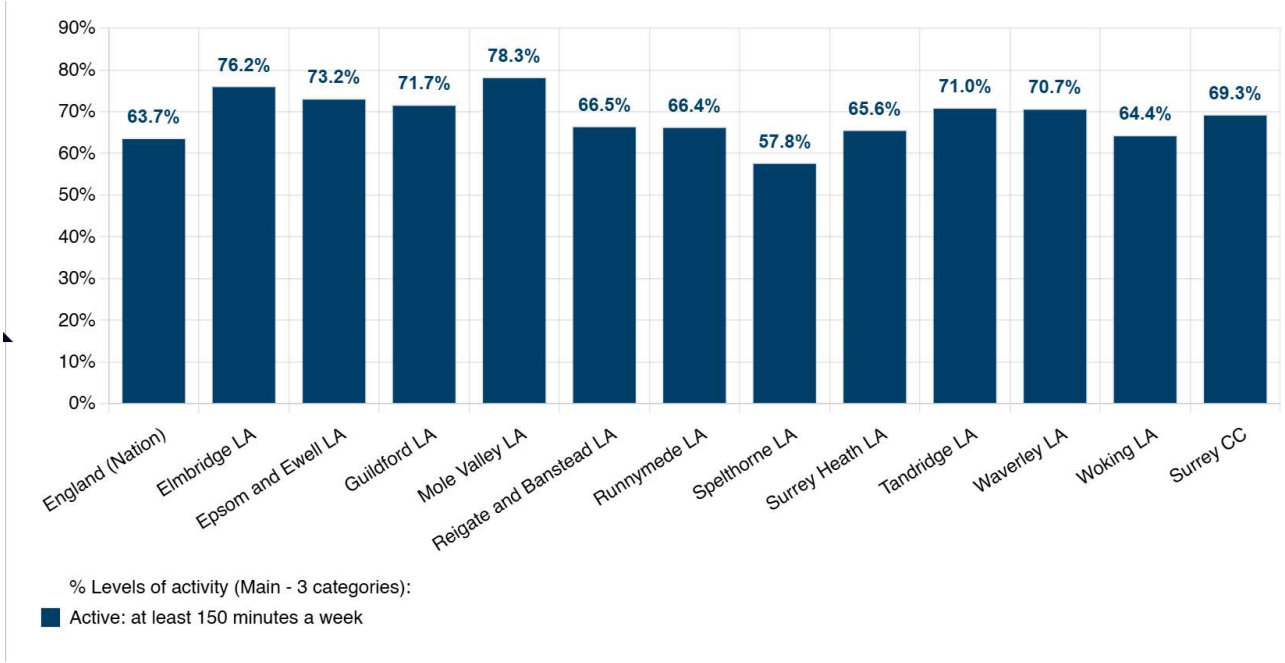
1. **Gender:** men (66%) are more likely to be active than women (61%) and those who describe their gender in another way (59%). Activity levels have increased for both men and women since 2015/16.
2. **Socio-economic position:** individuals in more affluent groups (NS-SEC 1-2; 73%) are more likely to be physically active than those in more deprived groups (NS-SEC 6-8; 52%). Similarly adults living in the least deprived (IMD 8 – 10; 68.9%)) are more likely to be active that those in most deprived (IMD 1-3, 55.5%). Longitudinal data suggest these inequalities have increased since 2015/16, with activity levels increasing amongst the most affluent groups, but decreasing amongst the most deprived.
3. **Age:** activity levels tend to decrease with age (70% 16-34; 65% 35-54; 63% 55-74; 43% 75+). Activity levels remain stable among younger adults (16- 54) and continue to grow among older adults (55+)
4. **Sexual orientation:** Gay men (69%) and bisexual adults (71%) were more likely to be active than heterosexual adults (64%)
5. **Ethnicity:** People of mixed (71%), white other (67%) or white British (65%) ethnicity were more likely to be active than those of Chinese (58%), Black (56%) or Asian (exc. Chinese; 55%) ethnicity. Whilst activity levels have increased by 2.4% since 2015/16 for White British adults, there have been no statistically reportable increase in the proportion of black, Asian or other minoritised ethnic group over the same time period.
6. **Disability and long-term health conditions:** Adults without a disability or long-term health condition are more likely to be active (69%) than those with (48%). This pattern has remained relatively stable over time.

Their report highlights that adults with two or more characteristics of inequality are the least likely to be active, with only 44% meeting the Chief Medical Officer's guidelines, compared to 62% of adults with one, and 74% of those with none.

5.2. Variation in physical activity outside cancer pathway in Surrey

Data from Sports England show variation in the proportion of physically active adults (%, 2023/24) between districts and boroughs in Surrey (see **Figure 5**). These variations may indicate inequalities in access to and engagement with physical activity services and programmes.

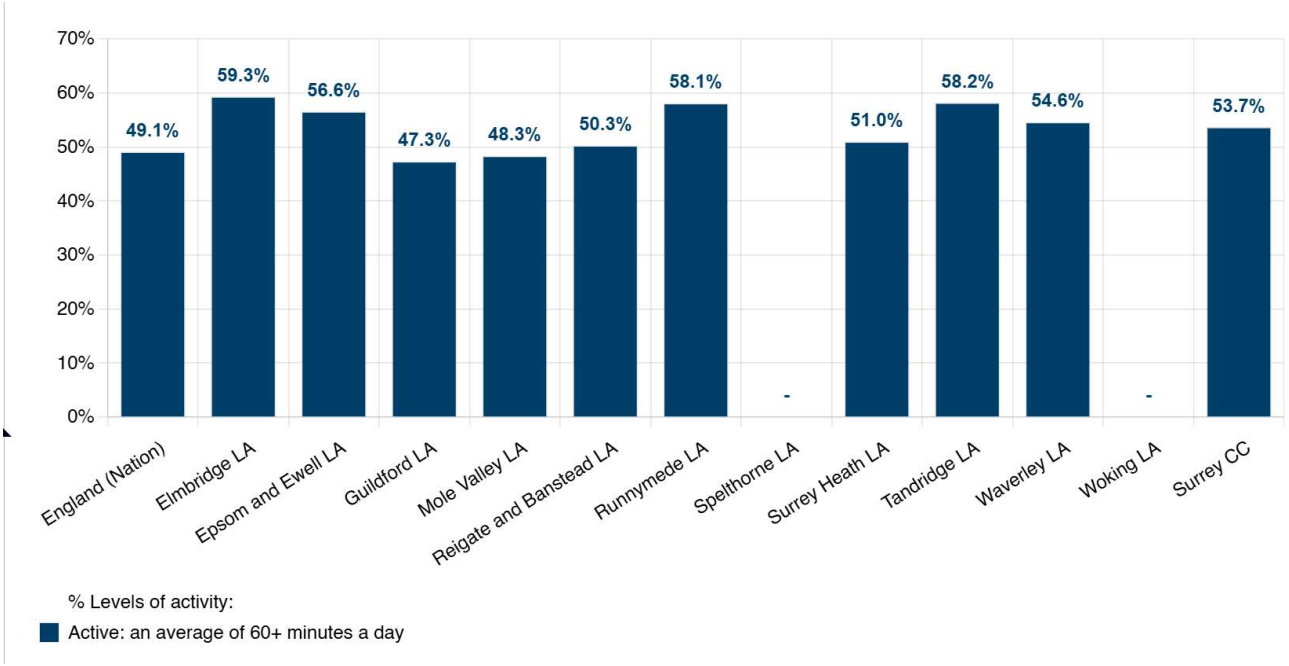
Figure 5. Percentage of physically active adults in across Surrey districts and boroughs 2023/24 proportion % (Sports England)



Overall, 69% of adults (aged 19+) are physically active in Surrey (defined as 'doing at least 150 moderate intensity minutes physical activity per week) compared to 64% in England (based on Sports England's Active Lives Adult Survey). The districts and boroughs with the lowest reported activity levels are **Spelthorne** (58%), Woking (64%), Runnymede (66%) Reigate and Banstead (67%) and Surrey Heath (67%%).

A different pattern is seen looking at proportions of physically active children and young people (**Figure 6**). Data from the Active Lives Children and Young People Survey (ALCYPS) (academic year 2024/25) report the percentage of children aged 5 to 16 that meet the UK Chief Medical Officers' (CMOs') recommendations for physical activity (an average of at least 60 minutes moderate to vigorous intensity activity per day across the week). This showed just 54% of children in Surrey meet the recommended target, with wide variation between districts and boroughs, ranging from 47% in Guildford, to 59% in Elmbridge. Data were not available for Spelthorne or Woking.

Figure 6. Percentage of physically active children and young people in across Surrey districts and boroughs 2024/25 academic year proportion % (Active Lives Children and Young People Survey)



5.3. Inequalities in physical activity within cancer pathway

5.3.1. Prehabilitation

Prehabilitation is an intervention delivered to patients after diagnosis but before treatment. It is designed to improve functional capacity before major interventions (typically surgery), as well as support physical and mental wellbeing. The main components include cardiovascular and strength training, nutritional management and psychological support. There is increasing evidence supporting the importance of prehabilitation for improving cancer outcomes for some cancer-types (Gennuso et al. 2024). Indeed, Surrey and Sussex Cancer Alliance have developed a Prehabilitation and Rehabilitation Information Hub, emphasising the core elements that should be tailored to an individual's needs and preferences: physical activity, nutrition and psychological support. The hub signposts to a page focusing specifically on physical activity, as well as hosting 'cancer prehabilitation and rehabilitation guidance'.

However, a recent narrative review (Stewart et al. 2025) report that pre-habilitation programmes pose a risk of creating 'intervention-generated inequalities'. This is based on their finding that people with *lower health literacy, from minority ethnic groups and socio-economically disadvantaged backgrounds*, are less likely to engage, despite often having worse

peri-operative outcomes. Furthermore, they report that pre-habilitation remains under-researched in many cancer types, and highlight multiple challenges and barriers for healthcare providers, systems and patients in implementing and engaging with pre-habilitation. Recently, NIHR committed £780,000 funding to a research programme designed to understand and improve equality of pre-habilitation programmes.

As part of this programme, an evidence review highlighted differences in the strength of evidence base supporting different types of pre-habilitation grounded in physical training. Generally, evidence supporting pre-habilitation programmes that aim to target a specific post-operative complication (eg, pelvic floor muscle training in prostate cancer surgery and respiratory muscle training for lung cancer surgery) is stronger than programmes targeting cardiorespiratory fitness. They also reported variability in recruitment and completion of studies of exercise-based prehabilitation programmes. Michael et al (2021) noted that between 46 and 100% of patients offered the opportunity to participate in studies agreed to do so, and between 47 and 100% of those recruited completed the studies. The authors reported that commonly-cited reasons for patients declining to participate included:

- Low interest, work or time constraints, physical or medical contraindications, and access to transport
- Studies in colorectal cancer appeared to recruit a greater proportion of patients than those in oesophagogastric cancer.
- Compliance and adherence and attendance were poorly-reported, raising the possibility that those patients who were most 'determined' or 'able' to complete prehabilitation may be over-represented in the data (Lambert et al. 2021)

These observations underline the potential of prehabilitation to widen health inequalities and serve some patient groups better than others, without close monitoring and evaluation.

5.3.2. Early stage cancer survivors

In early-stage cancer survivors, studies have shown that individuals from lower income, ethnic minority, and non-University educated backgrounds, those affected by overweight or who have a high number of comorbidities are less likely to be active (Speed—Andrews et al., 2012; Hong et al. 2006; Irwin et al. 2004; Naik et al., 2016).

5.3.3. People with advanced cancer

A 2024 paper analysed data from a cross-sectional survey distributed to people diagnosed with advanced breast, prostate and colorectal cancer between 2012 and 2015, across sites in London and Essex (UK) (Haider et al. 2024). The study identified 'potential educational and ethnic disparities' in meeting the World Health Organisation (WHO) guideline recommendation of 150 min moderate-vigorous physical activity (MVPA) per week for adults with cancer.

Overall, the study found that most (59%) individuals with metastatic cancer were not meeting the WHO guideline of 150 min of MVPA per week, but that the proportion meeting the guideline recommendation was lower for people with the following characteristics:

- Above retirement age 26.3% (below retirement = 49%)
- Males 36.3% (female = 43.4%)
- Not working 31.2% (working = 56.1%)
- No educational qualifications 24.3% (university degree or above = 51.7%)
- 3+ comorbidities 28% (0 comorbidities = 50.7%)
- Minoritised ethnic groups 27% (white = 57%)
- People with obesity 67% (healthy weight = 59%, overweight = 57%, underweight = 33%)

In the multiple logistic regression analysis, the odds of meeting the MVPA guideline were:

- Lower for unemployed individuals, compared to employed individuals (OR = *0.49*; 95% CI = *0.30–0.79*) ()
- Lower for ethnic minorities than for white individuals (OR = *0.43*; 95% CI = *0.21–0.87*).
- Higher for individuals with a university education (OR = *1.89, 95%* CI = *1.0–3.57*) *compared to* those with no qualifications,

Most (63.5%) participants felt they should be doing more physical activity. However, 70.1% did not receive any physical activity advice or support, despite 73.6% wanting to receive it.

5.4. Linking inequalities to factors influencing physical activity within and outside of cancer pathway

As described in Section 4, systematic reviews have identified common barriers and enablers to engaging with physical activity for people living with and beyond cancer. These multiple, interacting influences on the perceptions, beliefs and cues that drive the likelihood of an individual adopting or engaging with a healthy behaviour in many instances arise from and contribute to perpetuation of systematic, unfair and avoidable differences in outcome (in other words, inequalities).

For example, we know that the following commonly reported barriers are more likely to be encountered by groups at the highest risk of poorer health and cancer outcomes, including those from the most deprived communities, people with learning and physical disabilities, people with existing comorbidities (Elshahat et al., 2021):

- Affordability
- Inaccessible facilities and parking
- Physical inactivity before diagnosis
- Exercise as part of routine

- Perceptions of health benefits
- Social support
- Family responsibility
- Co-morbidities - physiological
- Time-pressure

It is therefore critical that systematic barriers to engaging with physical activity before, during and after cancer treatment are addressed to prevent further perpetuating pre-existing inequalities in incidence and outcomes.

5.5. Exercise as a tool for addressing cancer inequalities

A 2023 report by Yorkshire Cancer Research submitted to UK Parliament highlighted that there is a lack of evidence examining how exercise as part of cancer treatment could help address health inequalities. However, they drew attention to the potential for exercise programmes to both directly improve inequalities in health outcomes, and indirectly address inequalities by supporting dissemination of information on cancer to groups who may otherwise be missed by public health campaigns.

The report also highlighted key barriers to physical activity, including accessibility to facilities (due to travel and cost), low confidence or a lack of support. Exercise programmes can address these factors by providing a free, tailored exercise programme led by physical trainers in community locations that are easy to reach. These programmes can also be tailored for those from ethnic minority groups, as they can be group-based in a culturally appropriate facility, and can be tailored to cultural preferences (e.g., type of exercise, or exercising in a women-only group) and delivered or supported by multilingual individuals. Options for home-based exercise are also available to address issues faced by rural populations in travelling for treatment, removing the need for another long journey in an already heavy treatment schedule.

The report concluded that integrated exercise oncology services that deliver physical activity programmes and are considered part of cancer treatment can directly address barriers to taking part in physical activity such as costs, can provide support and increase the confidence that individuals with cancer have to engage in exercise.

6. What are the characteristics of effective physical activity interventions and programmes for people with cancer?

Several systematic and umbrella reviews have synthesised studies testing the impact of physical activity interventions among people with cancer (Misag et al., 2022; Qiu et al., 2023; Hoover et al., 2024). This section collates the conclusions made throughout these reviews to explore the characteristics of effective interventions, including insight into intervention type, dose, context (population and settings), outcome measures, and impact.

TOP-LINE INSIGHT SUMMARY

- **Populations:** Evidence of impact is strongest for breast cancer, with growing but less consistent evaluation across other cancer types and age groups.
- **Cancer stage:** Evidence suggests physical activity should be embedded throughout the cancer care continuum, starting as early as possible, as it improves clinical and quality-of-life outcomes.
- **Age:** While adult populations dominate the evidence base, structured, supervised, and individualised physical activity interventions are feasible and increasingly studied for children and adolescents

Types of intervention:

- **Dose:** Intervention lengths ranged from 2 weeks to 4.78 years, but 12 weeks was most commonly studied and identified as the most effective programme length.
- **Format and setting:** Electronic interventions (eg, apps and fitness trackers) are feasible for increasing physical activity, but evidence suggests multi-modal delivery works best, with strong evidence for home-based and tech-supported interventions, especially when combined with behavioural support. Both group and individual interventions can be effective so tailoring to patient preference and context is key.
- **Underlying theory:** Interventions grounded in behavioural theory (eg, social cognitive theory, transtheoretical model, theory of planned behaviour) and incorporating BCTs (goal setting, action planning, self-monitoring, social support, positive reinforcement) are more effective than those without.

Outcomes:

- Physical activity interventions deliver **multi-dimensional benefits**—improving fatigue, QoL, mental health, and potentially reducing recurrence risk—especially when combining aerobic and resistance exercise.

The populations (eg, cancer type and stage) within which physical activity interventions are evaluated and embedded influence their impact and effectiveness:

Cancer type: In Qiu et al's umbrella review of systematic reviews (2023), the most common cancer type involved in interventions included within the systematic reviews was breast cancer. Eight reviews focused on breast cancer, sixteen reviews focused on patients with different types of cancer, one review focused on colorectal cancer, and one review focused on paediatric cancer. In Misag et al's review (2022), the most common cancer type involved in interventions was breast cancer. Interventions also included those diagnosed with prostate, colorectal, pancreatic, paediatric and ovarian cancer. Hoover et al's (2024) systematic review focused specifically on interventions for adolescents and young adults. Studies had single (breast cancer or acute leukaemia) or multiple cancer types (i.e., lung, gynaecological, neck, and testicular cancer, germ cell, sarcoma, Hodgkin's lymphoma, non-Hodgkin's lymphoma, leukaemia, central nervous system, melanoma, medulloblastoma).

- **Age:** Most reviews focused on testing physical activity interventions for adults. However, Hoover et al's review (2024) looked specifically at children and adolescent cancer survivors, eleven studies reported supervised sessions in the presence of a trained, qualified professional. The qualified professional was a research team member ($n = 4$), an accredited exercise physiologist ($n = 3$), not specified ($n = 2$), or an exercise trainer ($n = 2$) The supervised physical activity occurred one to five times per week and was completed in a hospital gym ($n = 4$), not explicitly reported ($n = 4$), community gym ($n = 1$), a walking path at the hospital ($n = 1$), or oncology centre gym ($n = 1$). Each session had a duration of 30–60 minutes, including warm-up and cool-down time. Of these 11 supervised studies, only four had specific recommendations for PA at home. They ranged from formalized PA prescriptions of days per week to encouraging daily movement. Another common component across these interventions was creating and implementing individualized/tailored physical activity prescriptions for the participants. A physical activity professional (i.e., an accredited exercise physiologist or personal trainer) created the tailored PA interventions from a baseline assessment. These tailored interventions were used for physical activity progression in aerobic and strength training exercises. Eleven of the 15 studies enabled the physical activity professional to adjust the physical activity at each session. In contrast, three studies were unsupervised, with physical activity tailored by weekly interactions.
- **Point of pathway:** Macmillan Cancer Support's report (2018) summarised the research base for the role of physical activity across different parts of the cancer pathway (see **Figure 7**). They highlighted that evidence is growing to support the integration of physical activity promotion into cancer care. Enabling people to be physically active at all stages of their cancer journey can improve both clinical and quality-of-life outcomes. This includes 'prehabilitation' (before surgery or treatment) as well as rehabilitation

afterwards (Macmillan Cancer Support, 2017). A report from Toohey et al (2020) stated that the sooner physical activity is incorporated into a patient's treatment plan after diagnosis, the more effective it is. A recent study at the University of Surrey, which looked specifically at patients with oesophageal cancer, found that physical activity during chemotherapy and before surgery may help the body send more immune cells into cancerous tumours (Rayner et al., 2025). Traditionally, people have been encouraged to rest during cancer treatment. However, this advice has now been shown to be outdated. A review of evidence-based physical activity guidelines for cancer populations in Australia, Europe, and the United States now concludes that physical activity is safe and should be an integral and continuous part of care for all individuals (Buffart et al., 2014). General recommendations common to all published guidelines include:

- Avoid inactivity and return to usual activities as soon as possible after surgery.
- Aim to continue physical activity as far as possible while undergoing treatment.
- Build up to age-appropriate guidelines for health-enhancing physical activity after treatment (typically aerobic exercise for two and a half hours per week, resistance exercise twice a week, and balance/ coordination exercises twice a week), heeding key safety principles).

Figure 7. Key stages of the cancer care pathway where physical activity has potential benefit (Macmillan Cancer Support, 2018 Integrating physical activity into cancer care)

Stage	Outcomes	Evidence
Pre-treatment	Increased cardiorespiratory fitness, fewer post-operative complications and shorter hospital admissions	Preliminary evidence
Treatment	Helps to preserve cardiorespiratory and muscular fitness, and to control cancer-related fatigue	Promising evidence
Post-treatment	Increased cardiorespiratory and muscular fitness, reduced fatigue, and improved body composition and wellbeing outcomes	Promising evidence
Palliative	Exercise is feasible, and may help maintain physical function, control fatigue, and improve bone health	Preliminary evidence
Survivorship	Associated with longer survival and a lower risk of recurrence or disease progression	Preliminary evidence

Compelling	Promising	Preliminary
High-quality body of evidence with no uncertainty over the effects demonstrated	Moderate-quality body of evidence with some uncertainty over the effects demonstrated	Low or very low-quality evidence with considerable uncertainty over the effects demonstrated

6.2. Types of physical activity intervention

The characteristics of physical activity interventions that have been evaluated in people with cancer vary by dose (eg, programme length), format and setting (eg, type of exercise, where delivered, level of facilitation) and underlying theory.

Most studies included in reviews used a combination of intervention methods to increase physical activity among cancer patients, including use of workshops, group exercise, walking, behavioural counselling, home-based/group-supervised exercise classes, counselling, and group discussions, printed materials and pedometers (Qiu et al., 2023).

Qiu et al's umbrella review (2023) also highlighted different settings for physical activity interventions among those diagnosed with cancer. Intervention settings in the reviews included studies that included group, one on one, home, clinic or research-setting, and centre-based.

- **Dose (length):**
    - Intervention lengths within Qiu et al's (2023) umbrella review of systematic reviews varied from 2 weeks to 4.78 years. The most frequent and mean duration of physical activity interventions was 12 weeks. This aligns with habit research, which suggests that it can take 9 – 12 weeks to embed new behaviours (Lally et al., 2010).
    - Singh et al (2021) found that physical activity interventions lasting 12 weeks were more effective at increasing physical activity levels among those diagnosed with cancer when compared to interventions lasting less than 12 weeks.

- **Format and setting (electronic, home-based or clinic-based):**

    - ***Electronic***: 34% of studies in Qiu et al's (2023) umbrella review investigated the effect of electronic physical activity interventions among people with cancer. Of these:
        - **Electronic-health (eHealth) interventions:** eHealth uses technologies including telephones, websites, email, and mobile health (mHealth) technologies. Seven studies tested the effect of eHealth on exercise levels in cancer patients (Dorri et al., 2020; Roberts et al., 2017; Haberlin et al., 2018; Blackwood et al., 2021; Ester et al., 2021; Khoo et al., 2021; Cheung et al., 2021). Compared with the control interventions, eHealth technology provides communication (including real-time, automated reminders) and feedback. The majority of studies reported that eHealth interventions were effective and feasible in promoting physical activity in cancer survivors, and that eHealth resulted in a significant increase in moderate- to vigorous-intensity physical activity minutes/week (Roberts et al., 2017).
        - **Digital activity trackers:** Three studies examined the feasibility of digital activity trackers in cancer survivors and their effects on activity levels. Interventions based on physical activity trackers and pedometers usually include behaviour change theories or theory-based interventions (Roberts et al., 2017; Singh et al., 2022). In the included studies, wearable physical activity trackers mainly include Fitbit One, Polar A360/M400, GT3X + ActiGraph, ActivPAL, and Garmin Vivofit smartwatches. Four reviews (Blount et al., 2021; Schaffer et al., 2019; Blackwood et al., 2021; Khoo et al., 2021) found that wearable health technology–based physical activity interventions are effective in improving physical activity, and health-related outcomes in individuals with cancer. Additionally, Singh et al's (2022) review concluded that physical activity tracker and/or pedometer-based interventions had moderate to large effects on the amount of physical activity and steps among those diagnosed with cancer.

Face-to-face: A meta-analysis of face-to-face behaviour change counselling interventions were found to improve physical activity engagement among cancer patients (Meyer-Schwickerath et al., 2021).
Home-based: Most reviews included studies that were mainly delivered in home settings (Hailey et al., 2022; Bluethmann et al., 2015; Liu et al., 2021; Finne et al., 2018). Home-based exercise usually has behavioural support, including information feedback, ongoing interaction, or counselling with the research team. One meta-analysis found that interventions that included a home-based training component were more effective at driving engagement with physical activity than those delivered exclusively in clinics or gyms (Finne et al., 2018).
Clinic-based or Combination: Some interventions were delivered in a combination of supervised and home-based exercise (Short et al., 2013; Abdin et al., 2019; Turner et al., 2018). One review found that home-based combined with centre-based interventions increased self-reported physical activity more than home-based programs alone among overweight and obese female cancer survivors (Rossi et al., 2018). Nicol et al (2020) surveyed people with multiple myeloma suggested that interventions that are low-cost and located close to home are likely to be met with the highest interest and compliance. Greater contact time was associated with increased effectiveness in a meta-regression of 63 studies (B = 0.002, SE = 0.001, p = 0.008) (Sheeran et al. 2019). Through an inequalities lens, Qiu et al. (2023) reflected that reasonably low-intensity interventions "may be sufficient to induce lasting behavioural change in positive, young, well-educated, and white populations, but other populations may require more intensive support, especially older and physically constrained populations".

- **Group-based vs individual:** The reviews indicated that both group and individual physical activity interventions had positive outcomes for those diagnosed with cancer (Qiu et al. 2023).

- **Underlying theory:**
  - **Behaviour change techniques (BCTs):** Seven studies included in Qiu and colleagues (2023) review tested interventions explicitly using BCTs (Hailey et al., 2022; Short et al., 2013; Finne et al., 2018; Turner et al., 2018; Brunet et al., 2020; Meyer-Schwickerath et al., 2021; Mbous et al., 2020). The most commonly used BCTs were goal setting (behaviour), goal setting (outcome), action planning, habit reversal, instruction on how to perform the behaviour, self-monitoring, eliciting social support, positive reinforcement, and problem-solving. One meta-analysis concluded that BCTs had a significant effect on increasing physical activity levels among those with cancer (Finne et al., 2018). The BCTs prompts, reduce prompts,

graded tasks, non-specific rewards, and social rewards were significantly associated with larger effects, while information about emotional consequences and social comparison was associated with smaller effects size (Finne et al., 2018). In another meta-analysis, face-to-face behaviour change counselling interventions were found to improve physical activity engagement among cancer patients (Meyer-Schwickerath et al., 2021).

- **Theory-based intervention:** Four reviews focused on theory-based physical activity interventions (Liu et al., 2021; Rossi et al., 2018; Brunet et al., 2020; Mbous et al., 2020). Most studies cited the social cognitive theory, the transtheoretical model, and the theory of planned behaviour. Most reviews suggest that theory-based physical activity interventions can increase physical activity engagement in cancer survivors (Qiu et al., 2023). For example, in a meta-analysis of 8 studies, theory-based physical activity interventions among colorectal cancer survivors were found to improve physical activity (Mbous et al., 2020). A review based on 16 studies found that the combination of step trackers with counselling, printed materials, or motivational strategies based on behavioural change theory provided a consistently positive effect on adherence to self-directed physical activity among breast cancer survivors (Pudkasam et al., 2021).

6.3. Outcome measures and intervention effects

Different physical activity interventions have different objectives and therefore their effectiveness and impact have been evaluated using a wide range of outcome measures. The main impact and outcome measures associated with different types of intervention described within Qiu et al's umbrella review (2023) are summarised below:

Self-report physical activity:

Across, most studies used self-reported measures to assess the patients physical activity behaviour, including the Godin Leisure Time Exercise Questionnaire (GLTEQ), International Physical Activity Questionnaire (IPAQ), 7-day physical activity recall (7-DPARQ), Godin Leisure score index, Scottish physical activity questionnaire (Scot-PASQ), the Short Questionnaire to Assess Health Enhancing Physical Activity (SQUASH), 7-day PA and Community Health Activities Model Program for Seniors (CHAMPS) among others.

Physiological physical activity measures:

Fourteen reviews within Qiu et al's umbrella review (2023) used objective physical activity measures such as accelerometers, Fitbit, pedometers and activPAL – all of which are small, light and can be worn on the wrist, waist of thigh during waking hours. Qiu et al's umbrella review (2023) concluded that electronic, wearable health technology-based, BCTs, and theory-

based interventions were effective and feasible in increasing physical activity in cancer survivors. In Hoover et al's review (2024) looking specifically at children and adolescents, all 17 studies observed improvement (i.e., more steps, less sedentary time) in the physical activity outcomes, with nine reporting statistically significant improvements. These nine studies had varied PA intervention characteristics, including tailored/individualized PA prescriptions ($n = 6$), goal setting ($n = 5$), wearable device ($n = 5$), and supervised ($n = 4$).

Health-related outcomes:

Misag et al's (2022) review outlined other outcome measures for physical activity interventions among cancer patients, including treatment side effects, fatigue, quality of life, mental health, and recurrence. The effectiveness of selected interventions on commonly evaluated outcomes are described in more detail below.

- *Fatigue*

A review reported that an association between exercise and reduced fatigue has been demonstrated in patients with breast, prostate, colon and lung cancers (Avancini et al., 2020). One study included in the review, which involved an intervention for breast cancer patients, found that regular physical activity combined with an appropriate diet (the patients completed 71% of the aerobic exercise sessions of 41 ± 25 min and 58% of the resistance exercise sessions planned as part of the intervention) reduced the fatigue resulting from intensive cancer treatment (Carayol et al., 2019). In a study by Singh et al (2020) analysing the findings from 19 clinical trials, physical activity interventions were observed to have a significant effect on fatigue in patients with colorectal cancer as compared with usual cancer care.

- *Quality of life*

Misiag and colleagues (2022) review reported that physical activity improves physical and social QoL and reduces anxiety and depression in cancer patients'. This was based on findings from several studies, including one randomised controlled trial showing that an aerobic and resistance physical activity improved QoL by reducing depression, fatigue and physical deconditioning among breast cancer survivors (Dieli-Conwright et al., 2018). Furthermore, a combined aerobic and resistance physical activity intervention during chemotherapy resulted in better longer-term QoL outcomes in breast and colorectal cancer patients, improving sleep quality, reducing anxiety and depression and having a positive impact on happiness (An et al., 2019). Several other studies also showed that physical activity interventions improved QoL among paediatric cancer patients (Cheung et al., 2021; Howell et al., 2018; Li et al., 2018) and ovarian cancer patients (Jones et al., 2020).

- *Treatment-related side effects*

Chemotherapy and radiotherapy inhibit physical activity due to their side effects, such as severe fatigue, lack of energy as well as hair loss and mental health problems (Nielsen et al.,

2020). Interviews with people who had completed cancer treatment found that physical activity reduced the side effects of treatment, and fatigue (Liska et al., 2020).

- *Mental wellbeing*

Misiag and colleagues (2022) review concluded that physical activity positively impacts the mental health of cancer patients, based on evidence from multiple studies. For example, one study showed that an aerobic, resistance and flexibility physical activity intervention undertaken by prostate cancer for 3 months resulted in self-reported improvements in physical functioning, which had a positive influence on the mental health of the patients studied (Galvao et al., 2018).

Another study found that an 8-week physical activity intervention consisting of twice-per-week sessions of 60 min of resistance, flexibility and cardiorespiratory exercises performed by patients with different types of cancer improved the capability of the patients to express positive emotions, improved their functional capacity and had a positive influence on their mental health (Cataldi et al., 2020).

- *Risk of recurrence:*

The review by Misiag and colleagues (2022) reported that combined aerobic and resistance exercise reduces the incidence of metabolic syndrome in cancer survivors, particularly breast cancer survivors. A randomised controlled trial conducted among 100 breast cancer survivors, assigned either to physical activity or usual care, showed an improvement in BMI and levels of circulating biomarkers, i.e., insulin, IGF-1, adiponectin and leptin, in the physical activity group after the intervention. An improvement in all metabolic syndrome variables persisted at the 3-month follow-up in the exercise group, suggesting reduced risk of breast cancer recurrence (Dieli-Conwright et al., 2018).

7. What factors influence the implementation of physical activity interventions for people with cancer?

Despite evidence of the importance of physical activity for living well with and beyond cancer, physical activity is not always systematically promoted in practice.

Hardcastle et al's study (2025) identified challenges and solutions to promote physical activity within the cancer pathway as routine practice amongst a broad range of stakeholders in Ireland. Focus groups were conducted with 40 participants, including oncologists, oncology nurses, physiotherapists, cancer support centre managers, academics, consumers, policy representatives, and exercise specialists. Although the study took place in Ireland, the insights into key implementation factors should be considered in relation to physical activity for people with cancer in Surrey.

TOP-LINE INSIGHT SUMMARY

Four primary factors affecting physical activity intervention implementation for people with cancer were identified:

1. Embedding physical activity into the cancer pathway: Physical activity should be treated as an essential component of cancer care. Oncologists' leadership is critical for buy-in; national cancer plan seen as key enabler. Integration requires:

- **Subtheme 1: Consistent messaging from all healthcare professionals is essential.** Mixed messages undermine patient confidence. Nurses play a key role in reinforcing positive messages during treatment.
- **Subtheme 2: Physical activity should be prescribed as part of standard care,** not treated as optional. Prescriptions should include rationale (e.g., reducing side effects, recurrence risk, improving survivorship outcomes).
- **Subtheme 3: Opportunities to embed physical activity promotion into existing touchpoints** (e.g., chemotherapy education sessions, post-surgery physiotherapy visits). Advocates for a stepped care model (similar to psycho-oncology), with a tiered approach from basic advice to structured programmes. Emphasis on scalability and innovation to reach large patient numbers

2. Education and training: Structured training for HCPs is essential to deliver guideline-aligned advice and motivate patients effectively:

- **Gap in patient information:** Patients rarely receive written guidance or specific recommendations on physical activity. Many survivors are unaware of its importance for health and survivorship.
- **Misalignment with guidelines:** Activities often offered at Cancer Support Centres, such as yoga and Pilates, do not meet recommended guidelines (150 min/week of moderate-to-vigorous activity). Gentle exercise is perceived as "safe," reinforcing misconceptions.
- **Training needs for healthcare professionals and cancer support centres:** Education on physical activity guidelines and safe prescription. CPD modules on coaching and motivational techniques (e.g., motivational interviewing). Move beyond "expert-driven" advice to patient-centered behaviour change support.

3. Access to appropriate physical activity interventions: Survivors face significant barriers to accessing suitable physical activity programmes, driven by:

- **Workforce and cost constraints limit equitable access to cancer-specific exercise support**. Unequal geographical distribution of exercise specialists, especially in rural areas. Financial barriers include cost of hiring physiotherapists and running community programmes.
- **Improving referral systems and expanding community-based services are critical to scale access**: Low referral rates from oncologists and GPs; physical activity not prioritised in clinical conversations. Existing referrals often rely on patient interest rather than clinical prescription. Need for simple, streamlined referral mechanisms (e.g., digital systems, opt-out models).Referral pathways ineffective without adequate community services to refer into.
- **Service gaps:** Few community-based programmes; hospital-based programmes overburdened.

4. Tailored programmes: Flexible delivery models (including online, home-based, and individual options), tailored to individual preferences and needs, are essential to improve uptake and adherence:

- **Individual's preferences** for group vs individual sessions; online vs face-to-face vary.
- **Facility based group programmes are the current dominant model**, but these face poor uptake and high attrition (as low as 25% retention).
- **Cost** (e.g., gym fees, programme charges) and **logistical issues** (e.g., timing, transport, return to work) are barriers to engagement.

7.1. Theme 1: Embedding physical activity into the cancer pathway

The dominant theme was the importance of embedding physical activity into the cancer pathway and the importance of oncologists in physical activity promotion: "This all has to emanate from the consultant. If it's not coming from top down, I feel there's no buy in" (academic) and "It's that top down…from the oncologists to engage and the nurse specialists who are dealing quite intimately with the patients…that's where the core of information will come" (physiotherapist). Participants stated unequivocally that physical activity should be embedded as a key part of cancer treatment and assessed in the same way that other clinical parameters are measured as standard care: "It should become embedded as a key element of care, just like measuring your blood pressure or checking your blood count" (community provider of exercise programmes). However, physical activity may not be a high priority to oncologists: "The doctors have different views…some people view this as not a priority" (medical oncologist). Participants believed that the NCCP played an essential role in reaching oncologists: "It has to be through the NCCP…if we have the buy in through the NCCP we will get the oncologists" (cancer nurse specialist). The theme of 'embedding physical activity into the cancer pathway' contained three distinct sub-themes that represented key concepts that underpinned the overall theme; 'singing from the same hymn sheet' represented the importance of consistent messaging on physical activity from all those involved in delivering cancer care; 'physical activity as an essential element of treatment' represented the view that physical activity should be part of usual care (assessed, promoted, prescribed) and a form of treatment (i.e., exercise as medicine), alongside other standard treatments, such as chemotherapy or radiotherapy. The final sub-theme 'intervention opportunities and models of care' is related to how physical activity could be embedded into the cancer pathway. Therefore, the three elements of the theme are related in that physical activity promotion in cancer care is likely to need consistent messaging, be viewed as an essential element of usual care (i.e., integrated into the cancer pathway), and will need embedding into the cancer pathway through the development of a care pathway and identifying opportunities for intervention.

7.1.1. ***Sub-theme 1: Singing from the same hymn sheet.*** It was deemed important that all HCPs were involved in the promotion of physical activity: "We need to get all of the oncologists and oncology nurses on board…it's not just oncologists, it's the surgeons…the radiation oncologists, all of these people have a role to play in promoting exercise" (advanced nurse practitioner), and "We have to have clinicians stressing the importance of this whether it is the consultant, the nurse or anybody in the multi-disciplinary team (MDT)…The MDT stressing the importance of exercise" (NCCP 1). It was also seen as important that HCPs and allied support workers all sing from the same hymn sheet: "It requires absolutely everybody from day one to be

saying the same thing" (ANP). The continuity in physical activity messaging was viewed as particularly important given a consumer's recollection of negative feedback on her exercise participation by a cancer survivor "It's more negative, you should be taking it easy" (breast cancer survivor). The importance of consistent messaging to patients by the whole oncology team was underlined: "You can't underestimate the value of your nursing staff…when someone is getting chemotherapy, they're in the day ward for a number of hours…they're talking to the nurses… [the nurses could] reiterate the message that it is ok to exercise and giving that encouragement" (academic).

7.1.2. ***Sub-theme 2: Physical activity as an essential element of treatment.*** All participants believed that physical activity should be an essential part of cancer treatment that is integrated into the cancer care pathway: "To evoke/embed exercise as an essential part of the pathway" (CPEP 2), and "An ANP makes it almost mandatory for the patient to say 'you are finished with your treatment part and now I want you to go to this end of treatment workshop so that is your next appointment" (NCCP 2). In further reference to physical activity being essential rather than an adjunct treatment, several participants stated that physical activity should be prescribed to patients with an appropriate rationale provided, whether this be the role of physical activity to alleviate treatment-related side effects or the role of physical activity in the survivorship phase in terms of reducing cardiovascular disease risk or risk of cancer recurrence. For example, "We're prescribing this as a measure to counteract and limit some of the side effects of treatment initially" (physiotherapist), and "This is what you're supposed to be doing…exercise is safe and not only is it safe but you have to exercise…if you don't exercise you know you're more at risk of recurrence" (physiotherapy manager). One oncology unit provides exercise prescriptions to patients: "We print it out and give it when we are discussing chemotherapy or hormone therapy" (medical oncologist). Prescribed exercise was also advocated by a consumer: "My initial meeting with my oncologist and my radiation oncologist both said…the best things you can do for yourself are keeping active and keeping your weight down…but I heard them at the beginning and never again…It really needs to be prescribed" (breast cancer survivor).

7.1.3. ***Sub-theme 3: Intervention opportunities and models of care.*** Potential intervention opportunities and other models of care that could be translated to the physical activity domain was a sub-theme of embedding physical activity into the cancer

pathway. One such intervention opportunity is the integration of physical activity promotion within the chemotherapy education session: "We do chemo education, and I would spend usually up to an hour with the patient…I give many a week, I have never been asked about exercise. We cover it. We normally tell people to keep moving, keep to the level you are at if you can, but it is a sentence or two in an hour, there is something to be done there I think" (cancer nurse specialist). The potential of such sessions was echoed by a NCCP representative: "The daffodil nurses in all centres do a chemo education session at the start of treatment…maybe we could be stronger in our messaging as regards to exercise… even using some of the pieces you have talked about earlier in terms of time [minutes] and you know and importance of the type of moving [exercise intensity]" (NCCP 2). The meeting with the physiotherapist following surgery was also identified as an intervention opportunity to promote physical activity behaviour change rather than short-term mobility: "When I was in for surgeries you'd have a visit from physio and they go through the exercise…to stretch and that…there would be a real opportunity there for a physio to give people permission to start walking…so it's not just your exercise for the next 10 days or whatever" (breast cancer survivor).

Others referred to existing models in cancer care including that for psycho-oncology, which adopts a stepped care approach to intervention. It was noted that existing programmes (primarily supervised) were not required for all survivors: "Everybody doesn't need a structured programme and I would be going towards a model of care (like) psycho-oncology…that is stepped so we know we're going to start off for people who just need written information, advice or recommendations from HCPs" (physiotherapist). A stepped and innovative care approach was also highlighted as crucial to reach the large number (i.e., 44,000) of newly diagnosed cancer patients every year: "We don't have anywhere near the capacity to take 44,000 patients…We have to [be] pragmatic and take a staged approach here. It is obvious that centre-based facilities probably just won't work…so we have to be innovative in how we can facilitate physical activity" (academic).

7.2. Theme 2. Education & Training

This theme concerned the need for training for HCPs and allied workers concerning the importance of physical activity for cancer survivors, knowledge of the guidelines, and appropriate physical activity primarily. It seems that patients do not tend to receive written information or specific recommendations concerning physical activity: "There's very much a lack of information regarding exercise…no oncologist or breast surgeon or nurse suggested it to me" (breast cancer survivor). Cancer survivors may also not be aware of the importance of physical activity for their health or survivorship trajectory: "A lot of patients don't realise

the importance of exercise when they are diagnosed" (manager, Cancer support centre [CSC]). Related to education on the physical activity guidelines, there were concerns raised regarding some of the physical activities offered at CSCs that do not align well with the physical activity guidelines: "At our local centre they have yoga or Pilates but that is not meeting your activity guidelines…you can't put them in the same bracket as getting your cardiovascular exercise and the importance of that imparted to the patient" (physiotherapy manager, hospital). The first author shared with participants that yoga was the most common physical activity provided at CSCs, offered at 14 CSCs (out of 20 CSCs that offered activity opportunities or programmes). Participants believed this reflected the perception that survivors should only participate in gentle exercise: "I think that highlights that we still tend to think that people are not able to do that 150 min [of moderate-to-vigorous activity]…Yoga is provided because it's seen as gentle sport…a kind of gentle way of half exercising, but not going to hurt them…I think that sends the wrong message" (CNS, hospital). Another nurse explains that clinicians, nurses, and CSC staff would benefit from receiving further education and training: "I am only trying to learn all of this myself by my own interest in it. Whereas I suppose if doctors and nurses and the CSCs and all those kinds of supports have had some sort of a module that they could attend to learn all of this, it would be really useful to promote the awareness piece…HCPs actually need some form of module or CPD around exercise guidelines and the programmes available and how to coach and mentor your patient in a clinic in relation to exercise" (ANP, hospital). Another highlighted the need for further training on how to motivate patients for physical activity behaviour change that are not expert driven: "Training HCPs such as nurses in how to facilitate and give these programmes…snippets of techniques like motivational interviewing, teaching those types of coaching approaches to our medics and nursing staff and physio staff rather than the expert approach 'you should exercise'" (CNS).

7.3. Theme 3. Access to appropriate physical activity interventions.

Access to appropriate physical activity interventions included two sub-themes: (i) limited access to exercise specialists and (ii) ineffective exercise referral and lack of physical activity services.

7.3.1. Sub theme 1. Limited access to exercise specialists.

Limited access to appropriate personnel to lead physical activity programmes was considered a barrier to provision. This access issue was raised primarily by those managing CSCs: "Access to proper professionals…we're not experts in exercise…we have to outsource exercise and there's no drive from gyms to run courses" (manager, CSC), and "The main challenges are the funding to run programmes and getting physiotherapists can be difficult" (manager, CSC). Another refers to the unequal geographical distribution of exercise specialists in Ireland where the study took place: "We serve seven counties, but people may be living in Donegal

and there may not be a service where an exercise specialist who specialises in cancer is there to support those people" (exercise specialist, CSC). Limited access to exercise specialists was also related to the cost incurred in the provision of physical activity programmes: "The only thing that is stopping us is finances…getting the physio in more often. She's here two days a week… [and the] financial difficulty of offering exercise programmes: ExWell charge" (manager CSC) (ExWell Medical is the primary national provider of community-based exercise programmes in Ireland. They offer several programmes. Two CSCs refer patients to a supervised twice weekly, 12-week supervised programme (not cancer specific) at a cost of €220. ExWell Medical also provide a 'Move on' supervised exercise programme for cancer survivors at a cost €70 per month for 8 classes or €10 per class).

7.3.2. Sub-theme 2. Ineffective exercise referral and lack of physical activity services.

This sub-theme included low rates of referral to community exercise programmes, such as those offered by ExWell in Ireland and those offered through CSCs, and the need for a simple referral mechanism and a clear referral pathway. Participants noted generally low rates of referral for exercise: "Oncologists sometimes refer for general support but not exercise directly" (manager, CSC), and "Getting referrals from oncologists or GPs. Physical activity is not on their agenda. It is not highly valued…we need to find a way to sell exercise to clinicians" (manager, CSC 2). Low rates of referral were also noted by the NCCP: "Across a number of initiatives referrals can be quite low from the hospital settings to programmes in the community…so we are looking at other options like self-referral being allowed to programmes" (NCCP). Self-referral protocols may be problematic, because they are likely to attract sufficiently physically active survivors, rather than targeting those who are insufficiently physically active. For example, "Our referrals are where people have an interest in exercise…so we refer to ExWell where somebody during our introduction conversation expresses an interest in exercise…we are not prescribing it" (manager, CSC).

A simple and quick referral mechanism was noted as an important step to improve exercise referral rates: "It has to be made as simple as possible - that there is no cumbersome paperwork, or licking stamps or putting them on letters, you know, it's like Health Link… just press a button and it is done" (CPEP). An opt-out exercise referral was also viewed as useful: "Making the referral easy and also making the referral almost an opt-out rather than opt-in, that is an important concept" (CPEP). However, the opt-out option may not be effective if it bypasses the oncologist stating the importance of physical activity and explicitly stating that the patient is being referred: "We were quite shocked that we would phone somebody and they had never heard of us, even though they had been referred" (CPEP).

The establishment of a clear referral pathway was considered an important endeavour but so too was having the appropriate physical activity services in place to refer to: "If there's not a referral pathway there from the consultants, they [the exercise programmes] won't be as used

as they need to be…we're trying to build those links with the consultants here in Galway…It's really a two-pronged approach…We need the referrals, and they need to have the services available too" (exercise specialist, CSC). It was highlighted that there were few exercise programmes to refer survivors to: "I really struggle with where to send them…if I had a magic wand it would be that those levels of support are there and then we keep those people who need it the most" (physiotherapist, hospital), and "You can get swamped quite quickly in potentially inappropriate referrals…not everyone with cancer might need a specialised group to come in to" (physiotherapist, hospital). There was a recognition that many survivors did not need a supervised hospital-based exercise programme, but that there was a gap in provision of appropriate physical activity programmes in the community setting: "I think a proportion of those (I've seen) should have been an assess and advice session and straight out into the community but when I struggle to link people with the community, then I have to keep them for a little bit longer" (physiotherapist, hospital).

7.4. Theme 4: Tailored programmes.

The final theme concerned the importance of tailored programmes that align with survivors' exercise preferences and support needs. Tailored programmes included many aspects including the types of physical activity programmes offered to survivors with a recognition that "There is no one size fits all and I think we have to have the breadth, the flexibility that allows us to ensure that every individual, regardless of the circumstance, is going to get access to some form of intervention" (academic) and catering for varying exercise preferences: "To tailor it according to the needs of those patients…sometimes people like it in a group. Some people like it single…some online… some like it face-to-face. Some don't want to sit in with a load of cancer survivors because they don't identify themselves as cancer survivors. They just want to put it behind them and never think about it again" (medical oncologist, hospital). Some will not want to participate in exercise programmes alongside other cancer survivors: "I was told that very forcibly by a metastatic cancer patient…that the last thing she wants is to walk into a room and see other frail, bald, wearing scarves patients doing exercise who have cancer" (CPEP). The dominant model has been the delivery of facility and group-based exercise programmes for cancer survivors. However, poor uptake and high attrition can be a problem in such group-based programmes: "Of those who attended, those who started and those who are currently active you're down to 25% of the whole lot very quickly" (CPEP). Several reasons were provided for the low uptake and high attrition in such exercise programmes including cost, access, and exercise preferences. For example, cost was viewed as a barrier to participation: "Some wouldn't have the budget to go to a gym" (prostate cancer survivor), and "Funding is a huge issue for my patients. I'd love them all to go to ExWell"

(physiotherapist, hospital). Along with cost, logistical issues including access and availability of programmes were also noted as barriers to participation: “So many go back to work, and that affects our classes because they are not on in the evenings” (CPEP), and “A number of people on treatment are not able to drive…so that sort of disenfranchises them from being to attend gym sessions” (physiotherapist, hospital). It was also recognised that many survivors prefer individual rather than group-based programmes: “A lot of people work with me one-on-one. They don’t want groups” (physiotherapist, hospital).

8. What programmes and initiatives already exist to support people with cancer nationally and in Surrey with physical activity?

This section summarises existing national and Surrey-specific initiatives to promote access to and engagement with physical activity for people with cancer.

TOP-LINE INSIGHT SUMMARY

Surrey-specific programmes:

- Surrey & Sussex Cancer Alliance: Physical Activity Resource Hub.
- Royal Surrey NHS Foundation Trust: PRIME Prehabilitation Programme
- Exercise Referral Schemes

National programmes / examples from other areas:

- **Active Together Programme: Sheffield Hallam University & Sheffield Teaching Hospitals NHS Foundation Trust.** The Active Together programme is free and aimed to integrate physical activity, nutritional and psychological support into cancer care.
- **Prehab4Cancer: Greater Manchester Active & Greater Manchester Cancer Alliance.** The programme facilitates cancer patients to engage in exercise, nutrition and wellbeing assessments and interventions prior to, during and after treatment. The programme is offered to any person who meets eligibility criteria and who is registered to a GP within the Greater Manchester localities. Currently, the programme is open to adults with colorectal, lung and upper gastrointestinal cancers.
- **Prehabilitation programme: North Tees and Hartlepool NHS Foundation Trust.** University Hospitals Tees has introduced a new 'prehabilitation' service to prepare people with cancer for treatment. Patients are referred into the service upon receiving a cancer diagnosis. It supports those with cancer to get as fit and healthy as possible to help them cope with the physical and emotional tolls of treatment, reduce side effects and improve their recovery outcomes.
- **Macmillan Northern Ireland Regional Integrated Cancer Prehabilitation Programme**. A region-wide initiative designed to support people living with cancer by preparing them physically and emotionally for treatment. It was delivered across all five Health and Social Care Trusts in Northern Ireland - Belfast, Northern, Southern, South Eastern, and Western - between 2021 and 2024. The programme included people with colorectal, lung, head and neck, haematological, upper GI, hepatobiliary, breast, and gynaecological cancers.

Guidelines:

- **Macmillan 'Move More: Integrating Physical Activity into Cancer Care'.** This report highlights extensive research and evidence around physical activity and cancer; describes effective intervention models and includes a 'how to guide' around supporting cancer pathways to integrate physical activity
- **Macmillan Prehabilitation for people with cancer: Clinical and implementation guidelines (October 2025).** Recent guidelines describing evidence base and implementation guidelines for integration of prehabilitation into routine cancer pathways

8.1. Physical activity support for those with cancer in Surrey

There is already some great work going on in Surrey to support those with cancer to move more. A brief summary of this existing work can be found below.

8.1.1. **Surrey & Sussex Cancer Alliance: Physical Activity Resource Hub.** This includes information and resources outlining what physical activity is and why movement is important before, during and after cancer treatment. The page also contains bite sized eLearning videos going through research, physical activity during different treatment stages, recommendations, and patient stories. The page also signposts to other national resources such as Macmillan's cancer physical activity and cancer support page.

8.1.2. **Royal Surrey NHS Foundation Trust: PRIME Prehabilitation Programme.** The PRIME Prehabilitation programme supports patients in the lead up to major oncology surgery. It is a therapy led service made up of Physiotherapists, an Occupational Therapist and a Dietitian. The focus is to help patients prepare physically and emotionally for surgery, through supervised exercise classes and educational sessions, to support preparation and subsequent recovery. The service includes a physiotherapist completing an initial assessment where patients will be asked to complete some simple exercise tests to establish current levels of fitness. They will create a home exercise programme and provide patients with an information pack with relevant support services. They also offer two exercise classes a week; one in the Physiotherapy gym at Royal Surrey County Hospital and one virtually online. These are group classes run by the Physiotherapist who will set patients a programme and can guide them through the exercises and how to use equipment. In collaboration with Surrey FA and Surrey Sports Park, there is also free walking football available to cancer patients at Royal Surrey.

- **Exercise Referral Schemes.** There are a number of exercise referral schemes operating across the county. These come with a cost attached and provide structured exercise support for those with a long-term health condition. Eligibility varies between providers, but many are open to those diagnosed with cancer. A healthcare professional must refer the patient to the service in most cases. Active Surrey (2025) has a summary of exercise referral provision across the 11 boroughs and districts on their website.
- Services providing exercise programmes for people with cancer in Surrey are also listed on the Home Page | Connect to Support Surrey, and the Cancer Care Map including:
  - The Fountain Centre: Exercise
  - Cancer Rehab Collective Cancer Rehab Collective - Cancer Care Map
  - Guildford Spectrum: Exercise Referral Scheme
  - Wellbeing After Cancer and Cardiac https://www.wellbeingandexercise.co.uk/

- East Surrey Macmillan Cancer Information And Support Centre - Redhill, Surrey
- Topic of Cancer Fit: ToC Fit - Free Online Fitness Classes for Cancer Recovery
- YMCA's East Surrey Exercise Referral Programme Exercise Referral - YMCA East Surrey
- Exercise Referral Elmbridge Borough Council Exercise referral (wellness programme) | Elmbridge Borough Council

8.2. Physical activity support for those with cancer: National.

The final section of this review summarises some of the pilots, schemes and initiatives that have taken place across the UK to support those with cancer to be more physically active. Cancer patients were provided with comprehensive prehabilitation and rehabilitation support before, during, and after treatment, bringing vital cancer services into communities and closer to where people live.

8.2.1. **Active Together Programme: Sheffield Hallam University & Sheffield Teaching Hospitals NHS Foundation Trust.** The Active Together programme is free and aimed to integrate physical activity, nutritional and psychological support into cancer care.

Adults with a primary diagnosis of lung, colorectal, or upper gastrointestinal (GI) cancer and scheduled for curative treatment in Sheffield were referred to Active Together following decision to treat. Referrals were completed by healthcare professionals, including cancer nurse specialists, consultants, and allied healthcare professionals at Sheffield Teaching Hospitals NHS Foundation Trust. The healthcare professionals were asked to refer all patients meeting the above criteria to avoid excluding anyone based on underlying biases (e.g., a perceived ability to engage in exercise). Following referral to Active Together by their cancer care team, patients are invited to a private appointment where members of the team work with them to establish the best way to provide help and support over the coming weeks. Together they then develop a bespoke plan which may include physical activity, nutrition and psychological wellbeing support. Throughout each patient's cancer treatment, the Active Together team is there to offer phone and email support and works with the patient to adapt and develop their plan, based on how they are finding their treatment. Following treatment, patients are invited to a follow up appointment to catch up with the Active Together team and consider how they can best support each individual patient moving forwards.

The programme offered comprehensive support, including physical activity, dietetics, and psychological care, tailored to different stages of treatment: prehabilitation (following diagnosis), maintenance (during treatment), restorative (immediately post-treatment), and supportive rehabilitation (post-treatment and discharge). This support period can exceed 12 months, and needs are regularly re-assessed throughout the service pathway. The median

number of days spent in each phase during the pilot was 37 for prehabilitation, 69 for maintenance, 102 for restorative and 97 for supportive.

The service was delivered and supported by a multidisciplinary team, including physiotherapy, dietetics, clinical psychology, exercise professionals and administrative staff. The Active Together service integrated professionals from Sheffield Hallam University, Sheffield Teaching Hospitals NHS Foundation Trust, and Yorkshire Cancer Research.

Physical activity support formed a significant part of the service's resources, provided by a team of physiotherapists and fitness instructors. For patients with the highest needs, physiotherapists delivered specialised one-to-one care, while fitness instructors offered a range of exercise options tailored to patients with moderate to low needs. These included in person one-to-one sessions, group sessions (both in-person and online), pre-recorded online videos, and personalised exercise programmes that can be undertaken at home.

Key findings from the pilot report include:

- Improved one-year survival rates of 95% for people who took part, compared to 85% for those who did not.
- A net saving to the NHS of £366.36 per surgery, driven by reduced hospital stays and critical care time (modelled savings of £100 million to the NHS over the next 5 years if rolled out nationally).
- 97% of patients reported improvements in their health and wellbeing, feeling more empowered and in control of their health.
- 93% of healthcare professionals considering the service well or very well.

8.2.2. **Prehab4Cancer: Greater Manchester Active & Greater Manchester Cancer Alliance.** The programme facilitates cancer patients to engage in exercise, nutrition and wellbeing assessments and interventions prior to, during and after treatment. The programme is offered to any person who meets eligibility criteria and who is registered to a GP within the Greater Manchester localities. Currently, the programme is open to adults with colorectal, lung and upper gastrointestinal cancers.

The Prehab4Cancer programme helps cancer patients to make changes with combination of exercise and physical activity, eating well and looking after mental / emotional wellbeing. Once a nurse / keyworker has referred a patient to the programme, they will receive a call within a few days from the team. They will arrange for the patient to come in for an assessment with a specialist trainer, at a leisure centre within Greater Manchester. It will be as close as possible to the patient's home, or they can choose to go to one of our other assessment clinics around Greater Manchester. At the assessment, the patient will be asked

to complete some questionnaires and do some simple activities to assess current fitness. They won't be asked to do anything that's too difficult for them, and the exercise specialist will explain everything to the patient.

The physical activity part of the programme involves access to ether independent exercise classes with a specialist or access to exercise groups alongside others on the programme who may be going through a similar situation. There are also videos at different levels (after recommendations from an exercise professional) which can be accessed online.

The programme's exercise prescription is tailored to each patient. Following a full holistic assessment the exercise specialist will devise a suitable programme for the patient. They use two forms of exercise training principles:

RE-HIIT: This type of aerobic training is based on HIIT training and involves short periods of high intensity and effort interspersed with lower intensity exercises. The patients training zones are carefully calculated by the exercise specialists to make sure they are working at a suitable level.

Progressive/Continuous: This type of aerobic training sees the patient taken through progressive training zones, increasing as fitness increases. Again, training zones are carefully calculated by the exercise specialists

Resistance training is of equal importance for patients, and all programmes include some resistance training. It targets the main large muscle groups in the lower and upper body and making sure these muscles are strong will help patients after surgery, for example when getting out of bed or up from a chair.

Since the programme began in 2019, the programme has supported over 2000 people with cancer. Some of the key findings across that period include:

- Patients were optimised prior to surgery and had long-lasting health benefits following post-operative rehabilitation. This reduces demands on healthcare services throughout the cancer pathway.
- Quality of life and physical activity improvements indicated long-term behaviour change and health improvement, with patients taking control of their care.
- Improvements were seen in both ward and critical care bed day usage resulting in improved elective care capacity and effective use of resources. Additional positive impacts on 30 and 90-day readmission and emergency department admissions were observed.
- Efficiency improvements to pathways were visible which supported delivery of elective care and cancer recovery plans, and achievement of cancer performance standards.
- There was evidence that supports improved survival in patients who complete Prehab.

8.2.3. **Prehabilitation programme: North Tees and Hartlepool NHS Foundation Trust.** University Hospitals Tees has introduced a new 'prehabilitation' service to prepare people with cancer for treatment. Patients are referred into the service upon receiving a cancer diagnosis. It supports those with cancer to get as fit and healthy as possible to help them cope with the physical and emotional tolls of treatment, reduce side effects and improve their recovery outcomes.

It is led by a personalised cancer care prehabilitation lead at South Tees Hospitals who has a background in cancer nutrition, as well as a cancer prehabilitation lead at North Tees and Hartlepool who has a background in physiotherapy, strength and conditioning and physical activity promotion.

The prehabilitation leads have collaborated with patients and cancer specialists to pilot a co-designed virtual 'cancer prehabilitation school' and subsequent programme of support which underpins NHS England's long term plan and ambitions for cancer. The service will focus on five key pillars of prehabilitation to improve cancer patients' health:

- Physical activity
- Nutrition
- Psychological and mental wellbeing
- Smoking
- Alcohol and substance misuse

Launched initially as a pilot project, the school will offer a one-off digital session to:

- Learn about the importance of prehabilitation
- Gain tips and resources to implement the five key pillars
- Find out about support services, such as tobacco dependency services

Following this session, patients will enter a prehabilitation pathway suitable for their needs and personalised care plan. This means that interventions and services may differ from person-to-person. One such intervention is the option to opt in to take part in exercise classes. Both trusts are working closely with community gyms and local sporting facilities to bring this provision close to patients' homes.

8.2.4. **Macmillan Northern Ireland Regional Integrated Cancer Prehabilitation Programme**.

The Macmillan NI Prehabilitation Programme was a region-wide initiative designed to support people living with cancer by preparing them physically and emotionally for treatment. It was delivered across all five Health and Social Care Trusts in Northern Ireland - Belfast, Northern, Southern, South Eastern, and Western - between 2021 and 2024. The programme targeted individuals diagnosed with a range of cancers including colorectal,

lung, head and neck, haematological, upper GI, hepatobiliary, breast, and gynaecological cancers.

The approach was holistic, combining three core pillars: physical activity, nutrition, and psychological wellbeing. These elements were integrated into the cancer care pathway as early as possible, ideally from the point of diagnosis, to help patients build resilience before undergoing surgery, chemotherapy, or radiotherapy.

Physical activity was a central component of the prehabilitation model. The intervention was designed to be personalised, accessible, and clinically integrated, ensuring that patients received support tailored to their individual health status, treatment plan, and preferences.

Patients were assessed by trained professionals - typically physiotherapists or exercise specialists - who developed bespoke activity plans. These plans included a mix of aerobic and resistance exercises, with intensity and format adjusted based on the patient's baseline fitness, cancer type, and treatment stage.

Key features of the physical activity intervention included:

- Home-based exercise programmes: These were particularly important during the COVID-19 pandemic and for patients with mobility or transport challenges. Programmes included walking routines, chair-based exercises, and resistance band workouts.
- Supervised group sessions: Where feasible, patients were invited to attend group classes led by qualified instructors. These sessions fostered peer support and motivation, and were held in community centres, leisure facilities, or hospital settings.
- One-to-one coaching and virtual support: Patients who needed more tailored guidance received individual coaching, either in person or via video calls. This helped maintain engagement and allowed for regular progress monitoring.
- Integration with clinical care: Physical activity advice and referrals were embedded into oncology clinics and multidisciplinary team meetings. This ensured that patients were routinely offered support and that clinicians were confident in promoting exercise as part of treatment.
- Behaviour change techniques: Staff used motivational interviewing and goal-setting strategies to help patients overcome barriers and build long-term habits. Patients were encouraged to track their progress and celebrate milestones.

The programme also provided training for healthcare professionals to improve their confidence and competence in discussing physical activity with patients. This helped shift the culture within cancer services towards recognising movement as a vital part of recovery and survivorship.

The programme directly supported over 3,000 people, and a further 13,500 additional people were indirectly impacted through system changes, staff training and awareness campaigns. Patient, staff and system level outcomes are detailed below:

- 85% of patients reported improved physical function after engaging with the physical activity component.
- 78% of patients felt better prepared for treatment due to the prehabilitation support.
- 72% of participants reported improved mental wellbeing, including reduced anxiety and increased confidence.
- Patients noted increased energy levels, better sleep, and improved ability to carry out daily tasks.
- 92% of staff involved in the programme reported increased confidence in discussing physical activity with cancer patients.
- Staff felt more equipped to deliver personalised advice and refer patients to appropriate services.
- Multidisciplinary collaboration improved across oncology, physiotherapy, dietetics, and psychology teams.
- Referral pathways were established or strengthened, allowing for earlier intervention.
- The programme contributed to reduced treatment delays and improved recovery times, although exact hospital metrics were still being evaluated.
- Reduced length of hospital stays for surgical patients.
  Fewer post-operative complications among physically active patients.
- Potential long-term savings through improved treatment tolerance and reduced readmissions.

8.2.5. Macmillan 'Move More: Integrating Physical Activity into Cancer Care'.

This report highlights extensive research and evidence around physical activity and cancer. It aims to:

- provide decision makers with the evidence for integrating physical activity into cancer care
- describe effective intervention models
- demonstrate the connection to national policy and targets
- outline the economic implications of investing in physical activity for people living with cancer
- enable providers to decide on the right model and to implement it effectively as an integrated part of cancer care

The report also includes a 'how to guide' around supporting cancer pathways to integrate physical activity in the most effective way possible.

The section provides detailed guidance to local decision makers and service providers on the setting-up and running of a physical activity behaviour change care pathway, or 'Move More service', as an integrated part of the Recovery Package in cancer care.

The overarching model of a person-centred behaviour change service, that supports the individual to become and stay active, can be implemented in a number of different ways depending on the needs of the local area in question. These include: the cancer population, geography and health landscape, and the resources available.

All models start with the Recovery Package. The minimum viable product includes healthcare professionals advocating physical activity as part of the Recovery Package and signposting to the supported self-management resource – the Move More pack.

The comprehensive person-centred physical activity behaviour change service can be implemented in a healthcare, community or leisure setting. Physical activities can be either signposted to or delivered directly, but ideally a combination of the two. Full details and guidance can be found in the report.

8.2.6. Macmillan Prehabilitation for people with cancer: Clinical and implementation guidelines (October 2025)

The Macmillan Prehabilitation for People with Cancer: Clinical and Implementation Guidelines (2025) were updated in October 2025. They provide evidence-based national guidelines for design, delivery, and implementation of prehabilitation for people with cancer. They build on the original 2019 guidance and reflect a significant expansion of research and practice in the field. Full details can be found in the guidelines (Macmillan Prehabilitation for people with cancer: Clinical and implementation guidelines, 2025)

They define prehabilitation as a needs-based, multimodal intervention delivered before and during cancer treatment, aiming to optimise physical, nutritional and psychological health, improve treatment readiness and tolerance, and support recovery and quality of life.

The key aims of the guidelines are to

a. Standardise prehabilitation across the UK: To embed consistent, high-quality prehabilitation into routine cancer care across different settings (before and during treatment).

b. Improve patient outcomes and experience: Evidence presented in the guidelines shows prehabilitation leads to fewer treatment complications; shorter hospital stays; improved physical function & quality of life; reduced anxiety and depression; and a greater sense of

control

c. Support workforce and service development: The guidelines provide a workforce action plan, guidance on service models, and Health Economics analysis to help justify and sustain services.

d. Address inequalities: They include specific recommendations on reducing health inequalities in access, uptake, and outcomes.

The guidelines make recommendations across six key domains, including but not limited to physical activity.

1. Implementation recommendations

- Integrate prehabilitation into cancer pathways from diagnosis onwards.
- Use systematic screening via needs-based assessment to underlie a personalised intervention model.
- Use multidisciplinary teams to deliver multicomponent support (exercise, nutrition, psychology)

2. Health Economics & Business Cases to support implementation

- Build business cases for service development using evidence of reduced complications, bed-days saved and improved recovery.
- Use examples such as WESFIT/SAFEFIT trials and Prehab4Cancer Manchester (see details above - released significant ward and critical care bed days).

3. Apply Behaviour Change & Technology

- Support adherence using behaviour change techniques.
- Use digital tools (apps, virtual support, monitoring) to enhance delivery.

4. Exercise

- Provide individually prescribed, supervised or unsupervised programmes.
- Use baseline fitness assessments to guide prescriptions.

Additional cross-cutting recommendations include:

- **Addressing Health Inequalities:** By ensuring accessible formats, culturally appropriate interventions, and targeted support where prehabilitation uptake may be lower.
- **Screening, Assessment, Personalised Interventions:** Use systematic screening tools as early as possible post-diagnosis to develop bespoke plans based on level of need.
- **Group Education:** Offer group-based education to build confidence and peer support.
- **Workforce Development:** Build a skilled, multidisciplinary workforce with training to deliver multimodal prehabilitation.

9. Discussion and recommendations

Key findings

Physical activity confers meaningful benefits across the cancer continuum. There is compelling evidence that it reduces the risk of several cancers, with particularly strong dose–response associations for breast and colon cancers. Beyond prevention, moderate evidence indicates reductions in cancer-specific mortality for breast, colorectal and prostate cancers. Among people living with and beyond cancer, physical activity improves multiple outcomes; most consistently fatigue, mental health, sleep, pain, and quality of life, and with signals for reduced recurrence risk (especially in breast cancer). Although the evidence base is strongest for breast cancer and adult populations, structured, supervised, and individualised interventions are feasible and increasingly studied across other tumour sites and in younger cohorts. Optimal programmes frequently combine aerobic and resistance training over ~12 weeks, use multi-modal delivery (notably home-based and tech-supported), and are grounded in behavioural theory with core behaviour change techniques (goal setting, action planning, self-monitoring, social support, positive reinforcement).

Despite these benefits, access and uptake are uneven. Common barriers include treatment- and disease-related side effects, time pressures, low mood, and limited self-efficacy; as well as limited access to an appropriate service during treatment. Facilitators include clear guidance from health professionals, tailored support, social encouragement, and perceiving tangible benefits. Preferences include walking; home/private and clinic-based settings; receiving advice from allied health professionals and oncologists; and options to exercise alone or with family/peers rather than in large groups. Outside the cancer pathway, persistent inequalities in physical activity by gender, socioeconomic position, age, sexual orientation, ethnicity, disability and long-term condition status mirror patterns seen within the pathway (prehabilitation through to advanced disease), where engagement is lower among people with lower income or education, minoritised ethnic groups, older adults, those with multimorbidity, and people living with overweight/obesity.

Guidelines from Macmillan recommend physical activity should be embedded as a core component of routine cancer care, led visibly by oncologists and reinforced consistently by the multidisciplinary team. Priorities should include:

- prescribing activity with clear clinical rationale
- integrating advice at existing touchpoint
- adopting stepped-care models
- strengthening health care professional training on guidelines and behaviour change
- simplifying referrals (ideally digital/opt-out)
- expanding community capacity, with flexible, culturally-tailored, and low-cost options (including home-based and online).

Integrated exercise oncology services have the potential to both improve outcomes directly and narrow inequities indirectly by connecting underserved groups with wider cancer support. Local and national examples (e.g., resource hubs, prehabilitation programmes, and exercise referral schemes) demonstrate feasibility of implementing solutions at scale.

Future research should aim to close evidence gaps on subgroup effects (e.g., by socioeconomic position and ethnicity) to guide targeted implementation and ensure equitable impact.

9.1. Limitations

This review was designed to map the existing evidence base to guide next steps into developing recommendations to guide integration and optimisation of physical activity programmes and initiatives into cancer pathways in Surrey.

However, due to time and resource restrictions, this is not a systematic review, therefore the evidence included is not exhaustive. Instead the findings of recent umbrella, scoping and systematic reviews, as well as local data and information about national and local pilots, have been captured and synthesised. This review therefore does not claim to capture all relevant evidence, nor make conclusive claims about intervention effectiveness. Similarly, no formal critical appraisal has been undertaken to grade quality of included literature.

Where recommendations are made (see Section 9.3) these are based on existing best-practice guidelines, and guided by insights from the included evidence.

9.2. Recommendations

Overarching model:

Embed a standardised physical activity offer at each cancer pathway touchpoint with a tiered approach:

- Universal brief advice and signposting
- Targeted supported activity
- Specialist exercise rehab

Supporting recommendations:

1. Set a shared ambition for Surrey system: “Physical activity as standard of cancer care, with clear commitment to embedding physical activity/ personalised physical activity plans in cancer plans and contracts as a standard of care from diagnosis onwards, aligned with principals of personalised care

2. Create joint governance across key partners with a stake in delivery of shared ambition by establishing a system-level steering group, to include SCC Public Health, Cancer Alliance, Active Surrey, PCNs, VCS, Trusts, Neighbourhood Health
3. Map existing exercise community and hospital-based exercise programmes for people with cancer in Surrey and work with stakeholders and community to identify unmet need
4. Develop a physical activity in cancer behaviour change care pathway for Surrey (eg, based on Macmillan's physical activity behaviour change care pathway approach, Move More) and build business case for pilot:
    a. Pilot in small number of pathways, evaluate, refine and expand
5. Develop sustainable funding model (eg, through joint commissioning plan funding pathway co-ordination, workforce training, targeted programmes in underserved areas and evaluation)
6. Embed evaluation of outcomes of programmes
7. Embed activity into prehabilitation and rehabilitation as a continuum, ensuring every eligible patient has access to multimodal prehab before and during treatment using established Macmillan principals and building on existing local offer (eg, Royal Surrey pre-hab offer) and scaling across Surrey
8. Simplify referral route into community provision by creating one simple referral mechanism for health partners to refer into with cancer-appropriate safety and tailoring
9. Train workforce so physical activity advice around cancer is consistent, evidence-based and aligned with guidelines (including for primary care, oncology teams, social prescribing, leisure and exercise professionals) - eg., consider MECC approach
10. Build a Surrey 'cancer physical activity directory' that clinicians trust with quality-assured directory of local offers linked to existing Cancer Alliance and Active Surrey hubs
11. Targeted work with groups with highest inactivity and poorest outcomes (eg, key neighbourhoods, people with disability and long-term conditions) to co-produce formats to proactively address inequalities
12. Communications and public-facing awareness raising of evidence that physical activity reduces cancer risk and improves cancer outcomes

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Appendix 1. Evidence that physical activity prevents cancer: by cancer type (McTiernan et al., 2019)

Bladder Cancer

There is strong evidence to show that higher levels of physical activity are associated with a reduced risk of developing bladder cancer (McTiernan et al., 2019). Keimling et al's review (2014) was the most comprehensive, concluding that bladder cancer risk was statistically significantly lower for individuals engaging in high levels of physical activity when compared to those engaging in low levels.

Breast Cancer

There is strong evidence to show that higher levels of physical activity are associated with a reduced risk of developing breast cancer (McTiernan et al., 2019). Looking at all forms of physical activity, one meta-analysis highlighted a statistically significant reduction for the risk of breast cancer when comparing those most active to those who were least active (Pizot et al., 2016). It was also identified that premenopausal and postmenopausal women had similar reductions in breast cancer risk when comparing highest and lowest levels of activity. Two other meta-analyses that looked at the total population concluded that the risk of developing breast cancer reduced when comparing high levels of physical activity to low levels (Neil-Sztramko et al., 2017; Hardefeldt et al., 2017). However, one of these meta-analyses found that there was no association between physical activity and breast cancer risk before menopause (Neil-Sztramko et al., 2017). Cohort studies had similar findings, with increased physical activity engagement being associated with reduced breast cancer risk (Ma et al., 2016; Masala et al., 2017). One study found that increased physical activity during childhood and adolescence was associated with a lower risk of developing breast cancer in later life (Liu et al., 2016). Looking at postmenopausal breast cancer specifically, the final study found a statistically significant association between high levels of physical activity and reduced risk (Bellocco et al., 2016).

Colon Cancer

There is strong evidence to show that higher levels of physical activity are associated with a reduced risk of developing colon cancer (McTiernan et al., 2019). A meta-analysis concluded that risk of colon cancer is significantly lower when comparing those who were most active to those who were least active (Liu et al., 2016). Results from other meta-analyses were similar and supported this conclusion (Shaw et al., 2018; Mahmood et al., 2017). Some more recent cohort studies, which hadn't been included in the earlier meta-analyses, also found

that higher levels of physical activity reduce risk for colon cancer when compared to low levels of physical activity (Buron et al., 2017; Schmid et al., 2016; Eaglehouse et al, 2017).

Endometrial Cancer

There is strong evidence to show that higher levels of physical activity are associated with a reduced risk of developing endometrial cancer (McTiernan et al., 2019). One meta-analysis explored all forms of physical activity combined and concluded that the risk of developing endometrial cancer was significantly lower when comparing the highest levels of physical activity engagement to the lowest levels of engagement (Schmid et al., 2015). Further to this, the same meta-analysis also reported further risk reductions for recreational, occupational and walking activities, as well as reduced risk with all intensity levels of physical activity (light, moderate, vigorous). Other meta-analyses and cohort studies reported similar findings, with statistically significant associations between high levels of physical activity and low risk of endometrial cancer (Borch et al., 2017; Du et al., 2014).

Oesophageal Cancer

There is strong evidence to show that higher levels of physical activity is associated with a reduced risk of developing oesophageal cancer (McTiernan et al., 2019). One meta-analysis, which included 24 studies, concluded that the risk of developing esophagael adenocarcinoma (a form of cancer) was lower among individual engaging in high levels of physical activity, when comparing to those engaging in low levels of physical activity (Behrens et al., 2014). However, the same publication also concluded that physical activity was not related to risk of developing squamous cell carcinoma of the oesophagus. Other meta-analyses found similar results (Physical Activity Guidelines Advisory Committee Scientific Report, 2018).

Gastric Cancer

There is strong evidence to show that higher levels of physical activity are associated with a reduced risk of developing gastric cancer (McTiernan et al., 2019). The most comprehensive meta-analysis concluded that the risk of developing gastric cancer was statistically significantly reduced for individuals engaging in the highest levels of physical activity, when comparing to those engaging in the lowest levels of physical activity (Psaltopoulou et al., 2016). Other meta-analyses found similar results (Physical Activity Guidelines Advisory Committee Scientific Report, 2018).

Renal Cancer

There is strong evidence to show that higher levels of physical activity are associated with a reduced risk of developing renal cancer (McTiernan et al., 2019). One meta-analysis concluded that the risk of developing renal cancer was statistically significantly reduced for individuals engaging in the highest levels of physical activity, when comparing to those engaging in the lowest levels of physical activity (Behrens et al., 2013). Another pooled analysis found similar results (Physical Activity Guidelines Advisory Committee Scientific Report, 2018).

Lung Cancer

The evidence exploring the impact of physical activity engagement on risk of developing lung cancer can be classified as moderate/mixed (McTiernan et al., 2019). The most comprehensive meta-analysis at the time of the review found a 25% relative reduction in lung cancer risk for individuals engaging in the highest levels of physical activity, when comparing to those engaging in the lowest levels of physical activity (Brenner et al., 2016). However, the reviews (McTiernan et al., 2019; Physical Activity Guidelines Advisory Committee Scientific Report, 2018) could not rule out effect modification by tobacco use and thus the evidence was graded as moderate. Two additional cohort studies identified in McTiernan et al's (2019) review explored the association between physical activity engagement and lung cancer risk within the different smoking status categories i.e., current, former, or never smoker. Both of these studies found no association between physical activity engagement and reduced risk of lung cancer for some or all smoking status categories (Wang et al., 2016; Patel et al., 2017).

Other Cancers

For some of the other cancer sites remaining, very few systematic reviews and/or meta-analyses had been published at the time of the Physical Activity Guidelines Advisory Committee Scientific Report (2018). Therefore, they concluded that there was limited evidence to suggest an association between higher levels of physical activity and decreased risk of developing prostate, head and neck, pancreatic and hematologic cancers. As part of McTiernan et al's updated search in their 2019 review, they identified some additional studies relating to these cancer sites.

Five publications on the associations between physical activity and risk of hematologic cancers were identified in the updated literature search. One study found an association

between physical activity levels and risk of some forms of hematologic cancer (Walter et al., 2013). Three studies found varying associations of physical activity with risk of non-Hodgkin lymphoma, with one of them finding a non-significant association (Teras et al., 2012) and the two others finding no association (van Veldhoven et al., 1990; Lu et al., 2009). Finally, one study explored the association between physical activity and risk of multiple myeloma, which found no statistically significant associations (Birmann et al., 2007).

One report from the updated search exploring the association between levels of physical activity and risk of head and neck cancer found statistically significant decreases in risk with increases spent doing vigorous physical activity (Hashibe et al., 2013).

Two cohort studies of physical activity levels and ovarian cancer risk were identified as part of the updated search. One found no association between physical activity and risk (Huang et al., 2016), and the other suggested increased risk for ovarian cancer with higher levels of physical activity (Hildebrand et al., 2015).

Two publications identified in the updated literature search found no clear evidence to suggest an association between physical activity levels and risk of pancreatic cancer. One found a negative association in men but not women (Wu et al., 2018), and one observed a negative association in persons aged under 60 years but not in older individuals (Noor et al., 2015)

A meta-analysis and cohort study identified in the updated search both found no statistically significant relationship between levels of physical activity with risk of prostate cancer (Liu et al., 2017; Grotta et al., 2015). Another identified cohort study observed a statistically significant reduction only in risk of advanced prostate cancer in active versus inactive men (Hrafnkelsdottir et al., 2015)

The updated search also found publications focused on hepatobiliary, carcinoid tumours of the small intestine, squamous cell skin cancer, and testicular cancers that the PAGAC did not review for the 2018 Scientific Report. None provided enough evidence to reverse the PAGAC decision that evidence is lacking on the role of physical activity in risk for any of these cancers (McTiernan et al., 2019).

Appendix 2. Evidence of impact of physical activity on cancer outcomes: by cancer type

1.1. Breast Cancer

Data from multiple meta-analyses show a consistent inverse relationship between levels of physical activity engagement and both cancer-specific and all-cause mortality among those diagnosed with breast cancer (McTiernan et al., 2019).

When comparing the highest levels of physical activity engagement to the lowest, one meta-analysis estimated a 48% reduction in risk of all-cause mortality among those diagnosed with breast cancer (Lahart et al., 2015). Another meta-analysis found that, when compared to the lowest levels of physical activity engagement, the highest levels of physical activity engagement were associated with a 38% reduction in risk for cancer-specific mortality (Friedenreich et al., 2016). A pooled analysis looked to explore the association between meeting U.S. Physical Activity Guidelines and breast cancer outcomes (Beasley et al., 2012). The analysis found that engaging in 10 or more MET-hours[1] per week was associated with a 25% reduction in breast cancer-specific mortality and a 27% reduction in all-cause mortality. Other meta-analyses and studies across the reviews had similar findings, whereby higher levels of physical activity engagement were associated with improved survival outcomes among those diagnosed with breast cancer (McTiernan et al., 2019; Filis et al., 2025).

The reviews also highlighted associations between higher levels of post-diagnosis physical activity and reduced risk of recurrence (Miyamoto et al., 2022), reduced breast cancer-related fatigue (Brown et al., 2011), and improved mental health (Aune et al., 2022). Reviews with high certainty found that yoga reduced short-term sleep problems (Cramer et al., 2017) and improved health-related quality of life among women diagnosed with breast cancer (Machado et al., 2021). Two reviews with moderate-certainty evidence reported that physical activity can reduce pain among women diagnosed with breast cancer (Filis et al., 2025). One meta-analysis concluded that post-diagnosis physical activity interventions had a positive effect on aerobic capacity, fatigue and mental health (Andersen et al., 2022).

1.2. Colorectal Cancer

[1] "MET-hours" (Metabolic Equivalent-hours) is a measure of total physical activity that multiplies the intensity of an activity (measured in METs) by the duration of the activity in hours

Several meta-analyses looking specifically at those diagnosed with colorectal cancer highlighted an inverse relationship between post-diagnosis physical activity and cancer-specific mortality (McTiernan et al., 2019).

When comparing the highest levels of physical activity engagement to the lowest, one meta-analysis estimated a 42% reduction in risk of all-cause mortality among those diagnosed with breast cancer (Wu et al., 2016). Another meta-analysis found that, when compared to the lowest levels of physical activity engagement, the highest levels of physical activity engagement were associated with a 38% reduction in risk for colorectal cancer-specific mortality (Friedenreich et al., 2016). One meta-analysis assessed the dose-response effects between physical activity and colorectal cancer survivors (Schmid et al., 2014). In comparisons of less active to more active individuals, each 5, 10, or 15 MET-hours per week increase in post-diagnosis physical activity was associated with a 15%, 28%, and 35% lower risk for all-cause mortality. Two additional cohort studies had similar findings, estimating approximate reductions in risk of mortality when comparing the most active to least of 25% (Walter et al., 2017) and 50% (Ratjen et al., 2017). These studies also reflect the findings of Filis et al's umbrella review (2025), which concluded that there is strong evidence that colorectal cancer survivors with higher levels of post-diagnosis physical activity have lower risk for all-cause mortality (Qiu et al., 2022).

Beyond mortality, a systematic review and meta-analysis review and meta-analysis of exercise safety, feasibility and effectiveness among individuals with colorectal cancer pooled the results on 19 trials and found significant positive effects of exercise on quality of life, fatigue, aerobic fitness, strength, depression, sleep and body fat percentage (Singh et al. 2020). Subgroup analyses suggested larger benefits for QoL and fatigue for supervised interventions; for QoL, aerobic fitness and reduced body fat for ≥12-week interventions; and for aerobic fitness when interventions were during chemotherapy.

1.3. Prostate Cancer

Data from several meta-analyses highlighted an inverse relationship between post-diagnosis physical activity and cancer-specific mortality in prostate cancer survivors (McTiernan et al., 2019). One meta-analysis estimated that the highest levels of physical activity engagement were associated with a 38% reduction in risk of prostate cancer-specific mortality when compared to the lowest levels of physical activity engagement (Friedenreich et al., 2016). Another review concluded that highest versus lowest levels of total physical activity engagement were statistically significantly related to reduced risk for all-cause mortality (McTiernan et al., 2019). An additional cohort study that included a 12-month post-diagnosis follow up also concluded that higher levels of physical activity significantly reduced prostate cancer-specific mortality (Wang et al., 2017).

In addition to this, the reviews highlighted associations between higher levels of post-prostate cancer diagnosis physical activity and improved cardiovascular fitness (Andersen et al., 2022) and cancer related quality of life (Ussing et al., 2022), as well as reduced levels of reported fatigue (Vashistha et al., 2016). Finally, physical activity after diagnosis was found to be associated with reductions in body fat among prostate cancer survivors (Shao et al., 2022).

1.4. Lung Cancer

Physical activity for pulmonary rehabilitation has been found to have a positive effect on length of hospital stay following lung cancer surgery (Wang et al., 2022). Furthermore, a combination of preoperative breathing exercises and aerobic physical activity training also reduced the length of hospital stays among those diagnosed with lung cancer (Pu et al., 2021). Moderate-certainty evidence supported the view that mind–body physical activity improved cognitive function in people with lung cancer (Sun et al., 2023). Physical activity among those diagnosed with lung cancer has also been found to improve reported quality of life (Machado et al., 2021) and reduce pain (Chen et al., 2020).

Appendix 3. Patient case studies

Patient case study: pre-treatment (pre-rehabilitation). In 2005 Richard was diagnosed with bladder cancer. The cancer was successfully eradicated. However, his overall fitness declined. Richard decided to take part in the 'Macmillan Move More' project to improve his wellbeing and fitness. He consulted his doctor about 'Move More' who made the referral. Less than a year later, 2013, he was very thankful for participating in 'Move More' when diagnosed with stomach cancer. The decision was made to remove his stomach if it was considered he was fit enough for the operation. Richard, who has a heart condition, passed the fitness tests reasonably well and the operation was planned with an anaesthetist on hand who specialised on people with a heart condition. The gastrectomy went well, made all the easier because his general fitness had been maintained by his participation in 'Move More'. Recovery took over eighteen months before returning to the project. He is now back enjoying light exercise under the supervision of his Move More Activator, Stephanie. Richard completed the first three-month period of 'Macmillan Move More' and hopes to continue the scheme in the future. In 2015 he was diagnosed with Myelodysplastic Syndrome (MDS) which means he needed to maintain a good state of fitness and health to give any treatments the best chance of success. What Richard likes about the 'Macmillan Move More' scheme is that his fitness goals are regularly assessed and set to be within his capabilities, inspiring him to move forward without putting pressure on or to overstretch himself. Perhaps most noteworthy is that the project has prepared him for the unforeseen health issues that have come along.

Patient case study: during treatment. John, 63, was diagnosed with diffuse large B-cell lymphoma in 2015. Before cancer, John lived an active lifestyle: he regularly walked the dog and taught exercise classes at the leisure centre. The seriousness of his illness was a complete surprise and he went from being ok to being unable to walk in a couple of weeks. 'My illness shook both my wife and me. In fact, I think in the first weeks it was harder on my wife. All I had to do was lie in a hospital bed and get better. She had to do everything else.' John spent three months in hospital. For many weeks he was unable to move his lower body without help as the cancer had impacted his spinal cord. The first round of chemotherapy hit John badly and he had many side effects. Recovery was very slow, but he could see minor improvements in hospital towards the end. During John's recovery, he received physiotherapy and support from the Move More Eastleigh service. As a result, his strength, coordination, control, balance, mobility and stamina have all improved. This helps make the tasks of day-to-day living easier to accomplish and the level of pain has reduced, especially during and immediately after exercise. Exercise has helped John maintain a positive approach to life. John is now able to cycle 20 miles and walk with poles for 4 to 5 miles. He is setting further targets for 2017 with support from the Move More service and resources.

Patient case study: Post treatment. Clare, 52, was diagnosed with breast cancer in 2011. Clare now lives with lymphoedema, osteoporosis and mild asthma as a consequence of her treatment. Clare heard about the benefits of physical activity through the Macmillan website and a poster put up in her local cancer centre. She found out where the service was running in her area, and was referred by her cancer nurse onto the Get Active Feel Good service. Prior to Clare's cancer diagnosis she gardened and had an allotment, but otherwise hadn't done much activity since school, where she had played for the hockey and badminton teams. Since joining Get Active Feel Good, Clare has been introduced to a new way of life. 'Being involved in Get Active Feel Good has changed my whole outlook, my career, my whole everything. It's not just about being a sick person. It's not about the cancer. It's about more than that. Having a positive attitude and being mentally well, as well as physically well, helps you combat what has gone on before and after the cancer.