

THE IMPORTANCE OF  
**PHYSICAL  
ACTIVITY**  
FOR PEOPLE LIVING  
WITH AND BEYOND  
CANCER

A CONCISE  
**EVIDENCE  
REVIEW**

**WE ARE  
MACMILLAN.  
CANCER SUPPORT**

## **Acknowledgements**

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# Executive summary

This review provides commissioners and health professionals with an overview of the evidence for integrating the promotion of physical activity within the cancer care pathway.

The evidence is growing to support the role of physical activity during and after cancer treatment.

Physical activity is important for cancer patients at all stages of the cancer care pathway. There is evidence to support the role of physical activity for the following stages of the cancer care pathway:

- 1 During cancer treatment – physical activity improves, or prevents the decline of physical function without increasing fatigue.
- 2 After cancer treatment – physical activity helps recover physical function.
- 3 During and after cancer treatment – physical activity can reduce the risk of cancer recurrence and mortality for some cancers and can reduce the risk of developing other long term conditions.
- 4 Advanced cancer – physical activity can help maintain independence and wellbeing.

Promoting physical activity at all stages of the cancer care pathway has the potential to reduce NHS expenditure.

Cancer survivors\* should be advised to gradually build up to the health-related physical activity guidelines for the general population. The evidence shows that if an activity recommendation is carefully tailored to the individual, it is likely to have a positive impact on the patient.

There is a clear need for mechanisms within the cancer care pathway to support people in maintaining or initiating physical activity during and after treatment.

\*For the purpose of this report we are using the term 'cancer survivor' to refer to people both living with and beyond cancer.

# Background

There are over two million people living with or beyond cancer in the UK. If current trends continue, Macmillan estimates that four million people will be living with or beyond cancer by 2030.<sup>1</sup>

Many cancer survivors experience long-lasting adverse effects of their disease and treatments. These include fatigue, weight changes, urinary and bowel problems, peripheral neuropathy, osteoporosis, cardiotoxicity, lymphoedema, hot flushes, night sweats, anxiety, depression, and difficulty with memory or concentration.

A survey conducted for Macmillan Cancer Support indicated 78% of people living after cancer experienced at least one of these problems in the past 12 months, while 71% experienced at least one of these more than ten years after treatment.<sup>2</sup>

## The potential role of physical activity

The evidence is growing to support the role of physical activity during and after cancer treatment. Keeping active throughout the cancer journey can preserve or improve physical function and psychological well-being, reducing the negative impact of some cancer-related side-effects. Regular physical activity also has a potential role in reducing risk of cancer recurrence and increasing survival. This makes the promotion of physical activity an important consideration for NHS commissioners.

Promoting physical activity as part of cancer care is a cost-effective intervention for the NHS and social care. Commissioners and health practitioners can be confident that the routine provision of physical activity, and exercise rehabilitation services within the cancer care pathway, will enable the NHS to maximise the improvements to quality of care and patient outcomes.

# Physical activity for people with cancer – the evidence

Physical activity is important for patients at all stages of the cancer care pathway.

The following sections review the evidence, starting with the area where there is strongest evidence and moving on to the area where the evidence is still accumulating. In each section the evidence is graded A–C according to its strength and consistency (see the annex for details of the evidence grading system).

## **Patients receiving cancer treatment – impacts on physical function**

Most cancer therapies are associated with a range of side effects. Patients typically lose cardiovascular and muscular fitness, experience fatigue and report diminished psychological well-being over the course of treatment. Additionally, many are advised to rest throughout treatment,<sup>3</sup> and an overemphasis on energy conservation can exacerbate the treatment-related losses of physical conditioning and muscle strength. This can lead to the development of a perpetual cycle of deteriorating function and accumulating fatigue that is very hard to escape.

Current evidence supports the recommendation of exercise during treatment to prevent decline in functional outcomes without increasing fatigue. Exercise can also have positive

effects on aspects of psychological well-being, such as anxiety and self-esteem (table 1).

## **Patients who have finished treatment – recovering physical function**

Following the completion of cancer therapy many patients continue to experience adverse effects of treatments. There is sufficient evidence to recommend exercise as an effective way to help recover physical function (including building muscle strength and improving cardiovascular fitness), manage fatigue, improve quality of life, and mental health, and control body weight (table 2).

## **Patients following diagnosis – reducing the risk of cancer recurrence and mortality**

In addition to the physical and mental health benefits achievable through exercise for cancer survivors. A growing body of evidence suggests that maintaining or initiating physical activity after cancer diagnosis can influence disease recurrence and mortality for some cancers.

Although the body of evidence on the survival benefits associated with physical activity is still developing, the emerging picture is highly encouraging.

**Table 1**  
**Systematic review evidence for the effects of exercise during treatment**

<b>Outcome</b>	<b>Systematic review evidence</b>	<b>Effect size*</b>	<b>Evidence level*</b>
Physical function	Significant increases in fitness were demonstrated from 17 randomised controlled trial's (RCTs) of exercise during chemotherapy, radiotherapy, or hormone therapy, with similar modest increases seen for muscular strength from eight RCTs. <sup>4</sup>	Fitness = 0.33 (small)  Strength = 0.39 (small)	A
Fatigue	No difference in fatigue between exercise and control groups were observed from analysing 15 RCTs. <sup>4</sup> This is an important finding given the concern from patients that exercise will worsen their fatigue. An earlier systematic review including nine RCTs also showed no increase, and in fact reported a small benefit. <sup>5</sup>	Fatigue = 0.18 (small)	A
Well-being	Small improvements in anxiety based on six RCTs and self-esteem from three RCTs were reported, with no significant effect attributable to exercise demonstrated for quality of life (10 RCTs) and depression (eight RCTs). <sup>19</sup>	Anxiety = 0.21 (small)  Self-esteem = 0.25 (small)	A
Body composition	Pooled data from five RCTs showed slight increases in lean body tissue, along with significant reductions in body fat from seven RCTs. These favourable outcomes are encouraging given that fat gain and muscle loss are common consequences of several treatments. <sup>4</sup>	Body fat = 0.25 (small)	A
Arm dysfunction	For breast cancer patients undergoing axillary lymph node dissection, results from six RCTs showed significant improvements in shoulder mobility without increasing risk of lymphoedema. <sup>6</sup> These results are supported by a larger systematic review of the safety and effectiveness of exercise for upper limb dysfunction due to breast cancer treatment. <sup>7</sup>		A

\*See Annex for definitions

**Table 2**  
**Systematic review evidence for the effects of exercise post-treatment**

Outcome	Systematic review evidence	Effect size*	Evidence level*
Physical function	Significant improvements in fitness were observed from pooling 14 RCTs, and large increases in strength from seven RCTs. <sup>4</sup>	Fitness = 0.32 (small) Strength = 0.9 (large)	A
Fatigue	Significantly lowered fatigue was demonstrated from analysing 14 RCTs. <sup>4</sup> This supports results from an earlier systematic review of 10 RCTs. <sup>5</sup>	Fatigue = 0.54 (moderate)	A
Well-being	Significant improvements in quality of life were indicated from 16 RCTs, depression from 10 RCTs, and anxiety from seven RCTs. <sup>4</sup>	Quality of life = 0.29 (small) Depression = 0.3 (small) Anxiety = 0.43 (small)	A
Body composition	Significant small reductions in body fat were reported after combining 15 RCTs and increases in muscle mass from five RCTs. <sup>4</sup>	Body fat = 0.18 (small) Muscle mass = 0.13 (small)	A
Bone health	Some encouraging findings of preserved bone mineral density were reported, but overall results from eight trials of various designs were inconsistent. <sup>9</sup>		B

\*See Annex for definitions

### Example from the evidence – loss of physical function among cancer survivors

One study illustrates the loss of physical function experienced by cancer survivors.<sup>10</sup> Limitations in physical functioning were reported by a significantly higher proportion of both short-term (54%) and long-term (53%) cancer survivors, than by age-matched non-cancer controls (21%). The commonest problems experienced (ie crouching/kneeling, standing for long periods, walking short distances, and lifting/carrying a load) are all vital for carrying out basic daily activities, such as house and garden work, shopping and childcare.

These findings demonstrate that problems are not restricted to patients who have recently completed treatment, but also apply to longer-term survivors.



### Patients following diagnosis – reducing the risk of developing other conditions

Lack of physical activity is a risk factor for several major chronic diseases, including coronary heart disease, stroke, diabetes mellitus, osteoporosis, obesity, some cancers and dementia. Risk reductions of 20–50% are possible for people who are active at the recommended levels relative to those who are inactive.<sup>19</sup> The benefits of exercise for people who are living with and beyond cancer are clear. Yet regular and sustained physical activity is also important for reducing the risk of developing other long-term conditions or new cancers.

Equally important is the role of physical activity in helping to manage existing chronic conditions in cancer survivors. A Macmillan study showed that just under half (49%) of cancer survivors have at least one other chronic condition. This includes 15% who have two, and 6% who have three other chronic conditions.<sup>20</sup> Prevalence of co-morbidities increases with age,

and a US study reported an average of three co-morbidities in cancer survivors aged 70 years or above.<sup>21</sup>

Considerable evidence supports a beneficial role of physical activity in helping the long-term management of cardiovascular diseases, musculoskeletal health conditions, and mental illness.<sup>19</sup>

### Patients with advanced cancer – helping maintain independence and well-being towards end of life

There is accumulating evidence of the benefits of exercise for patients with advanced cancer. Systematic reviews of six studies in palliative care settings<sup>22</sup> and eight studies of patients with metastatic cancer<sup>23</sup> concluded exercise was feasible for these patients and offered important benefits in physical functioning, symptoms, and quality of life (table 4). Patient preference is important to consider, but exercise can be recommended to help maintain functional independence and quality of life towards the end of life.

#### Example from the evidence – supervised group exercise among women with breast cancer

An RCT in Glasgow offered a 12 week group exercise sessions for women with early stage breast cancer as an addition to standard care.<sup>8</sup>

The study found significant improvements in physical functioning, active daily living, shoulder range of movement, cardio-vascular fitness, positive mood, and breast cancer-specific quality of life. There were no adverse events reported.

There was also evidence that the intervention group spent fewer nights in hospital and made fewer visits to their GP than the control group. 10% of the patients in the intervention group and 20% in the control group reported at least one night in hospital and 72% and 84% respectively reported at least one visit to their GP.

This highlights the potential for cost savings to the NHS.

**Table 3**  
**Studies of exercise and cancer recurrence/mortality**

<b>Cancer site</b>	<b>Evidence from cohort studies of cancer survivors</b>	<b>Evidence level</b>
Breast	A systematic review of six studies indicated a breast cancer specific reduced mortality risk of 34% related to leisure-time physical activity. <sup>11</sup> A subsequent review supported these findings. <sup>12</sup> Results of the two largest studies suggested that women reaching the equivalent of the recommended minimum levels of physical activity (ie 150 minutes of moderate-intensity activity per week) had over 40% lower risk breast cancer-specific mortality, and breast cancer recurrence, compared with women active for less than one hour a week. <sup>13,14</sup>	A
Colorectal cancer	Results of two studies suggested that risk of disease recurrence, cancer mortality was reduced by about 50%, by performing the equivalent of six hours of moderate intensity physical activity per week. <sup>15,16</sup>	A
Prostate	Findings from two studies indicated a lower risk of prostate-specific mortality of approximately 30% <sup>17</sup> and a lower rate of disease progression of 57% <sup>18</sup> with three hours per week of moderate intensity physical activity (eg brisk walking).	A

**Table 4**  
**Studies of exercise in advanced cancer**

<b>Evidence from cohort studies of cancer survivors</b>	<b>Evidence level</b>
Home-based seated exercise slowed the decline in quality of life and fatigue observed during usual care in an RCT of 38 women with advanced breast cancer receiving chemotherapy. <sup>24</sup>	B
Supervised circuit training for six weeks improved fitness, functional ability, emotional wellbeing, and important symptoms such as fatigue, dyspnea and anorexia in an uncontrolled trial of 34 patients. <sup>25</sup>	B
Home-based daily activity programme for four weeks led to increased quality of life in nine cancer patients receiving home hospice care. <sup>26</sup>	B
Supervised resistance exercise for 12 weeks led to improvements in muscular fitness and quality of life in an RCT of 60 men with prostate cancer receiving androgen deprivation therapy with palliative intent. <sup>27</sup>	A

# Implications of the evidence

## Return on investment in the NHS

Few studies, to date, have looked specifically at the economic impact of increasing physical activity among people with cancer. However, robust evidence for return on investment is underway. Studies we are aware of include:

- Data from multiple RCTs in Holland looking at the cost-effectiveness of exercise interventions for different cancer populations will be available in due course. These will provide significant evidence on cost effectiveness.<sup>28,29,30,31,32,33</sup>
- Further analysis of the use of NHS services during the five-year follow up of the Glasgow study<sup>8</sup> should provide information on the effect of exercise interventions on healthcare-related cost savings.

## How much activity is enough?

Although no formal physical activity guidelines exist in the UK for people living with and beyond cancer, we can be confident that advising and supporting otherwise healthy cancer

survivors to gradually build up to the health-related physical activity guidelines for the general population are appropriate.

An excerpt from the American College of Sports Medicine round table consensus statement<sup>29</sup> on exercise guidelines for cancer survivors supports this: 'Exercise is safe both during and after most types of cancer treatment ... Patients are advised to avoid inactivity and return to normal daily activities as soon as possible after surgery, and during adjuvant cancer treatments. The standard age appropriate guidelines are also appropriate for cancer patients.'<sup>34</sup>

The recent expert consensus statement from the British Association of Sport and Exercise Sciences on exercise and cancer survivorship<sup>35</sup> also highlights the importance of avoiding total inactivity for all cancer patients. Those with cancer complications or co-morbidities, which prohibit moderate-intensity exercise should nonetheless aim to be as active as their abilities and conditions allow.

No reliable information is available on the proportion of cancer survivors meeting physical activity recommendations in the UK. However a study of 716 older men and women with a history of cancer in England revealed that only 51% reported being moderately active more than once a week.<sup>36</sup>

Furthermore among cancer survivors there is evidence that while some health-related behaviours (eg diet, smoking) improve after a cancer diagnosis, physical activity levels reduce significantly.<sup>37,38</sup>

## 2011 Physical activity guidelines from the UK Chief Medical Officers<sup>44</sup>

### Early years (under fives)

Physical activity should be encouraged from birth, particularly through floor-based play and water-based activities in safe environments.

Children of pre-school age who are capable of walking unaided should be physically active daily for at least 180 minutes (three hours), spread throughout the day.

All under fives should minimise the amount of time spent being sedentary (being restrained or sitting) for extended periods (except time spent sleeping).

### Children and young people (five–18 years)

All children and young people should engage in moderate to vigorous intensity physical activity for at least 60 minutes and up to several hours every day.

Vigorous intensity activities, including those that strengthen muscle and bone, should be incorporated at least three days a week.

All children and young people should minimise the amount of time spent being sedentary (sitting) for extended periods

### Adults (19–64 years)

Adults should aim to be active daily. Over a week, activity should add up to at least 150 minutes (2½ hours) of moderate intensity activity in bouts of 10 minutes or more – one way to approach this is to do 30 minutes on at least five days a week.

Alternatively, comparable benefits can be achieved through 75 minutes of vigorous intensity activity spread across the week or a combination of moderate and vigorous intensity activity.

Adults should also undertake physical activity to improve muscle strength on at least two days a week.

All adults should minimise the amount of time spent being sedentary (sitting) for extended periods.

### Older adults (65+ years)

Older adults who participate in any amount of physical activity gain some health benefits, including maintenance of good physical and cognitive function. Some physical activity is better than none, and more physical activity provides greater health benefits.

Older adults should aim to be active daily. Over a week, activity should add up to at least 150 minutes (2½ hours) of moderate intensity activity in bouts of 10 minutes or more – one way to approach this is to do 30 minutes on at least five days a week.

For those who are already regularly active at moderate intensity, comparable benefits can be achieved through 75 minutes of vigorous intensity activity spread across the week or a combination of moderate and vigorous activity.

Older adults should also undertake physical activity to improve muscle strength on at least two days a week.

Older adults at risk of falls should incorporate physical activity to improve balance and co-ordination on at least two days a week.

All older adults should minimise the amount of time spent being sedentary (sitting) for extended periods.

### Avoiding potential adverse effects

Patients and their friends and family are often concerned that exercise may be harmful during or soon after treatment. Although there are potential adverse side effects for some patients, most can be avoided with appropriate precautions (table 5).

Guidance on specific contraindications and modifications based on site of cancer has been published.<sup>34</sup> Systematic review evidence indicates that adverse events reported from exercise during and after treatment in research settings are rare, mild, and mainly musculoskeletal injuries.<sup>4</sup>

**Table 5**  
**General safety considerations regarding exercise during or after treatment**

Potential adverse event	Precautions
Exacerbation of symptoms (eg pain, fatigue, nausea, dyspnea)	Avoid high-intensity exercise; monitor symptoms; modify exercise type based on site of treatment (eg avoid exercise bike after prostate/rectal surgery).
Immunosuppression	If patient has low white blood cell counts, avoid high intensity/volume of exercise (keep to light – moderate intensity).
Falls	If patient has dizziness, frailty, peripheral sensory neuropathy: incorporate balance and co-ordination exercises (eg tai chi) and avoid activities needing considerable balance/coordination (eg treadmill).
Bone fracture	If patient has bone metastases/osteoporosis risk avoid high impact or contact activities.
Lymphoedema	To prevent lymphoedema, progress resistance exercises in small and gradual increments. To avoid exacerbation of lymphoedema, avoid strenuous repetitive exercise with affected limb; wear compression garment.

For the general population the percentages of those active enough to benefit their health are:

- in England, 39% of men and 29% of women<sup>39</sup>
- in Scotland, 43% of men and 32% of women<sup>40</sup>
- in Wales, 37% of men and 24% of women<sup>41</sup>
- in Northern Ireland, 33% of men and 28% of women<sup>42</sup>

Physical activity levels decline significantly with age. In England only 21% of men and 18% of women aged 65–74 achieve the physical activity recommendations, dropping to 9% and 6% respectively for those 75 and over.<sup>39</sup>

**Based on these figures Macmillan has estimated that at least 1.6 million of the two million cancer survivors are not active at recommended levels. Of these 1.1 million are aged 65 and over.**<sup>43</sup>

# Conclusions

This review demonstrates that good evidence exists to support the promotion of physical activity throughout the cancer care pathway.

Activity should be promoted to patients at all stages of cancer from initial diagnosis through to the later stages, where being active can continue to benefit physical function and quality of life. The evidence shows that if an activity recommendation is carefully tailored to the individual, and takes account of potential side effects, it is likely to have a positive impact.

There is a clear need for mechanisms within the cancer care pathway to support patients in maintaining or initiating physical activity during and after treatment.

# Resources

The following resources provide additional helpful information.

- [Advising cancer survivors about lifestyle: a selective review of the evidence.](http://www.ncsi.org.uk/what-we-are-doing/physical-activity) 2010. Macmillan, London. [www.ncsi.org.uk/what-we-are-doing/physical-activity](http://www.ncsi.org.uk/what-we-are-doing/physical-activity)
- Start active, stay active: a report on physical activity from the four home countries' Chief Medical Officers. 2011. Department of Health. [www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_128209](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_128209)
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- [The BASES Expert Statement on Exercise and Cancer Survivorship.](http://www.bases.org.uk/Exercise-and-Cancer) 2011. BASES. [www.bases.org.uk/Exercise-and-Cancer](http://www.bases.org.uk/Exercise-and-Cancer)

# Annex

## **Evidence-base grading**

The Evidence in this report has been graded using the Strength of Recommendation Taxonomy (SORT) which rates the body of evidence for a patient-oriented outcome on quality, quantity and consistency.<sup>45</sup>

**Level A** Systematic review of RCTs (or cohort studies for prognosis outcomes), or high-quality individual RCTs/cohort studies with clear consistent results

**Level B** Systematic review without clear results or lower-quality studies

**Level C** Consensus statements, case series and usual practice

## **Effect sizes**

Effect sizes are standardised mean differences between the treatment and control group in a randomised controlled trial. Effect sizes (ES) are conventionally interpreted as 0.2 = small, 0.5 = moderate and 0.8 = large.

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Macmillan Cancer Support, registered charity in England and Wales (261017),  
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