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CUP Continuous
Update
Project

Analysing research on cancer
prevention and survival



Survivors of breast and other cancers

2018



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WORLD CANCER RESEARCH FUND NETWORK

Our Vision

We want to live in a world where no one develops a preventable cancer.

Our Mission

We champion the latest and most authoritative scientific research from around the world on cancer prevention and survival through diet, weight and physical activity, so that we can help people make informed choices to reduce their cancer risk.

As a network, we influence policy at the highest level and are trusted advisors to governments and to other official bodies from around the world.

Our Network

World Cancer Research Fund International is a not-for-profit organisation that leads and unifies a network of cancer charities with a global reach, dedicated to the prevention of cancer through diet, weight and physical activity.

The World Cancer Research Fund network of charities is based in Europe, the Americas and Asia, giving us a global voice to inform people about cancer prevention.

Our Continuous Update Project (CUP)

The Continuous Update Project (CUP) is the World Cancer Research Fund (WCRF) Network's ongoing programme to analyse cancer prevention and survival research related to diet, nutrition and physical activity from all over the world. Among experts worldwide it is a trusted, authoritative scientific resource which informs current guidelines and policy on cancer prevention and survival.

Scientific research from around the world is continually added to the CUP's unique database, which is held and systematically reviewed by a team at Imperial College London. An independent panel of experts carries out ongoing evaluations of this evidence, and their findings form the basis of the WCRF Network's Cancer Prevention Recommendations (see inside back cover).

Through this process, the CUP ensures that everyone, including policymakers, health professionals and members of the public, has access to the most up-to-date information on how to reduce the risk of developing cancer.

The launch of the World Cancer Research Fund Network's Third Expert Report, *Diet, Nutrition, Physical Activity and Cancer: a Global Perspective*, in 2018 brings together the very latest research from the CUP's review of the accumulated evidence on cancer prevention and survival related to diet, nutrition and physical activity. [Survivors of breast and other cancers](#) is one of many parts that make up the CUP Third Expert Report: for a full list of contents, see dietandcancerreport.org.

The CUP is led and managed by World Cancer Research Fund International in partnership with the American Institute for Cancer Research, on behalf of World Cancer Research Fund UK, Wereld Kanker Onderzoek Fonds and World Cancer Research Fund HK.

How to cite the Third Expert Report

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Key

See **Glossary** for definitions of terms highlighted in *italics*.

References to other parts of the Third Expert Report are highlighted in [purple](#).

Introduction

In recent decades, progress in the early detection and treatment of cancer has led to a dramatic increase in the number of cancer survivors, defined as all people who have been diagnosed with cancer, including before, during and after treatment [1]. *Survival rates* vary for different cancers but are highest for colorectal, prostate, melanoma, endometrial and breast cancers [2]. Coupled with an increase in incidence, improved treatment and detection of the disease in an earlier phase (including some cancers through screening that were previously not detectable), the number of people living with or beyond cancer is growing every year. In addition, therapeutic control of tumour growth and progression in patients with recurrent disease has led to a prolonged *chronic* course for many cancers and a longer lifespan with acceptable quality of life for survivors. In 2012, 32.6 million people worldwide were living with a diagnosis of cancer [3]. The research focused on aspects of cancer survivorship has grown in parallel to the prevalence of cancer survivors.

The term ‘cancer survivor’ covers a wide variety of circumstances beginning at diagnosis through cancer treatment to the end of life. The definition of ‘cancer survivor’ here does not include people living with a diagnosis of a benign tumour or conditions defined as premalignant, such as premalignant cervical and breast lesions or polyps in the colon. Using a single term to cover cancer survivors at all of these stages cannot do justice to the heterogeneous reality of cancer and its survivorship. Each stage of survivorship has its own particular characteristics, and the impact of interventions or exposures, including diet, nutrition and physical activity, varies according to the stage, as much as it does with the nature of the particular cancer.

There is clear evidence for the role that diet, nutrition and physical activity play in cancer prevention (see [Exposure sections](#)) and although survival research is more recent and lesser in volume, there are clear indications that some of these factors are related to outcome (see [CUP breast cancer survivors report 2014](#)). However, more research is needed to fully understand the impact of interventions that change body composition, dietary intake and levels of physical activity.

A systematic literature review on cancer survivorship was commissioned for the 2007 Second Expert Report [4]; it noted the emerging evidence linking various aspects of diet, nutrition or physical activity with various outcomes in cancer survivors. However, there was insufficient evidence that distinguished the impact of these factors on cancer survivors as compared with people without cancer. Since then, new evidence has accrued, mostly for breast cancer survivors, but also emerging for other cancers. For this part of the Third Expert Report, a single systematic literature review of the evidence linking diet, nutrition and physical activity to survival and the occurrence of new primary cancers in survivors of breast cancer was conducted as part of the Continuous Update Project (CUP); see [CUP breast cancer survivors report 2014](#). No other systematic reviews of additional cancer sites were conducted. Therefore, this part of the Third Expert Report focuses on this evidence for breast cancer survivors but includes some information on other cancers. Systematic reviews of additional cancer sites are planned for the future.



This part of the Third Expert Report

- Outlines the prevalence of cancer survival across the globe
- Discusses some of the key issues in research relating to diet, nutrition and physical activity and cancer survivors
- Reports the CUP Expert Panel's judgements on the evidence in breast cancer survivors
- Presents advice and recommendations for survivors of breast and other cancers provided by other organisations
- Summarises two of the main randomised controlled trials conducted on diet and breast cancer survival and the evidence on physical activity and breast cancer survivorship
- Summarises the evidence on diet in survivors of breast and other cancers
- Discusses research gaps and future priorities

1. Prevalence

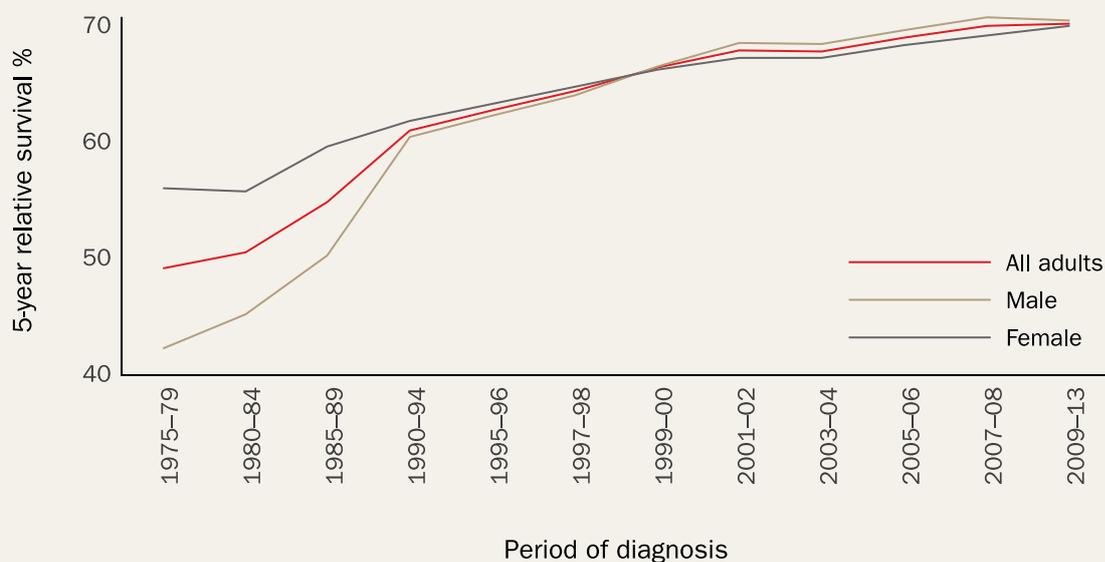
The global burden of cancer is increasing due to a growing and aging population as well as increases in risk factors including smoking, obesity, physical inactivity and unhealthy dietary patterns [5]. In 2012, 32.6 million people worldwide were living with a diagnosis of cancer [3].

In 1975 a person diagnosed with cancer in the United States had a less than 50 per cent chance of surviving for five years. By 2013 that probability had increased to nearly 70 per cent [6] (see **Figure 1**).

The number of cancer survivors has increased in recent decades and this is predicted to continue. In the United States over the next decade (2016 to 2026), the number of people who have lived five years or more after their cancer diagnosis is projected to increase by approximately 35 per cent, to 14 million [7].

The 5-year survival rates in England and Wales have also improved over time but unlike in the United States, the rates for women are

Figure 1: Evolution of cancer survivorship, USA, 1970s to present



consistently better than for men (see **Figure 2**) [2]. There are several possible reasons why this may be, including increased use of prostate-specific antigen (PSA) tests in the United States, which disproportionately detect cancers that may not lead to death and introduce *lead-time bias*.

Data are not available for all countries, particularly low- to middle-income countries.

Improvements in survival reflect advances in treatments, as well as earlier and more precise detection and diagnosis for some

cancers due to improved screening.

However, in the presence of screening it is difficult to disentangle how much of an observed improvement in survival is real and how much is due to lead-time bias and diagnosis of relatively indolent cancers that previously would have remained undetected.

Survival varies greatly by cancer type. Liver and lung cancer have high mortality rates with low age-standardised 5-year survival rates observed in all nations. Survival rates for breast and colon cancer are higher but vary by geographical location [8] (see **Table 1**).

Figure 2: Evolution of cancer survivorship, England, 1970s to present

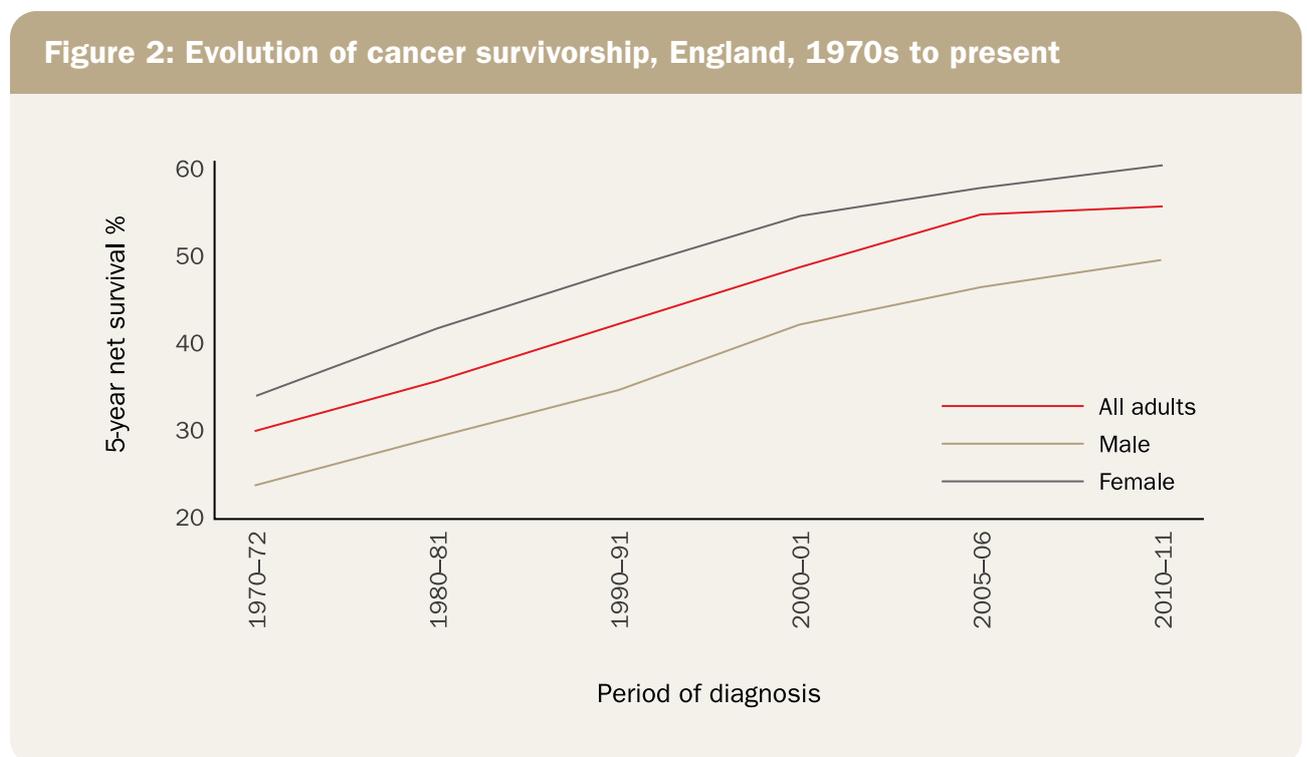


Table 1: Age standardised 5-year survival percentage

	Liver	Lung	Breast	Colon
UK¹	9%	10%	81%	54%
USA¹	15%	19%	89%	65%
China²	13%	18%	81%	55%
Australia¹	15%	15%	86%	64%
South Africa³	10%	19%	53%	–
Brazil⁴	12%	18%	87%	58%

¹ Population covered >80%, ² Population covered 3%, ³ Population covered 2%, ⁴ Population covered 6%

Another factor that influences cancer survival is the stage at which the cancer is diagnosed, as this is highly predictive of cancer mortality. In general, people diagnosed with early (stage 1 or 2) cancers have a better survival than those diagnosed with advanced (stage 3 or 4) cancers [9, 10].

International comparisons reveal very wide differences in survival trends that are likely to be attributable to differences in access to early diagnosis and the availability of effective therapies and optimal supportive care.

Cancer prevention is a crucial component of the World Health Organization's (WHO) global target of a 25 per cent reduction in deaths from cancer and other *non-communicable diseases* (NCDs) in people aged 30 to 69. However, achieving this target by 2025 (referred to as 25x25) [11] requires more effective deployment of treatment approaches with health systems to improve cancer survival [12].

2. Diet, nutrition, physical activity and cancer survival

2.1 Nature of the evidence

Randomised controlled trials (RCTs) and prospective *cohort studies* are considered the strongest types of evidence, but both can be challenging to conduct in cancer survivor populations. Well-conducted RCTs remain the gold standard of clinical trials and may yield powerful evidence of the effect of specific dietary constituents as they have excellent internal validity and can provide strong evidence.

Observational studies have provided the bedrock of understanding the impact of diet, nutrition and physical activity on the incidence of cancer. However, observational cohort studies are particularly susceptible to additional methodological challenges in the setting of cancer survivorship. The presence of symptoms, disease or treatment effects may differentially affect the distribution of exposures in cancer survivors, leading to issues of confounding and reverse causation in observational studies. In contrast, the challenges of designing and conducting RCTs to explore cancer incidence, particularly the size and duration required to accumulate sufficient numbers of relatively rare outcomes and address the relevant period of exposure and lag time, are largely circumvented in the setting of cancer survivorship. The higher event rate and much shorter period of relevant exposure or intervention make RCTs more feasible in cancer survivors. Furthermore, cancer survivors may be highly motivated research participants, willing to change diet or levels of activity.

However, it is important that the inherent limitations of RCTs and their direct relevance to the care of patients in routine practice be carefully considered. In particular, patients, providers and concurrent care in the general population can be different from those in



clinical trials, so the generalisability of RCTs may be limited [13, 14]. Patients are highly selected to participate in RCTs (less than 10 per cent of patients with cancer are entered in a clinical trial), and a limiting factor in interpreting them is that patients seen in routine practice can be different from patients included in RCTs. Patients with advanced age [15, 16] and greater comorbidity and those from lower socioeconomic background [17] are under-represented in RCTs. There can also be important differences in the provision of care for patients on RCTs (for example, highly regulated trial protocols at specialised centres of excellence) compared with patients in routine practice (depending on the exposure being trialled).

Cohort studies with large numbers of cases and high follow-up rates may have better generalisability. However, in order to provide strong evidence, data from cohort studies must be fully adjusted for potential confounders such as clinical characteristics (stage, grade), tumour type, treatment modalities, dose and duration of treatment received, and the locations and burden of disease, and these adjustments are not always made. Outcomes in cancer survivors may relate to the time to progression of disease (for example, recurrence or metastasis) or to associated measures of quality of life or performance status issues such as fatigue, physical performance or depression. Whereas some of these are relatively straightforward to characterise (for example, metastasis), others (for example, quality of life) are less easy to measure.

The challenge for reviewing the evidence for diet, nutrition, physical activity and cancer survivorship is the scale and heterogeneity of the field. Part of this heterogeneity stems from the different phases of survivorship and the relative priorities of associated endpoints during each phase. Characterisation both of exposure (diet, physical activity, body composition) and of outcome (such as

progression-free survival, disease-specific mortality, co-existing conditions, quality of life or side effects) is complex and imprecise at present. Future observation studies must pay attention to the role of issues that may be unique to specific cancers, as well as taking account of the type of treatment or stage of disease. Currently it is not possible to exclude with confidence that any observed association is not due to unidentified confounding or to reverse causation.

Substantial improvements in cancer survival have been achieved. Therefore, it is essential that the long-term health needs of cancer survivors, beyond those directly related to their cancer, be considered. The benefits of lifestyle changes in otherwise healthy people are well documented for most NCDs [18], of which cancer survivors are often at an elevated risk. There is some evidence that improving aspects of diet, nutrition, body composition or physical activity can improve risk factors for these NCDs in cancer survivors [19–22]. A great deal of research has focused on the role of diet, nutrition and physical activity on improving cancer-related outcomes such as disease-specific survival, progression-free survival and recurrence, but many studies were not equipped to address the clinical heterogeneity of disease and its management.

2.2 Diet, nutrition and physical activity

Historically, dietary advice to cancer patients focused on maintaining a patient's energy intake and *micronutrient* sufficiency and on mitigating the effects of nausea and gastrointestinal toxicity caused by systemic cytotoxic therapy and radiotherapy. Changes in dietary habits and the reduction in physical activity levels over the past 30 years have led to a dramatic increase in the prevalence of overweight and obesity; the impact of overweight and obesity on survival of and living beyond cancer is currently uncertain.

Prospective research and RCTs on the role of diet, nutrition and physical activity in people living with and beyond cancer have typically been of short duration, of small size and focused on specific food items or in highly selected populations that do not necessarily represent typical experience. The evidence for the beneficial or adverse effects of specific foods or nutrients is limited (see matrix on page 12).

In addition to the potential for beneficial impacts of diet and nutrition on reducing treatment-related toxicity and improving efficacy, concerns have been raised regarding the potential for dietary supplements to negatively impact the efficacy of cancer therapies [23]. Diet also plays a role in symptom management. Patients undergoing treatment experience a multitude of symptoms, including fatigue, pain, difficulty breathing, nausea, appetite loss, unintentional weight change and loss of muscle mass [24–27].

Physical activity, and specifically various forms of exercise (including cycling [28], weight training [29], walking [30] and aerobic exercise [31–33]), after treatment has been proposed to confer diverse benefits on cancer patients [34]. There is good evidence that these benefits include increased aerobic fitness, reduced fatigue, reduced depressive symptoms, improved quality of life, reduced therapeutic toxicity and improved tolerance [35–37]. In addition, some studies have reported improved cancer-specific and overall survival, but for these, the evidence is currently limited (see [CUP breast cancer survivors report 2014](#)).

There is evidence to suggest elevated body fatness is a predictor of poor outcome in breast cancer survivors (see [CUP breast cancer survivors report 2014](#)). The exact cause of this association is unclear. Chronic inflammation associated with obesity may enhance the progression of disease and the impact of

overweight and obesity on risk of other chronic diseases such as diabetes and cardiovascular disease may contribute to reduced overall survival in cancer patients. There is also evidence that women who are overweight or obese display adverse tumour characteristics (size, grade) that might affect outcome. It has also been proposed that reduced treatment efficacy might be due to under-dosing of chemotherapy treatment [38–40].

Currently it is not possible to conclude with confidence that interventions aimed at reducing body fatness would necessarily improve outcome in breast cancer survivors. Furthermore, associations have been found between being overweight at diagnosis and longer survival in patients with certain types of cancers, including colorectal and lung [41, 42]. The association between higher body mass index (BMI) and improved outcome is currently unexplained. Patients who are overweight might have sufficient lean (as well as adipose) tissue to provide resilience against the metabolic side effects of cancer and its treatment [43, 44]. A crucial limitation of the studies reviewing weight is the ability to distinguish between intentional and disease-related (unintentional) weight loss. *Sarcopenia* and *cachexia* are late complications associated with poor outcome in cancer patients, so an apparent beneficial effect of overweight may simply reflect a lack of underlying occult disease [45, 46]. There is evidence that both underweight and weight loss after diagnosis are related to reduced survival in women with breast cancer [47]. The impact of weight loss will vary depending on the stage of survivorship due to the dynamic nature of the disease and its treatment.

While the evidence remains inadequate to make specific Recommendations for cancer survivors with confidence, the Panel judges that following the [Cancer Prevention Recommendations](#) is unlikely to be harmful to survivors who have completed

treatment. Therefore, cancer survivors who have finished the acute phase of treatment are encouraged, if appropriate to their circumstances and unless otherwise advised by a health professional, to follow the general advice for cancer prevention: to be a healthy weight; be physically active; eat more wholegrains, vegetables, fruits and legumes (such as beans); avoid sugary drinks and limit consumption of ‘fast foods’ and other processed foods high in fat, starches or sugars; limit consumption of red meats (such as beef, pork and lamb); avoid processed meats and alcohol; and not rely on supplements. For some cancers, especially those diagnosed at early stages (for example, prostate and breast), cardiovascular disease (CVD) will be a more common cause of death than cancer. As the risk of diseases other than cancer are also modified by diet, nutrition and physical activity, following the Cancer Prevention Recommendations will also be expected to help reduce the risk of other NCDs.

In 2014, the World Cancer Research Fund (WCRF) Network published its first report on diet, nutrition, physical activity and breast cancer survivors (see [CUP breast cancer survivors SLR 2014](#) Appendix 1). A protocol was developed specifically for reviewing this evidence, and through this process several key issues were identified (see below). Although these relate specifically to breast cancer, similar complexity would be expected for each cancer site.

2.2.1 Time frame

The time frames of exposure assessment used were before primary breast cancer diagnosis, less than 12 months after diagnosis of primary breast cancer and 12 months or more after diagnosis of primary breast cancer. These time frames take into account exposure assessment at various stages of treatment – those who have not started, those undergoing treatment and those who have finished

treatment. Although most treatment will finish by a year, other treatments such as hormonal therapy (tamoxifen, aromatase inhibitors) last for many years.

2.2.2 Treatment

Treatment varies by breast cancer type, spread and patient characteristics. The type and amount of treatment can have a greater effect on survival than most exposures related to diet, nutrition and physical activity, and is a likely modifying factor.

2.2.3 Time periods and changes in treatments

Treatment regimens vary according to time period, country and socio-economic status within countries.

2.2.4 Reverse causation

An exposure being studied may be a result of the diagnosis (or treatment), and not the other way around.

2.2.5 Mortality and breast cancer subtype

Pre-existing disease, and some specific subtypes of breast cancer, are more likely to lead to early recurrence or death, conventionally defined as occurring within the first two years after diagnosis. If a survivor cohort is assembled a long time after diagnosis, such women at high risk for mortality may not be included. Furthermore, advances in treatment coupled with earlier diagnosis have led to longer survival beyond five years. Therefore, it is important to consider survival in terms of both the cancer subtype and the time point after diagnosis when data collection occurs and follow-up begins.

These issues contributed to the CUP Expert Panel being unable to make strong conclusions (‘convincing’ or ‘probable’) for the evidence on diet, nutrition, physical activity and breast cancer survival.

3. Diet, nutrition, physical activity and breast cancer survival

The CUP systematically reviewed the evidence in relation to diet, nutrition and physical activity, and all-cause mortality, breast cancer mortality and risk of second primary breast cancer in [CUP breast cancer survivors report 2014](#) [48]. Published in 2014, this was the WCRF Network’s first systematic analysis of global research in this topic area. Below is the summary matrix of the CUP Panel’s conclusions. There are other important cancer-related outcomes, including quality of life and fatigue, and non-cancer-outcomes, including incidence of other NCDs, which were not reviewed in the 2014 review of breast cancer survivors. The outcomes reviewed were limited to those that could be meta-analysed or otherwise combined in a systematic way.

Other outcomes suffer from wide variation in definition, measurement and ascertainment that make synthesising the evidence complex and difficult. For instance, recurrence was not included due to differences in definitions included in the studies. The time periods considered in the 2014 review of breast cancer survivors were dictated by the nature of the evidence available within the studies included in the review. Reviews of the evidence in relation to diet, nutrition and physical activity in survivors of other cancers will be conducted in the future.

Each conclusion on the likely causal relationship between an exposure and survival from breast cancer shown in the matrix below forms a part of the overall body of evidence that is considered during the process of making Cancer Prevention Recommendations. Any single conclusion does not represent a recommendation in its own right.

DIET, NUTRITION, PHYSICAL ACTIVITY AND BREAST CANCER SURVIVAL – ALL CAUSE MORTALITY					
		DECREASES RISK		INCREASES RISK	
		Exposure	Time frame	Exposure	Time frame
STRONG EVIDENCE	Convincing				
	Probable				
LIMITED EVIDENCE	Limited – suggestive	Physical activity	Before diagnosis	Body fatness	Before diagnosis
			≥12 months after diagnosis		<12 months after diagnosis
		Foods containing fibre	Before diagnosis		Total fat
			≥12 months after diagnosis	Before diagnosis	
		Foods containing soy	≥12 months after diagnosis	Saturated fatty acids	Before diagnosis
		STRONG EVIDENCE	Substantial effect on risk unlikely		

STRONG: Evidence strong enough to support a judgement of a convincing or probable causal relationship and generally justify making recommendations

LIMITED: Evidence that is too limited to justify making specific recommendations

Definitions of World Cancer Research Fund (WCRF)/American Institute for Cancer Research (AICR) grading criteria

‘Strong evidence’: Evidence is strong enough to support a judgement of a convincing or probable causal (or protective) relationship and generally justify making public health recommendations.

‘Convincing’: Evidence is strong enough to support a judgement of a convincing causal (or protective) relationship, which justifies making recommendations designed to reduce the risk of cancer. The evidence is robust enough to be unlikely to be modified in the foreseeable future as new evidence accumulates.

‘Probable’: Evidence is strong enough to support a judgement of a probable causal (or protective) relationship, which generally justifies goals and recommendations designed to reduce the risk of cancer.

‘Limited evidence’: Evidence is inadequate to support a probable or convincing causal (or protective) relationship. The evidence may be limited in amount or by methodological flaws, or there may be too much inconsistency in the direction of effect (or a combination), to justify making specific public health recommendations.

‘Limited – suggestive’: Evidence is inadequate to permit a judgement of a probable or convincing causal (or protective) relationship, but is suggestive of a direction of effect. The evidence may be limited in amount, or by methodological flaws, but shows a generally consistent direction of effect. This judgement generally does not justify making recommendations.

‘Limited – no conclusion’: There is enough evidence to warrant Panel consideration, but it is so limited that no conclusion can be made. The evidence may be limited in amount, by inconsistency in the direction of effect,

by methodological flaws, or any combination of these.

‘Substantial effect on risk unlikely’: Evidence is strong enough to support a judgement that a particular lifestyle factor relating to diet, nutrition, body fatness or physical activity is unlikely to have a substantial causal (or protective) relation to a cancer outcome.

For further information and to see the full grading criteria agreed by the Panel to support the judgements shown in the matrix, see [Judging the evidence](#).

3.1 Summary of Panel judgements for breast cancer survival

The conclusions made by the Panel are based on the evidence from epidemiological studies. They are an interpretation of the data relating specific exposures and survival from breast cancer. Each conclusion on the likely causal relationship between an exposure and survival from breast cancer forms a part of the overall body of evidence that is considered during the process of making Cancer Prevention Recommendations. Any single conclusion does not represent a Recommendation in its own right. The 2018 Cancer Prevention Recommendations are based on a synthesis of all these separate conclusions, as well as other relevant evidence, and can be found in [Recommendations and public health and policy implications](#).

Due to the issues discussed previously (including time frame, treatment reverse causation and subtypes), the CUP Panel was unable to draw strong evidence conclusions (‘convincing’ or ‘probable’).

Tables 2 and 3 summarise the evidence identified by the CUP in relation to breast cancer survivors and all-cause mortality.

The CUP Panel drew the following conclusions:

LIMITED EVIDENCE

Limited – suggestive

- **Before diagnosis**
 - The evidence suggesting that being physically active and consuming a diet higher in foods containing fibre before a diagnosis of breast cancer reduces the chances of dying earlier after diagnosis is limited.
 - The evidence suggesting that greater body fatness or consuming a diet higher in fat or saturated fatty acids before a diagnosis of breast cancer increases the risk of dying earlier after diagnosis is limited.
- **After diagnosis¹**
 - The evidence suggesting greater body fatness after diagnosis of breast cancer increases the risk of dying earlier after a diagnosis of breast cancer is limited.
 - The evidence suggesting that being physically active or eating a diet higher in foods containing fibre or soy after a diagnosis of breast cancer decreases the risk of dying earlier after a diagnosis of breast cancer is limited.

Table 2: Summary of CUP 2014 meta-analyses of diet, nutrition and physical activity prior to diagnosis of breast cancer and subsequent all-cause mortality

Exposure	Outcome	Increment	RR (95% CI)	I ²	No. of studies	No. of deaths
Physical activity	All-cause mortality	Total PA H vs L	0.83 (0.62–1.12)	23%	2	505
		Recreational PA H vs L	0.74 (0.67–0.83)	5%	8	2,892
Foods containing fibre	All-cause mortality	Per 10 g/day	0.68 (0.55–0.84)	0%	3	443
Greater body fatness	All-cause mortality	Per 5 kg/m ²	1.17 (1.13–1.21)	13%	14	6,261
Total fat	All-cause mortality	Per 10 g/day	1.19 (1.01–1.41)	82%	4	178
Saturated fatty acids	All-cause mortality	Per 10 g/day	1.66 (1.26–2.19)	32%	3	178

Table 3: Summary of CUP 2014 meta-analyses of diet, nutrition and physical activity after diagnosis of breast cancer and subsequent and all-cause mortality

Exposure	Outcome	Increment	RR (95% CI)	I ²	No. of studies	No. of deaths
Physical activity	All-cause mortality	Total PA H vs L	0.63 (0.41–0.97)	44%	3	514
		Total PA per 10 MET-h/week	0.90 (0.79–1.03)	79%	3	514
		Recreational PA H vs L	0.61 (0.50–0.74)	46%	5	2,337
		Recreational per 10 MET-h/week	0.81 (0.73–0.90)	64%	5	2,337
Foods containing fibre	All-cause mortality	Per 10 g/day	0.88 (0.78–0.99)	0%	3	1,092
Foods containing soy	All-cause mortality	Per 10 mg/day	0.91 (0.83–1.00)	68%	3	794
Greater body fatness	All-cause mortality	Per 5 kg/m ²	1.08 (1.01–1.15)	0%	4	1,703

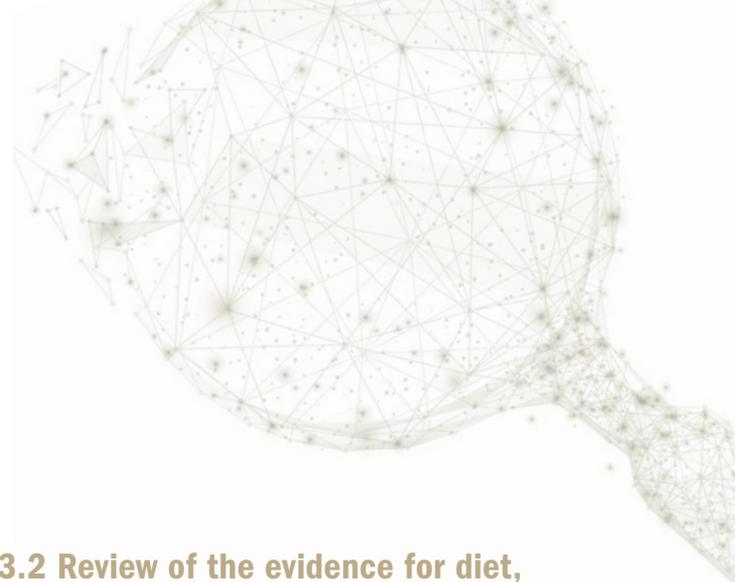
PA = physical activity, H vs L = highest level compared with lowest levels, MET-h = metabolic equivalent hours

¹ After breast cancer diagnosis refers to 12 months or more after diagnosis.

The CUP breast cancer survivors SLR 2014 identified two RCTs on total mortality [49, 50]. Both studies, the Women's Intervention Nutrition Study (WINS) and the Women's Healthy Eating and Living (WHEL) Randomised Controlled Trial, tested whether changing dietary pattern can influence a woman's prognosis following breast cancer.

The WINS study, which included 2,437 women between the ages of 48 and 79 with early-stage breast cancer, was undertaken starting in 1987 to test the hypothesis that dietary fat reduction would prolong relapse-free survival. Although the intervention was intended to maintain body weight, the intervention group experienced modest weight loss. The hazard ratio of relapse events in the intervention group compared with the control group was 0.76 (95% CI 0.60–0.98, $p = 0.077$ for stratified log rank and $p = 0.034$ for adjusted Cox model analysis). Exploratory analyses suggested a differential effect of the dietary intervention based on hormonal receptor status. The authors concluded that a lifestyle intervention reducing dietary fat intake, with modest influence on body weight, may improve relapse-free survival of breast cancer patients receiving conventional cancer management [49].

The WHEL Study was an RCT of the effectiveness of a high-vegetable, low-fat diet in reducing additional breast cancer events and early death in women with early-stage invasive breast cancer (within 4 years of diagnosis). Between 1995 and 2000, it randomly assigned 3,088 women to an intensive diet intervention or to a comparison group. Within the cohort, baseline fruit and vegetable consumption was already 7.4 servings per day. Two-thirds of the women were under 55 years of age at randomisation [50]. During a 7.3-year follow-up period (96 per cent participant retention), women in the intervention arm reduced their fat intake but did not lose weight, and there was no difference between the intervention and control arms in recurrence-free survival.



3.2 Review of the evidence for diet, nutrition and physical activity on cancer survivorship by other groups

3.2.1 Physical activity and breast cancer survivorship

A recent review of the literature on physical activity and breast cancer survivorship was conducted for the US Physical Activity Guidelines Advisory Committee [51]. This analysis was not part of the CUP.

That review of several systematic reviews and meta-analyses shows a consistent inverse association between physical activity level after diagnosis and cancer-specific and all-cause mortality among breast cancer survivors [48, 52–58]. A 2015 meta-analysis of eight cohorts found that highest versus lowest levels of physical activity were associated with a 48 per cent reduction in risk for all-cause mortality [56]. A 2016 meta-analysis of ten cohorts found that highest versus lowest levels of post-diagnosis physical activity were associated with a 38 per cent reduction in risk of breast cancer-specific mortality [54]. This latter study found that risk of recurrence was significantly reduced in four cohorts and in one trial that collected recurrence data [54]. It should be noted that the various studies used quite different definitions of recurrence, so it is difficult to interpret the combined effect of these results. The pooling project addressed the association between meeting activity levels recommended in the 2008 Physical Activity Guidelines and breast cancer survival.

The pooling project found that engaging in 10 or more metabolic equivalent (MET) hours per week was associated with a 27 per cent reduction in all-cause mortality and a 25 per cent reduction in breast-cancer-specific mortality [59]. Little information is available on the dose–response association of physical activity with breast cancer survival. A meta-analysis of four cohort studies found that each 5, 10 or 15 MET-hours per week increase in post-diagnosis physical activity was associated with a 6, 11 and 16 per cent reduction in risk of breast cancer mortality, respectively [57]. Furthermore, each 5, 10 or 15 MET-hours per week increase in post-diagnosis physical activity was associated with a 13, 24 and 34 per cent decreased risk of all-cause mortality, respectively [57] (see **Table 4**).

3.2.2 Diet in survivors of breast and other cancers

A meta-analysis of cohort studies investigated the association between food intake and dietary patterns and overall mortality among

cancer survivors [60]. Higher intakes of vegetables and fish were inversely associated with overall mortality, and higher alcohol consumption was positively associated with overall mortality. Adherence to the highest category of diet quality was inversely associated with overall mortality, as was adherence to the highest category of a prudent or healthy dietary pattern. The Western dietary pattern (based on high intakes of red and processed meat, refined grains, sweets and desserts, and high-fat dairy products) was associated with increased risk of overall mortality (see **Table 5**). Consumption of alcoholic beverages was associated with an increased risk of cancer recurrence (RR 1.17 (95% CI 1.05–1.31), $I^2 = 38\%$, studies = 17).

Some evidence exists for a synergistic effect of better-quality diets combined with physical activity and improved survival of breast cancer independent of obesity [61, 62].

Table 4: Summary of published pooled and meta-analyses – physical activity

Analysis	Outcome	Increment/ Comparison	RR (95% CI)	I^2	No. of studies	No. of deaths
Lahart, 2015 [56]	All-cause mortality	PA Highest vs lowest	0.52 (0.43–0.64)	54%	8	6,898
Friedenreich, 2016 [54]	Breast cancer-specific mortality	Post-diagnosis PA Highest vs lowest	0.62 (0.48–0.80)	61%	10	1,239
	Recurrence ¹	Post-diagnosis PA Highest vs lowest	0.68 (0.58–0.80)	0%	5	1,377
Beasley, 2012 [59]	All-cause mortality	≥10 MET-hours/ week	0.73 (0.66–0.82)	–	4	1,468
	Breast cancer-specific mortality	≥10 MET-hours/ week	0.75 (0.65–0.85)	–		971
Schmid, 2014 [57]	Breast cancer-specific mortality	5 MET-hours/week	0.94 (0.92–0.97)	–	4	–
		10 MET-hours/week	0.89 (0.85–0.94)	–		–
		15 MET-hours/week	0.84 (0.78–0.91)	–		–
	All-cause mortality	5 MET-hours/week	0.87 (0.80–0.94)	–		–
		10 MET-hours/week	0.76 (0.64–0.89)	–		–
		15 MET-hours/week	0.66 (0.62–0.84)	–		–

¹ Studies used different definitions of recurrence, so it is difficult to interpret the combined effect of these results. PA = physical activity, MET-hours = metabolic equivalent hours

Table 5: Risk of overall mortality, comparing highest versus lowest category of pre- or post-diagnosis dietary exposure

Analysis ¹	Outcome	Increment/ Comparison	RR (95% CI)	I ²	No. of studies	No. of deaths
Vegetables	All-cause mortality	Highest vs lowest	0.86 (0.79–0.94)	43%	21	–
Fish	All-cause mortality	Highest vs lowest	0.85 (0.78–0.93)	0%	7	–
Alcohol	All-cause mortality	Highest vs lowest	1.08 (1.02–1.16)	70%	63	–
Diet quality	All-cause mortality	Highest vs lowest	0.78 (0.72–0.85)	0%	8	–
Prudent or healthy dietary pattern²	All-cause mortality	Highest vs lowest	0.81 (0.67–0.98)	44%	8	–
Western dietary pattern³	All-cause mortality	Highest vs lowest	1.46 (1.27–1.68)	0%	8	–

¹ Random effects analyses data only ² Includes high intakes of fruit and vegetables, whole grains, poultry and low-fat dairy products.

³ Based on high intakes of red and processed meat, refined grains, sweets and desserts, and high-fat dairy products.

4. Advice for cancer survivors from other organisations

In addition to the CUP’s review of the evidence for breast cancer survivors and the CUP Expert Panel’s advice for cancer survivors to follow the Cancer Prevention Recommendations, additional organisations also provide guidance on nutrition and physical activity for cancer survivors. This section reviews this guidance (see **pages 19 to 22** for a summary).

4.1 American Cancer Society

The American Cancer Society (ACS) provides guidelines on nutrition and physical activity for cancer survivors [63]. These guidelines state that during the post-treatment phase, setting and achieving lifelong goals for weight management, a physically active lifestyle and a healthy diet are important tools to promote overall health and quality and quantity of life.

These guidelines are based on the consideration that people who have been diagnosed with cancer are at a significantly higher risk of developing second primary cancers and other NCDs such as cardiovascular disease, diabetes and osteoporosis, and

thus the guidelines established to prevent those diseases are relevant. In brief, the ACS guidelines advise survivors to achieve and maintain a healthy weight. Cancer survivors living with overweight or obesity should limit consumption of high-calorie foods and beverages and increase physical activity to promote weight loss. All survivors should engage in regular physical activity and avoid inactivity, aiming to exercise at least 150 minutes per week, including strength training exercises at least two days per week; eat a diet high in vegetables, fruits and wholegrains; and limit alcohol, red meat and processed meat. These guidelines are consistent with the ACS Guidelines on Nutrition and Physical Activity for Cancer Prevention for the general population [64] (see **pages 19 to 22**).

4.2 European Society for Clinical Nutrition and Metabolism

The European Society for Clinical Nutrition and Metabolism (ESPEN) developed evidence-based guidelines to translate current best evidence and expert opinion into recommendations for multidisciplinary teams responsible for identification, prevention and treatment of reversible elements of



malnutrition in adult cancer patients [65]. ESPEN defines a ‘cancer patient’ as a patient with a cancer diagnosis who is either waiting for or on cancer-directed treatment, on symptomatic treatment and/or receiving palliative care. ESPEN defines ‘cancer survivors’ as patients cured from their cancer.

ESPEN recommends that in all patients – with the exception of end-of-life care – energy and substrate requirements should be met by offering in a step-wise manner nutritional interventions from counseling to parenteral nutrition. However, the benefits and risks of nutritional interventions must be balanced with special consideration in patients with advanced disease. Nutritional care should always be accompanied by exercise training. To counter malnutrition in patients with advanced cancer there are few pharmacological agents and they only have limited effects. Cancer survivors should engage in regular physical activity and adopt a prudent diet (see **pages 19 to 22**).

4.3 American Society of Clinical Oncology

The American Society of Clinical Oncology (ASCO) has developed clinical guidelines on obesity [66] and endorsed guidelines [67–69] for survivors of some cancers to address the ongoing care of the growing population of cancer survivors. The guidelines were developed to help primary care clinicians and other healthcare

professionals provide comprehensive clinical follow-up care for adults who have completed initial treatment (see **pages 19 to 22**).

4.4 National Comprehensive Cancer Network

The National Comprehensive Cancer Network (NCCN) has developed a set of guidelines [70] detailing the sequential management decisions and interventions that apply to 97 per cent of cancers affecting patients in the United States and provide recommendations based on the best evidence available at the time. The intent of the NCCN Guidelines is to assist in the decision-making process of people involved in cancer care – including physicians, nurses, pharmacists, payers, patients and their families – with the ultimate goal of improving patient care and outcomes (see **pages 19 to 22**).

4.5 American College of Sports Medicine

The American College of Sports Medicine (ACSM) has distilled the literature on the safety and efficacy of exercise training during and after adjuvant cancer therapy to provide guidelines based on the conclusion that exercise training is safe during and after cancer treatments and results in improvements in physical functioning, quality of life and cancer-related fatigue in several cancer survivor groups [71, 72]. Implications for disease outcomes and survival are still unknown. Nevertheless, the ACSM concluded that the benefits to physical functioning and quality of life are sufficient for the recommendation that cancer survivors follow the 2008 Physical Activity Guidelines for Americans, with specific exercise programming adaptations for disease and treatment-related adverse effects. The advice to ‘avoid inactivity’, even in cancer patients with existing disease or undergoing difficult treatments, is likely helpful (see **pages 19 to 22**).

Summary of WCRF/AICR ACS, ESPEN, ASCO, NCCN and ACSM recommendations for cancer survivors

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Be a healthy weight

- Keep your weight within the healthy range and avoid weight gain in adult life.

ACS nutrition and physical activity guidelines for cancer survivors [63]

- Achieve and maintain a healthy weight.
- If overweight or obese, limit consumption of high-calorie foods and beverages and increase physical activity to promote weight loss.

ESPEN guidelines on nutrition in cancer patients [65]

- Maintain a healthy weight (BMI 18.5 to 25 kg/m²) and maintain a healthy lifestyle, which includes being physically active and eating a diet based on vegetables, fruits and wholegrains, and low in saturated fat, red meat and alcohol.

ASCO guidelines on survivorship care [66]

- Clinicians to advise patients of their current weight status and whether there is need to lose weight or prevent weight gain, based on BMI category and considerations regarding disease state and treatment; encourage healthy weight in all patients, regardless of weight status; and discuss possibility of weight gain, if appropriate, when patients initiate adjuvant therapy.

ASCO endorsed guidelines on survivorship care [67–69]

- **Colorectal cancer survivors:** Maintain an ideal body weight.
- **Breast cancer survivors:** Achieve and maintain a healthy weight; if overweight or obese, limit consumption of high-calorie foods and beverages and increase physical activity to promote and maintain weight loss.
- **Prostate cancer survivors:** Achieve and maintain a healthy weight by limiting consumption of high-calorie foods and beverages and increasing physical activity.

NCCN general principles of healthy lifestyles and physical activity for cancer survivors [70]

- Achieve and maintain a healthy body weight throughout life. Pay attention to calories consumed versus calories expended through diet and physical activity. Achieve and maintain a normal BMI and strive for metabolic health. Weigh yourself daily if goal is weight loss and if not, weigh yourself at least weekly to monitor weight.



Summary of WCRF/AICR ACS, ESPEN, ASCO, NCCN and ACSM recommendations for cancer survivors

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Be physically active

- Be physically active as part of everyday life – walk more and sit less.

ACS nutrition and physical activity guidelines for cancer survivors [63]

- Engage in regular physical activity.
- Avoid inactivity and return to normal daily activities as soon as possible following diagnosis.
- Aim to exercise at least 150 minutes per week.
- Include strength training exercises at least 2 days per week.

ESPEN guidelines on nutrition in cancer patients [65]

- Engage in regular physical activity. As soon as possible after finishing treatment, adopt a physically active lifestyle of at least 30 minutes (preferably 45–60 minutes) of moderate to vigorous physical activity on at least five days per week, including both endurance and strength exercise.

ASCO guidelines on survivorship care [66]

- Exercise regularly at all points from diagnosis to long-term follow-up.

ASCO endorsed guidelines on survivorship care [67–69]

- **Colorectal cancer survivors:** Engage in a physically active lifestyle.
- **Breast cancer survivors:** Engage in regular physical activity consistent with the ACS guidelines and specifically (a) avoid inactivity and return to normal daily activities as soon as possible after diagnosis; (b) aim for at least 150 minutes of moderate or

75 minutes of vigorous aerobic exercise per week; and (c) include strength training exercises at least two days per week.

- **Prostate cancer survivors:** Engage in at least 150 minutes per week of physical activity; this may include weight-bearing exercises.

NCCN general principles of healthy lifestyles and physical activity for cancer survivors [70]

- Physical activity and exercise recommendations should be tailored to individual survivors' abilities and preferences. Overall volume of weekly activity should be at least 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity or equivalent combination. Include two to three sessions per week of strength training that includes major muscle groups. Stretch major muscle groups at least two days per week. Engage in general physical activity daily (e.g., taking the stairs, parking in the back of parking lots). Physical activity includes exercise, daily routine activities and recreational activities. Avoid prolonged sedentary behavior (e.g., sitting for long periods).

ACSM exercise guidelines for cancer survivors [72]

Follow US physical activity guidelines for Americans (except in specific circumstances):

- **Aerobic:** engage in 150 minutes per week of moderate-intensity or 75 minutes per week of vigorous-intensity activity, or an equivalent combination.
- **Resistance:** engage in muscle-strengthening activities of at least moderate intensity at least two days per week for each major muscle group.
- **Flexibility:** stretch major muscle groups and tendons on days other activities are performed.

Summary of WCRF/AICR, ACS, ESPEN, ASCO, NCCN and ACSM recommendations for cancer survivors

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Eat a diet rich in wholegrains, vegetables, fruit and beans

- Make wholegrains, vegetables, fruit and pulses (legumes) such as beans and lentils a major part of your usual daily diet.

ACS nutrition and physical activity guidelines for cancer survivors [63]

- Achieve a dietary pattern that is high in vegetables, fruits and wholegrains.

ASCO guidelines on survivorship care [66]

- Prioritise healthy eating at all points from diagnosis to long-term follow-up.

ASCO endorsed guidelines on survivorship care [67–69]

- **Colorectal cancer survivors:** Eat a healthy diet.
- **Breast cancer survivors:** Achieve a dietary pattern that is high in vegetables, fruits, wholegrains and legumes; low in saturated fats; and limited in alcohol consumption.
- **Prostate cancer survivors:** Achieve a dietary pattern that is high in fruits and vegetables and wholegrains. Consume a diet emphasizing micronutrient-rich and phytochemical-rich vegetables and fruits, low amounts of saturated fat, at least 600 IU of vitamin D per day, and adequate, but not excessive, amounts of dietary sources of calcium (not to exceed 1,200 milligrams per day).

NCCN general principles of healthy lifestyles and physical activity for cancer survivors [70]

- Maintain a healthy diet high in vegetables, fruits and wholegrains.

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Limit consumption of 'fast foods' and other processed foods high in fat, starches or sugars

- Limiting these foods helps control calorie intake and maintain a healthy weight.

NCCN general principles of healthy lifestyles and physical activity for cancer survivors [70]

- Maintain a healthy diet low in sugars and fats.

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Limit consumption of red and processed meat

- Eat no more than moderate amounts of red meat, such as beef, pork and lamb. Eat little, if any, processed meat.

ACS nutrition and physical activity guidelines for cancer survivors [63]

- Limit consumption of processed meat and red meat.

NCCN general principles of healthy lifestyles and physical activity for cancer survivors [70]

- Limit red meat and avoid processed meat.



Summary of WCRF/AICR, ACS, ESPEN, ASCO, NCCN and ACSM recommendations for cancer survivors

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Limit consumption of sugar sweetened drinks

- Drink mostly water and unsweetened drinks.

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Do not use supplements for cancer prevention

- Aim to meet nutritional needs through diet alone.

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

Limit alcohol consumption

- For cancer prevention, it's best not to drink alcohol.

ACS nutrition and physical activity guidelines for cancer survivors [63]

- If consumed, limit consumption of alcoholic beverages.

ASCO endorsed guidelines on survivorship care [67–69]

- **Breast cancer survivors:** Limit alcohol consumption.
- **Prostate cancer survivors:** Avoid or limit alcohol consumption to no more than two drinks per day.

NCCN general principles of healthy lifestyles and physical activity for cancer survivors [70]

- Minimise alcohol intake. Limit intake to no more than one drink per day for a woman and two drinks per day for a man.

NCCN general principles of healthy lifestyles and physical activity for cancer survivors [70]

- Routine use of dietary supplements is not recommended for the purposes of cancer control. Nutrients should be obtained from food sources rather than relying on dietary supplements.

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

For mothers: breastfeed your baby, if you can

- Breastfeeding is good for both mother and baby.

WCRF/AICR Cancer Prevention Recommendations and public health and policy implications

After a cancer diagnosis: follow our Recommendations, if you can

- Check with your health professional what is right for you.

5. Research gaps on cancer survivors

The current recommendations for cancer survivors are based largely on extrapolation from the Cancer Prevention Recommendations (see [Recommendations and public health and policy implications](#)) with insufficient specific evidence for the role of these factors in survival directly, particularly during each of the specific phases of cancer survival.

The vast majority of research relating diet, nutrition, body fatness and physical activity aspects of cancer survivorship has been conducted in breast cancer survivors. However, even in this context, the evidence is insufficient to be considered strong ('probable' or 'convincing'; see [Judging the evidence](#)) and, consequently, specific recommendations cannot be justified. Carefully designed, adequately powered prospective cohort studies and RCTs are needed to address the most relevant issues and highest priorities for each phase of survival and across diverse cancer types (see [Future research directions](#)).

The identification of specific gaps in the evidence for diet, nutrition, body fatness and physical activity aspects of cancer survivors, at each phase of survivorship and for each type (and potentially sub-type) of cancer, is a priority. Another key research gap is lack of knowledge regarding the underlying biological mechanisms linking diet, nutrition body fatness and physical activity to cancer survival.

The exposure periods reported in many studies seem determined by availability of data rather than specific a priori hypotheses. There is a need for studies that are specifically designed to address pre-defined outcomes associated with accurate exposure assessments. For example, what is the effect of tobacco cessation after a diagnosis of cancer?

Only one longitudinal study has evaluated the association between smoking status before and after breast cancer diagnosis and examined the impact on survival [73]. Recommendations for lifestyle modification after a cancer diagnosis must be supported by evidence that those changes are associated with measurable benefits. Similarly, what is the effect of weight loss after a diagnosis? Do patients who were formerly obese experience similar attenuations of risk that are reported in former smokers for other chronic disease outcomes? RCTs of weight loss (diet plus physical activity) and physical activity alone on survival and related outcomes are also required as well as cohort studies of survivors to be followed longer term, especially for those cancers with long survival (breast, prostate) and cohorts (or pooled cohorts) large enough to look at associations with particular subsets of cancer survivors.

Cancer survivorship research would benefit from the development of a set of core outcomes and defined exposure periods so that compatibility of research could be maximised for pooled analyses. Given the vulnerability of the cancer survivor population, the lack of consensus regarding the direction of effect for some crucial lifestyle-related exposures and the potential for opposing impacts in sub-groups of survivors, rigorous assessment of observational evidence is essential before large-scale interventions can be justified for several factors.

The absence of survivorship data from various parts of the world, particularly from *low- and middle-income countries*, needs to be addressed to reduce death and disability in these areas. Continuous worldwide surveillance of cancer survival is an indispensable source of information for cancer patients and researchers and a stimulus for politicians to improve health policy and healthcare systems.

Translational work is an additional research gap as ultimately, research findings need to be translated into clinical practice.

The CUP plans to review the evidence for survivors of other cancers (including colorectal and prostate cancers) and the WCRF Network plans to continue funding research in this area (wcrf.org/int/research-we-fund/grant-programmes). Other funding bodies are actively encouraged to do so too.

6. Summary

With the global burden of cancer increasing, the need to clearly understand the role that diet, nutrition and physical activity play in cancer survival becomes ever more important. For this part of the Third Expert Report, a systematic review of the evidence linking diet, nutrition and physical activity to cancer outcomes was performed only for breast cancer, for which there was most evidence. In addition information was also sought for other cancers. Together these reviews showed persuasive evidence that nutritional factors, such as body fatness, as well as physical activity, reliably predict important outcomes for patients with cancer. However, as exemplified by the systematic review for breast cancer, the evidence that changing these factors after diagnosis will alter the clinical course of cancer is limited, particularly by the quality of published studies. The evidence on breast cancer survivors has a number of limitations, which are also likely to apply to the evidence for survivors of other cancers, including the lack of evidence from RCTs. Most published studies did not account for relevant factors such as cancer subtypes, type and intensity of treatment, and other illnesses. In addition, observational studies are challenging to interpret in relation to weight change in the dynamic context of active disease and treatment. However, the Panel judges that following the Cancer Prevention Recommendations is unlikely to be harmful to survivors who have completed treatment. Therefore, cancer survivors are encouraged, if appropriate to their circumstances and unless otherwise advised by a health professional, to follow the general advice for cancer prevention. Moving forward the focus should be to conduct studies that are specifically designed to address pre-defined outcomes associated with accurate exposure assessments and to develop a set of core outcomes and defined exposure periods so that compatibility of research could be maximised for pooled analyses.



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Abbreviations

ACS	American Cancer Society
ACSM	American College of Sports Medicine
AICR	American Institute for Cancer Research
ASCO	American Society of Clinical Oncology
BMI	Body mass index
CI	Confidence interval
CUP	Continuous Update Project
ESPEN	European Society for Clinical Nutrition and Metabolism
<i>n</i>	Number of cases
NCCN	National Comprehensive Cancer Network
NCD	Non-communicable disease
RCT	Randomised controlled trial
RR	Relative risk
SLR	Systematic literature review
WCRF	World Cancer Research Fund

Glossary

Cachexia

A loss of lean tissue mass, involving weight loss greater than 5% of body weight in 12 months or less in the presence of chronic illness or as a body mass index (BMI) lower than 20 kg/m².

Chronic

Describing a condition or disease that is persistent or long lasting

Cohort study

A study of a (usually large) group of people whose characteristics are recorded at recruitment (and sometimes later) and followed up for a period of time during which outcomes of interest are noted. Differences in the frequency of outcomes (such as disease) within the cohort are calculated in relation to different levels of exposure to factors of interest – for example, tobacco smoking, alcohol consumption, diet and exercise. Differences in the likelihood of a particular outcome are presented as the relative risk, comparing one level of exposure with another.

Lead time bias

Lead time is the time between the detection of a disease (for instance through screening) and its usual clinical presentation. Lead time bias is the spurious apparent improvement in outcome, for example, overall or disease-free survival from diagnosis, following, for example, introduction of screening, without any real change in the natural history of the condition.

Low- and middle-income countries

As defined by the World Bank, low-income countries are countries with an average annual gross national income per capita of US\$1,005 or less in 2016. Middle-income countries, are countries with an average annual gross national income per capita of between US\$1,006 and US\$12,235 in 2016. These terms are more precise than and used in preference to 'economically developing countries'.

Meta-analysis

The process of using statistical methods to combine the results of different studies.

Micronutrient

Vitamins and minerals present in foods and required in the diet for normal body function in small quantities conventionally of less than 1 gram per day.

Non-communicable diseases (NCDs)

Diseases which are not transmissible from person to person. The most common NCDs are cancer, cardiovascular disease, chronic respiratory diseases, and diabetes.

Pooled analysis

In epidemiology, a type of study in which original individual-level data from two or more original studies are obtained, combined and re-analysed.

Randomised controlled trial (RCT)

A study in which a comparison is made between one intervention (often a treatment or prevention strategy) and another (control). Sometimes the control group receives an inactive agent (a placebo). Groups are randomised to one intervention or the other, so that any difference in outcome between the two groups can be ascribed with confidence to the intervention. Sometimes, neither investigators nor subjects know to which intervention they have been randomised; this is called 'double-blinding'.

Sarcopenia

Loss of skeletal mass normally seen in association with ageing.

Survival rate

The percentage of people in a study or treatment group who are still alive for a certain period of time after they were diagnosed with or started treatment for a disease.

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Our Cancer Prevention Recommendations

Be a healthy weight

Keep your weight within the healthy range and avoid weight gain in adult life

Be physically active

Be physically active as part of everyday life – walk more and sit less

Eat a diet rich in wholegrains, vegetables, fruit and beans

Make wholegrains, vegetables, fruit, and pulses (legumes) such as beans and lentils a major part of your usual daily diet

Limit consumption of ‘fast foods’ and other processed foods high in fat, starches or sugars

Limiting these foods helps control calorie intake and maintain a healthy weight

Limit consumption of red and processed meat

Eat no more than moderate amounts of red meat, such as beef, pork and lamb.
Eat little, if any, processed meat

Limit consumption of sugar sweetened drinks

Drink mostly water and unsweetened drinks

Limit alcohol consumption

For cancer prevention, it’s best not to drink alcohol

Do not use supplements for cancer prevention

Aim to meet nutritional needs through diet alone

For mothers: breastfeed your baby, if you can

Breastfeeding is good for both mother and baby

After a cancer diagnosis: follow our Recommendations, if you can

Check with your health professional what is right for you

Not smoking and avoiding other exposure to tobacco and excess sun are also important in reducing cancer risk.

Following these Recommendations is likely to reduce intakes of salt, saturated and trans fats, which together will help prevent other non-communicable diseases.

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