The societal costs and benefits of physical activity for cancer patients

Study report for AKTIV Against Cancer

oslo economics

AKTIV mot kreft

Bristol-Myers Squibb

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AKTIV Against Cancer

AKTIV Against Cancer is a private foundation which works to incorporate exercise in cancer treatment.

We establish Cancer Fitness Centres at hospitals in Norway, support research on the effect of exercise on cancer, and educate AKTIV instructors in collaboration with the Norwegian School of Sport Sciences and Oslo University Hospital.

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AKTIV mot kreft

Summary

Research into exercise and cancer is still at an early stage, but studies so far indicate that exercise for cancer patients and survivors can improve treatment and reduce side-effects, and thereby provide better health and quality of life, reduce the use of health services, and allow employed people to return to work more quickly. A Cancer Fitness Centre offers tailored exercise in hospitals, while AKTIV instructors provide exercise in the home community. If one in three cancer patients takes advantage of these, the annual monetary societal value is put at NOK 170 million (-NOK 36 to +NOK 362 million). In addition, there are non-monetised benefits such as reassurance and coping.

The disease burden of cancer is increasing

32 827 people were diagnosed with cancer in Norway in 2016
This figure is expected to increase by 40% within 2034

Over 30 000 people in Norway are diagnosed with cancer every year, and more than 250 000 are cancer survivors. Cancer cases are expected to increase by 40% over the next 15 years.

In addition to the burden on those directly affected – patients and their next-of-kin – cancer represents a considerable economic burden. The estimated annual health-care cost of cancer-related disease is NOK 17.5 billion. Higher spending on treatment, and growing pressure on the health service in general, call for new ways of thinking about cancer treatment.

Cancer imposes a considerable burden

A cancer diagnosis and subsequent treatment places a considerable burden on the body – both physically and mentally.

Treatment may damage not only cancer cells but also healthy cells in the body. It may accelerate the natural ageing process, and many patients experience reduced physical function and changes in body composition. Many patients also experience uncertainty and anxiety. Cancer treatment increases the risk of cardiovascular disease, cancer recurrence and premature death.

New national strategy – *Live with cancer*

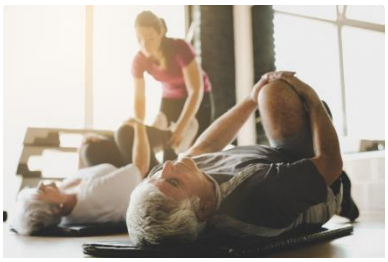
Norway's cancer strategy for 2018-22 aims to improve care for the disease while also facing the challenges posed by a rising burden of illness and the consequent increasing requirements for capacity, expertise and effective care.

Exercise is identified as an intervention with a positive effect during and after cancer treatment, which improves physical health, coping and quality of life.

One goal of the strategy is to develop guidance for physical activity and exercise during and after cancer treatment, tailored to the individual patient, and incorporate recommendations on exercise as part of the treatment regime.

Exercise as part of cancer treatment

Exercise can counter the accelerated ageing process resulting from cancer treatment. Patients who work out cope better with the treatment, both physically and mentally. This also helps to reduce side-effects (such as fatigue and reduced balance) and can reduce the risk of late-effects.



Exercising in a Cancer Fitness Centre

A Cancer Fitness Centre is a hospital facility which offers tailored group and individual exercise programmes for cancer patients during and after treatment. Its staff have special expertise in exercise and cancer. The Cancer Fitness Centre is a low-threshold provision and is perceived by users as a very important part of their treatment. They say it provides reassurance, integrated treatment, visibility and coping, as well as solidarity with others in the same position.

Exercising for one year in a Cancer Fitness Centre costs about NOK 21 800 (NOK 15 300-28 400) per user. The guidance also provides reassurance and motivation to exercise on one's own.

Exercising with an AKTIV instructor

Exercising with an AKTIV instructor is a provision for people who either suspect they have cancer on medical grounds or have completed cancer treatment. The instructors have special expertise in exercise and cancer.

The aim is to have AKTIV instructors available nationwide as a local provision for people who have completed cancer treatment or have no access to a Cancer Fitness Centre.

The total cost of exercising in a Cancer Fitness Centre and with an AKTIV instructor is put at NOK 27 000 (NOK 17 300-38 000) per user.

Tailored exercise for cancer patients boosts health and quality of life

Research shows that tailored exercise for cancer patients and survivors yields better physical and mental health. Exercising during and after treatment helps, for example, to enhance muscle strength, improve bodily function and balance, and reduce the risk of developing other chronic illnesses such as cardiovascular disease, diabetes and osteoporosis. Research also shows that exercising during and after treatment boosts quality of life.

Improved health and quality of life affect the use of health services and labour market participation. Recent research suggests that cancer patients who exercise use health services less and return to work earlier compared with those who do not exercise.

Exercise has societal value

Compared with the cost of tailored exercise provision (NOK 27 000 per user), represented here by the Cancer Fitness Centre and AKTIV instructors, the analyses suggest an average societal effect of NOK 42 500 per cancer patient who receives tailored exercise provision and who acquires the knowledge and motivation to pursue their own appropriate exercise regime.

The net benefit of tailored exercise (societal benefit less societal cost) is NOK 15 500 per user.

The overall net societal benefit of the 1 750 current users of Cancer Fitness Centres is estimated at NOK 27.1 million. If one in three cancer patients had utilised this provision, the net benefit amounts to NOK 170 million.

Methodology: *On behalf of AKTIV Against Cancer, Oslo Economics has analysed the value of exercise for cancer patients. This analysis is based on Norwegian and international research, official guides for conducting economic analyses, interviews with key stakeholders (specialists, researchers, Cancer Fitness Centre staff and users, and AKTIV instructors), available statistics and surveys of Cancer Fitness Centre staff and AKTIV instructors. The work has been financed by Bristol-Myers Squibb. Many thanks to all contributors.*

Terms

AKTIV instructor: A fitness instructor who has special expertise in working out with people who are undergoing or have undergone treatment for cancer. They have taken the course on exercise and cancer at the Norwegian School of Sport Sciences (NIH), which has been developed there in cooperation with Oslo University Hospital and AKTIV Against Cancer. This course is structured both as a part-time programme for physiotherapists, sports educators and personal trainers, and as an optional subject for BSc students at the NIH.

Physical activity and exercise: Physical activity means all body movements which result from muscle work and which lead to increased energy consumption (Shephard & Balady, 1999). Exercise applies to physical activity which is planned, structured and repeated regularly, and which is intended to improve or maintain physical conditions, health and sporting performance (Norwegian Directorate of Health, 2018).

Costs: Means the consumption of resources measured in monetary terms. A cost is not the same as an expense or a payment.

Quality adjusted life years: Number of years of life adjusted for their quality. A quality adjusted life year corresponds to one year with perfect health.

Observational studies: Research studies where the researcher observes what has happened (retrospectively) or what is happening (prospectively) during a defined period with a delimited and defined study population. Observational studies can incorporate a control group, but this will not be chosen on a randomised basis and is therefore not directly comparable with the intervention group.

Cancer Fitness Centre: A facility at a hospital which offers tailored group and individual exercise programmes for cancer patients during and after treatment. The staff have special expertise in exercise and cancer, and several of them are qualified AKTIV instructors.

Societal benefit: A concept used in socioeconomic analyses which specifies the value of an intervention to society. Net benefit is the difference between the societal benefit of an intervention and its cost. An intervention whose societal benefit exceeds its cost has a positive net benefit and is accordingly defined as “cost-effective”. If some of the effects are not monetised, all monetised and non-monetised benefits and costs are compared.

1. The need to identify the value of exercise for cancer patients

Patients being treated for cancer experience reduced physical and mental health, side effects and increased risk for several other chronic illnesses. Since the number of people who have had cancer treatment is expected to rise, cost-effective interventions which can help to reduce the risk of late effects following such treatment need to be identified.

Exercise for cancer patients can boost health and quality of life. AKTIV Against Cancer is a private foundation which works to incorporate physical activity and exercise as part of cancer treatment. In this report, Oslo Economics outlines the societal value (costs and benefits) of facilitating exercise for cancer patients and survivors.

1.1 Purpose of the analysis

As part of AKTIV Against Cancer's work, the societal value (costs and benefits) of tailored exercise for cancer patients needs to be identified. The foundation has established Cancer Fitness Centres for patients at Norwegian hospitals, as well as a provision with AKTIV instructors who have expertise on exercise and cancer. The purpose of the analysis is to identify the costs associated with the Cancer Fitness Centres and AKTIV instructors, and the societal value of these interventions.

1.2 AKTIV Against Cancer

AKTIV Against Cancer is a private foundation established by Grete Waitz and Helle Aanesen in 2007. It works to get exercise incorporated in cancer treatment, both while this is under way and afterwards. The goal is that such exercise will help to reduce side effects and the risk of recurrence, and increase stamina, strength, vigour, the feeling of coping and quality of life.

AKTIV Against Cancer established the first of its Cancer Fitness Centres in 2008, after Oslo's Ullevål Hospital had opened the very first such facility in its new cancer centre in 2006. These facilities provide cancer patients during and after their treatment with expert guidance from fitness specialists in a friendly and pleasant environment. Sixteen hospitals in Norway have Cancer Fitness Centres today.

In addition to the Cancer Fitness Centres, AKTIV Against Cancer has established an AKTIV instructor course in collaboration with the Norwegian School of Sport Sciences and Oslo University Hospital. This is structured both as a part-time programme for physiotherapists, sports educators and personal trainers, and as an optional subject for BSc students at the School of Sport Sciences. Its graduates are certified as AKTIV instructors, who have special expertise in providing personal exercise guidance to people who are undergoing or have undergone cancer treatment. The goal is that such instructors will be available nationwide, so that as many cancer patients as possible can continue with guided exercise after their treatment is over. This provision can also be used during treatment by patients who live some distance from their hospital.

1.3 Data and methodology

The analysis has been carried out based on Norwegian and international research, official analysis parameters, interviews with key stakeholders (professionals, researchers, Cancer Fitness Centre staff and users, and AKTIV instructors), available statistics and surveys of Cancer Fitness Centre staff and AKTIV instructors. Work on the study was done in April-July 2018. Read more about the methodology and data sources in the appendix.

Name: Helle Aanesen

Position: General manager, AKTIV Against Cancer

What is your background?

I'm educated as a business economist and have previously worked on sales, marketing and project management for employers such as the Lillehammer Olympic Organising Committee (LOOC), David-Andersen, the Norwegian Ski Association, Innesvingen Golf and Oslo Spektrum. I'm curious and interested in most kinds of sport and have always been fairly active.

Why is exercise important for cancer patients?

First and foremost, exercise is important for everyone! There is finally sufficient research-based evidence available to show that exercise can reduce the risk of developing certain types of cancer, reduce suffering during cancer treatment and play a key role in post-treatment rehabilitation. Exercise contributes to maintaining (as much as possible) the body's physical condition during treatment, which means that people recover faster. Exercise can also be important during palliative care, since a connection has been observed between such activity and an improved quality of life. Exercise is also important for mental health, and we see in the Cancer Fitness Centres that the social aspect of exercising with others in the same position is also important. Exercise helps you to cope as well as possible during a challenging period of your life.

Why did you and Grete Waitz start AKTIV Against Cancer?

Actually, it was a coincidence. When I was going to sign up for the New York City Marathon in 2007, I discovered how incredibly good the Americans are at combining major sporting events with collecting large sums for noble causes. It occurred to me that an opportunity existed to achieve the same in Norway as well. It was very natural then to think of Grete as the right partner, not only because of the New York City Marathon but also because she had been diagnosed with cancer the year before. With her on board, AKTIV Against Cancer attracted the necessary attention and credibility. We'd never have been where we are today without her.

How do you work in AKTIV Against Cancer?

There are five of us, doing the equivalent of 4.6 full-time jobs, and we work purposefully to raise funds for and spread information about our three core activities – the Cancer Fitness Centres, education of AKTIV instructors and research. We collaborate closely with the business community, sports events and other foundations. Put briefly, we usually say that we "raise money from exercise for healthy people and apply it to exercise for cancer patients."

Why are the Cancer Fitness Centres and AKTIV instructors important?

Since exercise is significant before, during and after cancer treatment, it's important to have provisions tailored for patients in all these treatment phases. The Cancer Fitness Centre offers exercise tailored to your own diagnosis and daily condition during and immediately after treatment, in secure, attractive surroundings with qualified guidance and alongside others in similar circumstances. The feedback we get from users is overwhelming. When patients have completed their hospital treatment, it's important that this expertise is found close to where they live. This is why we've established the AKTIV instructor course, so that physiotherapists, sports educators and personal trainers can acquire supplementary expertise in exercise for post-treatment cancer patients. We all have different preferences for where we exercise, so our goal is that an AKTIV instructor will be available everywhere where exercise is offered.

How do you envisage continuing to develop AKTIV Against Cancer over the next few years?

We want exercise incorporated as a natural part of cancer treatment in Norway – and other countries. We'll contribute to that by establishing Cancer Fitness Centres in the country's hospitals and by continuing to educate AKTIV instructors. Further research is important, because we still know far too little about what effect different kinds of exercise have on which cancer cells. We're keen to be a key player i this area during coming years, and therefore have a dream of establishing a big centre of expertise on exercise and cancer in Oslo.

Photo: Nils Petter Dahle

2. Cancer presents an increasing disease burden

More than 30 000 people get cancer in Norway annually, and that number is expected to rise by 40% over the next 15 years. Cancer imposes a big burden on patients, their next-of-kin and the health service. Modern treatment methods may damage not only cancer cells but also healthy cells in the body. They can speed up the natural ageing process, and a lot of patients experience reduced physical function. Many also experience reduced personal control, uncertainty and anxiety. Cancer treatment can cause late effects and increase the risk of cardiovascular diseases, infection and premature death.

Just over 250 000 people in Norway live with cancer today. The risk of getting the disease rises with age. Over 30 000 new cases are diagnosed annually (Table 2-1), and roughly one Norwegian in three will become patients before they are 75. The commonest forms are prostrate, breast, lung and bowel cancer (Cancer Registry of Norway, 2017).

Table 2-1: New cancer cases in Norway in 2016, by type

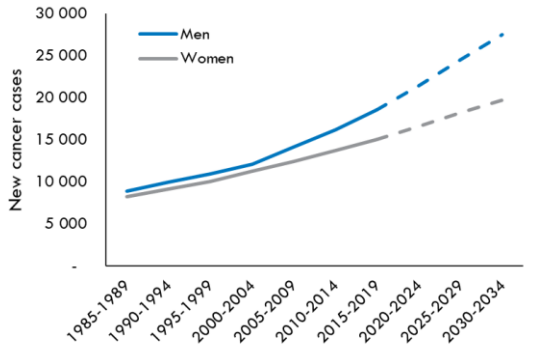
Cancer	New cases, both genders (2016)
Prostate	5 118
Breast	3 371
Lung	3 080
Bowel	3 003
Melanoma	2 114
Other	16 141
Total	**32 827**

Source: Cancer Registry of Norway, 2016

New cancer cases are expected to continue rising in coming years. Forecasts indicate more than 40 000 new cases annually in 2034 (NORDCAN, 2017).

More people are surviving cancer. Excluding deaths from other causes, 72% of cancer patients now live for five years after diagnosis. That represents an increase of three percentage points compared with the figures for the previous five-year period (2007-2011) (NORDCAN, 2017).

Figure 2-1: New cancer cases per year



Source: NORDCAN, 2017

2.1 Cancer – a big strain on the patient and their next-of-kin

Being diagnosed with cancer usually puts a big strain on both the patient and their next-of-kin – diagnosis and subsequent treatment can affect the physical and mental health of those who get cancer or have survived it.

Many patients and their next-of-kin experience a cancer diagnosis as stressful. How a person deals with their diagnosis depends on the cancer type, its prevalence, prognosis and the type of treatment planned, and their circumstances and age. Many people experience uncertainty, agitation and anxiety while awaiting a diagnosis and clarification of their treatment. Patients also lose a degree of control over their daily lives, since they cannot know everything about the optimal cancer treatment.

A cancer diagnosis is followed by a treatment pathway which comprises various components (surgery, radiation, chemotherapy, medication and so forth). Each can be very demanding for the patient's physical and mental function. Treatment times can vary from weeks and months to several years (as with prostate, breast and bowel cancer). Acute side effects can be experienced during the treatment, such as nausea, reduced immune defence, hair loss and changes to mucous membranes. Side effects related to late effects include weakened musculature, poorer balance, weight changes, fatigue and problems with concentration (Norwegian Cancer Society, 2018; Schmitz et al, 2010). The patient's physical and mental condition will vary, and depends on the extent of the disease, the type of treatment provided, age, and their physical and mental function prior to treatment.

The various types of cancer treatment may be associated with short- or long-term side effects. Surgical interventions and radiation therapy can have such effects as tiredness, stiffness, pain or other problems which make it difficult to be physically active. Chemotherapy can also cause considerable fatigue, muscle weakening and occasionally personality changes with a consequent reduction in drive. Hormone therapy can have many similar side effects and reduce muscle mass in combination with stiffness in muscles and joints.

After cancer treatment has ended, the patient has an increased risk of late effects and a number of other chronic conditions. Somebody who has had cancer may often face some risk of recurrence. Having had cancer often means an increased vulnerability to developing a new cancer, either in the same organ or elsewhere in the body. The risk of recurrence depends in part on the type of cancer involved, characteristics of the original tumour, and what treatment has been given. Patient characteristics (such as family disposition) and lifestyle in relation to risk factors (such as smoking for lung cancer) are also of significance for getting cancer again. Improved knowledge increases opportunities for providing tailored lifestyle advice and better monitoring. Exercise affects a number of biological mechanisms as well as physical and mental function, which in part enhance muscle strength and counteract its loss, improve heart/lung and intestinal function, maintain bone mass and prevent weight gain.

As early as the 1980s and 1990s, studies were being pursued into how extensive cancer treatment could affect later illness and survival (Fosså et al, 1991). It is now known that various types of chemotherapy as well as newer biological medications can affect the cardiovascular system's function in various ways (American Cancer Society, 2015). Cancer survivors are at increased risk of cardiovascular disease compared with people who have not been treated for cancer (Kiserud et al, 2010), both directly through damage to the heart induced by radiation therapy and chemotherapy (Scott et al, 2018) and indirectly through a reduced level of activity, for example, and weight gain. This has been described in the literature as the "multiple-hit" theory (Jones et al, 2007) – in other words, the cancer treatment can accelerate the ageing process at the same time as existing risk factors for cardiovascular disease worsen over the course of the treatment.

Furthermore, prospective observational studies have compared the occurrence of serious health-related events in childhood cancer survivors with their siblings. The results show that the risk of further serious health-related events tripled among these cases (Schaapveld et al, 2015). Studies have also shown that cancer survivors suffer more frequently from psychosocial complaints such as fatigue, anxiety and depression compared with a normal population (Clarke et al, 2006).

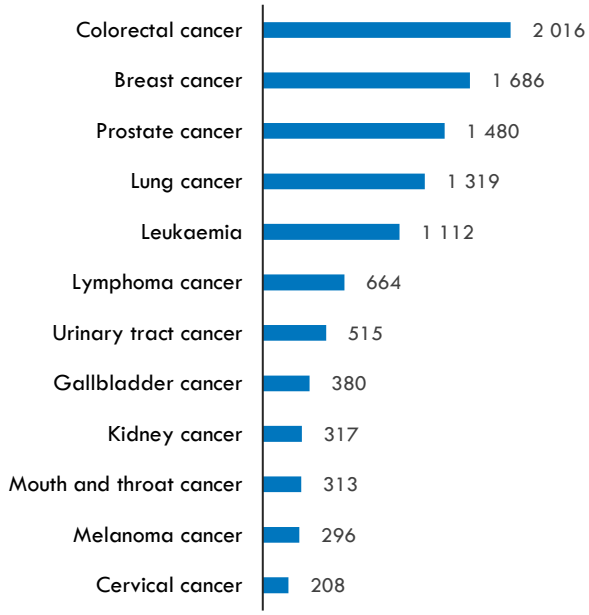
In addition to an increase in the general risk of illness (which could be related to both pre-cancer ill health and the actual treatment), recent studies suggest that certain types of cancer treatment can speed up the ageing process and thereby shorten survival. In one study, childhood cancer survivors had a 30% lower life expectancy than the general population (Cupit-Link et al, 2017). In line with other studies, it also found that various types of cancer treatment are associated with increased risk of osteoporosis, nerve damage, skin thinning, infection, hearing loss, muscle wastage, kidney and liver disease, cardiovascular disease, infertility and dementia.

Getting cancer and undergoing treatment may have side effects which could cause considerable suffering in the short and long terms for both the patient and those around them. The number of people living with and surviving cancer is rising with the growth in those getting the disease and surviving it. As a result, the need to identify cost-effective interventions which can help reduce the risk of late effects after cancer treatment is increasing.

2.2 Costs of cancer

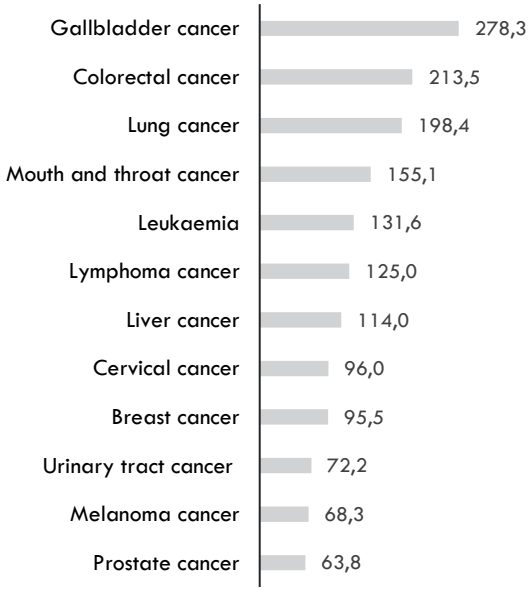
The annual cost of cancer-related illness for health and social care services is put at NOK 17.5 billion (Oslo Economics, 2016). The three most resource-intensive cancers in 2014 were colorectal (NOK 2 billion), breast (NOK 1.7 billion) and prostate (NOK 1.5 billion). Costs per patient are highest for pancreatic, colorectal and lung cancers in both primary and specialist health services. The cost per pancreatic cancer patient in the specialist health service, for example, was NOK 278 300 (Figure 2-3).

Figure 2-2: Overall health service costs for treating various cancers, NOK million, 2014-costs



Source: Oslo Economics, 2016. **The figures are based on registration data from the Norwegian Health Economics Administration (Helfo), the Norwegian Patient Registry and the Norwegian Prescription Database, and include costs related to the primary and specialist health services and pharmaceuticals supplied by pharmacies. Nursing and care services are not included.**

Figure 2-3: Average cost per patient in contact with the specialist health service in 2014 by various cancers, NOK 1 000



Source: Oslo Economics, 2016

2.3 Global health challenges and national cancer strategy

Non-infectious illnesses, such as cardiovascular disease, cancer, diabetes and chronic pulmonary conditions, have been declared the pandemic of our day (World Health Organisation, 2010), and are viewed globally as the commonest cause of death (World Health Organisation, 2017). Such conditions are largely attributable to behavioural factors, such as physical inactivity, unhealthy diet and the use of tobacco and alcohol. These increase the risk of excess weight, high blood pressure and cholesterol, and of serious illnesses in the longer term.

Physical inactivity is a growing problem globally. To reverse the negative trend, a number of global and national players have launched strategies to boost the level of exercise. The WHO, for example, has initiated a global action plan (World Health Organisation, 2018) to help countries scale up measures for promoting exercise.

Norway aims to meet the UN's sustainability goal of cutting premature death from non-infectious disease by a third up to 2030. In its national cancer strategy for 2018-22 (Ministry of Health and Care Services, 2018), the ministry specifies that this will be achieved through prevention and treatment, and by promoting mental health and quality of life. The strategy aims to improve Norwegian cancer care even further, while meeting the challenges posed by a rising sickness burden and the consequent increase in demand for capacity, expertise and an efficient patient pathway.

Figure 2-4: Targets in the national cancer strategy

1. More user-oriented cancer care
2. Norway will be a leader for good patient care pathways
3. Norway will be a leader for cancer prevention
4. More patients will survive and live longer with cancer
5. Best possible quality of life for cancer patients and their next-of-kin

Source: Ministry of Health and Care Services, 2018

The 2018-22 cancer strategy is a continuation of its 2013-17 predecessor and is based on the overall health policy goal of creating "the patient's health

service". It incorporates a number of targets which aim to improve treatment provision for and follow-up of cancer patients (Figure 2-4). It also highlights the importance of prevention, with the emphasis on established risk factors for cancer – including tobacco, alcohol, excess weight, unhealthy diet and physical inactivity.

The strategy emphasises the importance of good post-treatment cancer care. One target is to provide cancer patients with better follow-up by their local authority following treatment in the specialist health service. This will be implemented through a home patient pathway, where patient needs in the transition from hospital to local authority will be outlined. Furthermore, the strategy notes that greater knowledge is required about latent effects of the illness and treatment.

The quality of Norway's cancer care is good. Primary and secondary prevention occupies a key place in the work, and exercise is one of a number of interventions mentioned in this context.

Name: Bent Høie

Position: Minister of Health, Norway

What is your background?

I have been Norway's Minister of Health for almost five years. Before that, I was a member of the Storting (parliament) from 1997 to 2013 and chaired its standing committee on health and care services for the last four years.

Why is exercise important for cancer patients?

There are several reasons for why exercise is important. Exercise helps to reduce side effects such as nausea, fatigue and insomnia. It also contributes to increased endurance, muscle strength and vigour. In sum, this helps the patient to cope better with their illness and increases their quality of life.

The government's cancer strategy for 2018-22 emphasises the importance of exercise for cancer patients. Documentation showing that physical activity and systematic exercise tailored to the individual patient has positive effects during and after cancer treatment is steadily improving.

What do you think about the work of AKTIV Against Cancer?

I think they do a great and important job. They took the initiative on establishing exercise for cancer patients as a scientific discipline in Norway. They have made a considerable contribution to measures which promote exercise among cancer patients, in part through establishing the Cancer Fitness Centres at hospitals and educating AKTIV instructors. It is also very positive that the foundation supports research in Norway, and internationally, about exercise for cancer patients.

Do you think it's important to facilitate exercise for cancer patients?

Yes. It's also important to ensure that health personnel are conscious about the value of exercise for these patients. Cancer treatment or living with this disease can increase fatigue and other problems. Many people may feel uncertain about what activities are appropriate but would likely want to exercise in a reassuring setting with good guidance. In the national cancer strategy, we say that we'll prepare guidance for physical activity and exercise during and after cancer treatment, tailored to each patient, and incorporate recommendations on exercise in the treatment regime.

How will tomorrow's health service incorporate exercise in treatment provision for cancer patients?

Exercise should be included in the treatment regimens to a greater extent. It's very positive that AKTIV Against Cancer supports research about the effects of exercise for cancer patients both in Norway and internationally. These research projects help to provide us with important new knowledge about the effects of physical exercise and about what types of exercise that may have the best possible effect on different cancer types. Some studies show that certain types of exercise can have a negative effect for some cancer patients. Knowledge of such relations is important for patients and health personnel and will be an important part of the guidelines to be prepared.

Any other comments?

AKTIV Against Cancer is an important initiator of new interventions, and an important collaborator for the health care service. I'd like to thank them for their important commitment, and hope for continued good collaboration with the government and the health care service in the coming years.

Photo: Bjørn Stuedal

3. Exercise as a component in cancer treatment

That exercise has a positive effect on physical function and general health is well established today. The effect of exercise on cancer patients is not as firmly identified, but existing research indicates that it can have major health benefits for patients. AKTIV Against Cancer is working to strengthen the knowledge base and to get exercise and exercise accepted as part of the treatment procedure for cancer patients.

3.1 Exercise gives health benefits

The significance of exercise for good health was already noted by Hippocrates:

> *"If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health."*
>
> **Hippocrates (460-377 BC)**

Bernardino Ramazzini, the renowned specialist in occupational medicine, observed 300 years ago that tailors who spent much time seated were paler and often sicker than messengers. A London Transport workers study (Morris et al, 1953) in 1953 showed that the incidence of cardiovascular disease was substantially higher among bus drivers than conductors. While both groups had roughly the same occupational background, social status and exposures at work, the latter were considerably more physically active in their job since they had to go up and down the stairs in doubledeckers.

A number of studies subsequently observed a positive and preventive effect of exercise on the risk for and optimal treatment of cardiovascular disease, diabetes, osteoporosis, muscle conditions and mental disorders. Since then, it has been well established that physical exercise is positive for physical and mental health. The most important effects of regular exercise are summarised in Figure 3-1. In addition to these general effects, it has also been demonstrated that regular exercise can also help to prevent and counter such conditions as cardiovascular disease and diabetes. Exercise is also important for preventing and countering excess weight and mental problems (World Health Organisation, 2018).

Based on the convincing documentation that exercise has health benefits, the health directorate has prepared recommendations on exercise (Norwegian Directorate of Health, 2014). Adults should spend at least 150 minutes a week in moderate activity (in other words, which causes them to breath faster than usual). Children should spend at least 60 minutes a day in such activity.

Exercise also influences many other significant biological processes. That includes a positive effect on the levels of several important hormones (such as oestrogen and insulin), which can in turn affect cancer development. It is well documented that high levels of exercise reduce the overall oestrogen level which women are exposed to during their lives, and anti-oestrogen medications play a key part in treating breast cancer. Exercise enhances insulin sensitivity and glucose take-up, and can make blood sugar levels more stable. Many cancer survivors have complaints related to the gastrointestinal system, with both constipation and/or diarrhoea. Exercise optimises bowel transit time for food, and helps to normalise digestion and ensure favourable levels of bile salts. Cancer treatments such as chemotherapy or hormone therapy can lead to osteoporosis, which exercise counteracts and can thereby help to prevent broken bones.

Exercise can also reduce and prevent anxiety and depression, enhance coping and combat fatigue. Exercising in groups can also help to maintain a social network and solidarity with others in a similar position. Patients who begin exercise organised by the treatment facility are often happy and say they should have started with this much earlier. Exercise therefore reduces physical and mental side effects of both the cancer and its treatment and can also improve physical and mental function in cancer patients and survivors.

The significance of physical activity and exercise related to cancer risk was initially identified as an issue in a couple of studies during the 1980s, but first became an issue in relation to cancer risk and treatment in the 1990s (Courneya & Friedenreich, 1997; Thune, 1998). A number of studies have since been published, and the need for a scientifically detailed and extensive review of this work has been met particularly by the World Cancer Research Fund (WCRF). Its latest report was published in 2018 as *Diet, Nutrition, Exercise and Continuous*

Update Project findings and Reports (World Cancer Research Fund, 2018).

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

Recommendation for cancer prevention from the WCRF. Source: World Cancer Research Fund, 2018

These reports are produced with support from the World Health Organisation), the American Society of Clinical Oncology and a number of other international organisations. Responsibility for them rests with a number of the world's leading cancer researchers, who review all available scientific studies and conduct detailed evaluations and analyses. Based on this continuous work, these specialists have published some of the most comprehensive reports available on the significance of exercise, for example, for the risk of developing a number of different cancers.

In their latest reports, they have also looked at the significance of exercise for specific cancer survival (World Cancer Research Fund International, 2018). These studies suggest that exercise can reduce the risk of developing the commonest cancers, such as bowel, prostate and breast. In addition, more recent studies suggest that it can hinder recurrence of both bowel and breast cancer (Friedenreich et al, 2016). Meta-analyses suggest that exercise can reduce the risk of developing the primary disease for 13 of 26 cancers (Moore et al, 2016), but more work is required to establish a solid knowledge base.

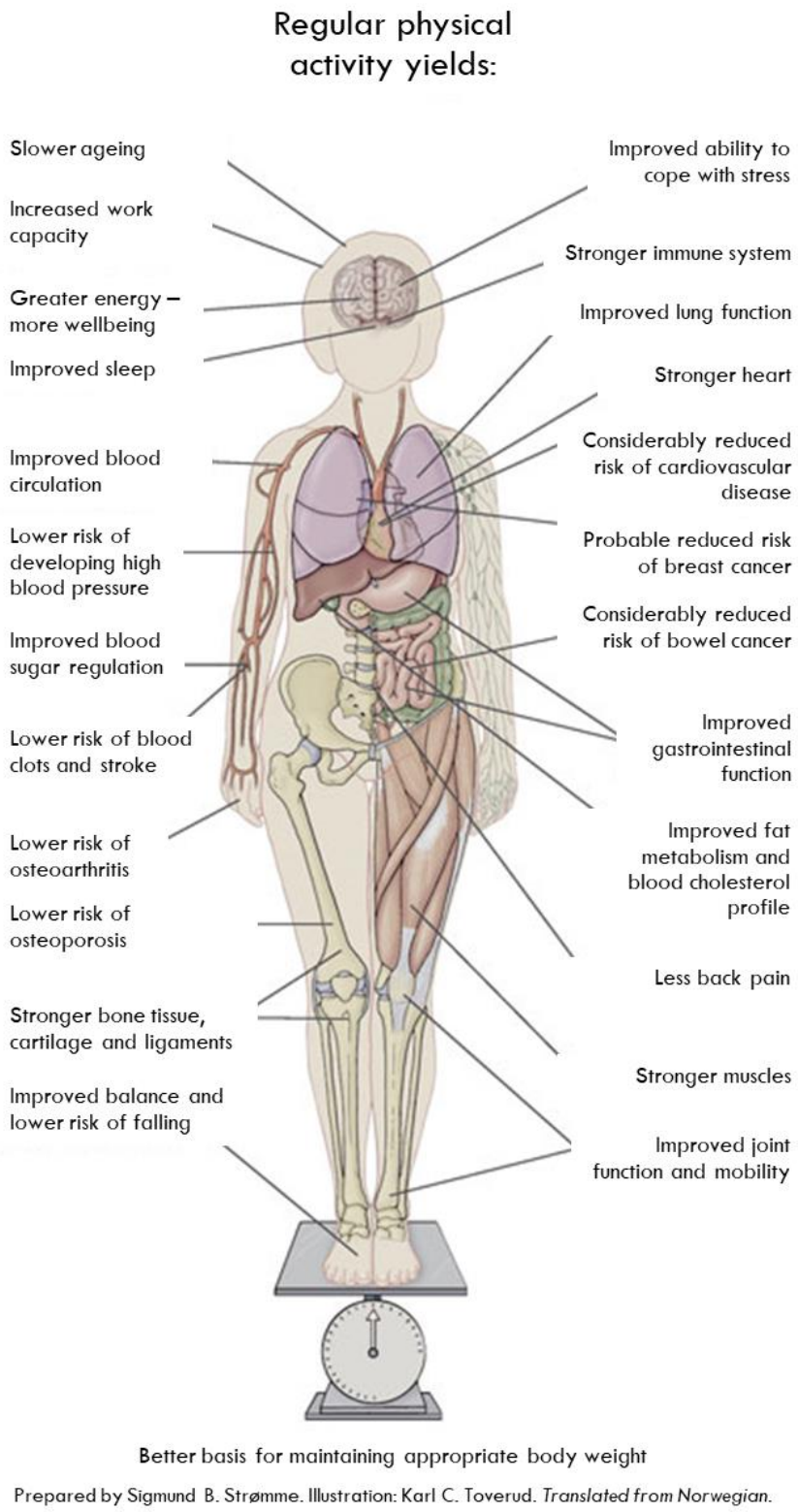
Methodological challenges

When reviewing studies which investigate the effects of exercise on health, it is important to be aware of some methodological challenges which are significant for interpreting the results. This refers particularly to reverse causation and selection bias.

Reverse causation means that a relationship exists between exercise and physical health, but that the actual *causal relationship* is uncertain. When observational studies show that people who exercise are healthier, we do not know for certain whether this is because exercise confers improved health or whether those with better health also exercise more. If this is the case, observational studies cannot revel the effect of exercise.

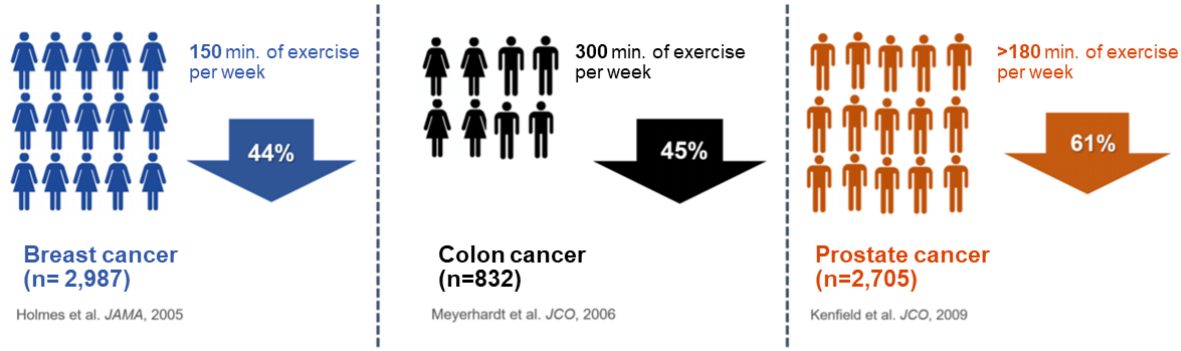
Selection bias is a phenomenon which occurs if research objects themselves can indicate their interest in participating in research studies. It is not unreasonable to assume that people with an interest in exercise are more likely to want to take part in studies looking at the effects of exercise than those who are uninterested in it. The former are perhaps more physically active or in better condition than people who do not choose to participate in such studies, which weakens the transferability of the results from the study participants to the population at large. Those who take part are not a representative sample of the population, and the findings cannot necessarily be generalised.

Figure 3-1: The effects of regular exercise



Source: Sigmund B Strømme, accessible at Helsenorge.no (Helsenorge.no, 2014). Adapted from the original Norwegian version.

Figure 3-2: Exercise and reduced risk of cancer recurrence



Source: AKTIV Against Cancer

3.2 Exercise for cancer patients

Since all types of medical treatment have become more specialised and demanding, with substantially improved survival rates for several cancers, an awareness has grown that modern cancer treatment can result in serious late effects (described in chapter 2).

"Bathing beaches" where people could cleanse themselves and revel in nature existed as far back as the Roman empire. Special health resorts emerged in parts of Europe (such as Germany) to provide cancer patients, among others, with extra care, where exercise played a natural and important role. In addition to small research reports from European health resorts, it was observed in the late 1980s that exercise could affect functional capacity, body composition and patient-reported nausea among breast cancer patients on chemotherapy (Winningham et al, 1989; Winningham & MacVicar, 1988). The rationale for this study was that treatment reduced physical function, which in turn weakened the cardiovascular system. It showed that breast cancer patients who were most physically active had a smaller decline in physical function as well as reduced nausea and fatigue (Winningham et al, 1989; Winningham & MacVicar, 1988). This study was very controversial in its day, since contemporary guidelines recommended maximum peace and quiet for patients in order to "conserve their energy".

Since this breast cancer study, the research field has grown and attracted increasing interest (Thune, 1998), and many countries and organisations have developed guidelines for exercising with cancer (Segal et al, 2017; Schmitz et al, 2010; Jones & Alfano, 2013). Courneya and colleagues, for example, have observed in a number of studies that exercise improves quality of life as well as physical and mental function for a number of cancers (Courneya & Friedenreich, 1997).

As a research field, *exercise and cancer* (also known as exercise oncology) benefits in addition from studies which investigate the significance of exercise for other chronic illnesses, such as cardiovascular disease and diabetes. This is because the biological mechanisms which lead to cardiovascular disease, for example, also increase the risk of and can affect treatment outcomes for cancers. (Jones & Alfano, 2013; Jones et al, 2008).

National and international research teams

Many strong teams researching the relationship between exercise and longer-term outcomes for cancer patients have emerged around the world with time. One of the first and largest was Kerry Courneya in Edmonton, Canada, and Anne McTiernan at the Fred Hutchinson Cancer Research Center in the USA.

Among Norway's teams is an outstanding research community at Oslo University Hospital, where the clinical research group is headed by Inger Thune. She leads, for example, the EBBA II study on energy balance and breast cancer aspects, which aims to establish whether and how exercise affects the body's energy and hormonal balances in women with breast cancer, and whether this process is significance for recurrence of the disease. This project is ongoing, and participants are being monitored for up to 10 years after the intervention. The exercise regime involves exercise at least three times a week, including two sessions of outdoor exercise with physiotherapist guidance. In recent years, the Norwegian School of Sport Sciences has also offered a separate course on exercise and health, where this research team participates and has carried out studies related to exercise and cancer.

Lee Jones' research team at the Memorial Sloan Kettering Cancer Center in New York, USA, has paid special attention to identifying the optimal exercise regime (in other words, dose, type and

length) in order to influence the overall experience, and how this depends on the cancer type, treatment and characteristics of each patient (Jones & Alfano, 2013). Dr Jones was recently interviewed by the *New York Times* in connection with a published study which showed that mortality was lower among childhood cancer survivors who exercised in young adulthood compared with those who did not (Scott et al, 2018).

> *"If you or a loved one have had cancer, I'd strongly recommend that you talk with your physician about exercise"*

Dr Lee Jones, exercise and cancer scientist. Source: *New York Times* (Reynolds, 2018)

Extensive documentation now exists that exercise is acceptable in terms of medical science during advanced cancer treatment. It has also been established that physical activity and exercise during and after treatment improves physical and mental function and thereby enhances quality of life.

Physical health

Exercise improves physical function, counters loss of muscle strength and offers such benefits as improving lung and intestinal function, retaining bone mass and preventing weight gain.

Research indicates that physical condition at diagnosis can be significant for the benefit of cancer treatment and thereby for prognosis. Since few studies exist on this, however, we do not know whether exercise has a direct effect on specific cancer survival. Nevertheless, studies exist which show promising results (Davis et al, 2014; American Cancer Society, 2015). One study, which looked at 248 women after a breast cancer diagnosis, found that those who were in good shape (measured by maximum oxygen uptake VO_{2peak} >1.09 l/min) when diagnosed had a better survival prognosis than women in poorer condition (VO_{2peak} <1.09 l/min) (Jones et al, 2012). Since this was an observational study, however, the possibility that the results reflect selection bias cannot be excluded.

Being physically active during and after cancer treatment can reduce the risk of side effects and late effects (Juvet et al, 2017), including the risk of cardiovascular disease (Jones et al, 2014; Adams et al, 2017; Courneya & Friedenreich, 1997). Observational studies, for example, have shown that childhood cancer survivors who are active in line with Norwegian recommendations (30 minutes of moderate exercise daily) are at lower risk (RR: 0.45 (95% CI, 0.26 to 0.80)) of developing cardiovascular disease (Jones et al, 2014).

The high-intensity interval training in testicular cancer survivors (HIITTS) study investigated whether 12 weeks of high-intensity interval training on a treadmill could reduce risk factors for cardiovascular disease among such survivors (Adams et al, 2017). In addition to improving its physical condition measured by maximum oxygen uptake (difference in change between the groups: 3.7 ml/kg/min), the exercise group's Framingham risk score was reduced by 0.6%. Together with other measurements, this indicated a risk reduction for cardiovascular disease of more than 20%.

Exercise (depending on type and exertion) for cancer patients can also reduce the risk of other late effects, such as osteoporosis (Fornusek & Kilbreath, 2017) as well as depression and fatigue (Tomlinson et al, 2014; Cramp & Byron-Daniel, 2012; Juvet et al, 2017). A recently published meta-analysis found that exercise during radiation therapy reduced exhaustion and fatigue among prostate cancer patients (Horgane & O'Donovan, 2018).

Health personnel we have talked with (in the Cancer Fitness Centres and at Oslo University Hospital) and who interact with patients on a daily basis say that they notice a general improvement in the physical function and general condition of patients as a result of tailored exercise.

> *"Cancer Fitness Centre users find daily activities easier – such as using stairs, shopping and housework. They generally report reduced pain and body stiffness and a lighter mood"*

Source: AKTIV Against Cancer, Cancer Fitness Centre annual report.

Although no established knowledge exists today about the significances of exercise for specific cancer survival, a number of studies suggest that such activity can affect post-treatment survival. A study which investigated the association between self-reported exercise among 4 623 Swedish prostate cancer survivors found that patients who reported more than 20 minutes of daily activity (walking or cycling) had a better survival rate 15 years after diagnosis than those who were less active (Bonn et al, 2015). A Norwegian study investigated survival rates among 1 364 breast cancer patients of normal weight (BMI < 25 kg/m^2) aged 55 years old or above at diagnosis (Emaus et

al, 2010). Mortality was 66% among the women who had exercised regularly before diagnosis compared with those who had not.

The effect of reducing or avoiding the incidence of unfortunate health outcomes involves not only a health benefit for the patients (improved quality of life and potentially more years of life), but also savings on treatment costs in the health service, increased productivity (reduced sickness absence) and positive consequences for next-of-kin.

Physical health

Research suggests that exercise helps to improve physical health among cancer patients, such as reduced depression and anxiety (Midtgaard et al, 2005). A recent study found that exercise was associated with a reduced incidence of depression (Kyoung et al, 2017).

Health-related quality of life

That exercise by cancer patients during and after treatment improves quality of life is now established knowledge (American Cancer Society, 2015). A systematic review which covered 29 randomised controlled trials and eight systematic reviews concluded that exercise during and after cancer treatment not only improved muscle strength and body function but also enhanced quality of life (Segal et al, 2017). A meta-analysis of 16 randomised controlled studies found that exercise had a significant effect on quality of life (Gerritsen & Vincent, 2016). These studies concluded that the evidence base was sufficient to support recommendations on exercise for cancer patients.

Name: Inger Thune

Position: Senior consultant at Oslo University Hospital and professor at the Norwegian School of Sport Sciences and the University of Tromsø

What is your background?

While studying medicine, I was surprised by the lack of knowledge about the implications of exercise for cancer progression and treatment. This was despite the importance of energy conversion for cell growth and cancer development. Alongside specialising in oncology, I therefore pursued training in research methods related to exercise and cancer progression in the USA, New Zealand and the UK. I graduated with my PhD in 1997 with a thesis on exercise and cancer, with studies on bowel, breast, prostate, testicular and lung cancer. This work and many later studies have led to participation in and leadership of various international and national research teams and expert panels (WHO_IARC, CUP-WCRF/AICR), such as the National Council for Exercise, with the focus on exercise and cancer. In 1998, I formulated the first cancer slogan focused on exercise for both Norway and internationally: "Take the time to exercise".

What are your research fields?

As the clinical research group leader for translational research on energetics and cancer (TREC) at Oslo University Hospital, we study the relationship between exercise, energy conversion, diet and weight with respect to the risk of and prognosis for most cancers. MSc and PhD students, post-doctoral fellows and researchers participate in the group and pursue work in several cancer-related disciplines. We study properties of both patients and tumour related to treatment, and conduct follow-up and ongoing clinical studies in the field of exercise (such as the EBBA studies).

What is the value of exercise for both physical and mental health in cancer patients?

Being active improves physical function, counteracts loss of muscle strength, improves lung and bowel function, maintains bone mass and prevents weight gain. Exercise can also reduce and prevent anxiety and depression, enhance self-esteem, improve the ability to cope and combat fatigue. Exercising in groups can also help to maintain a social network and solidarity with others in a similar position. Patients who begin exercise organised by the treatment facility are often happy and say they should have started with this much earlier. Exercise therefore reduces physical and mental side effects of both the cancer and its treatment.

Why is an offer of tailored exercise for cancer patients important?

Cancer patients are found in every age group, with very different needs which vary with their type of cancer, effects of the disease, treatment regime and duration. Tailored exercise is therefore highly important and necessary.

Any other comments?

Modern treatment for cancer is demanding, expensive and challenging. Exercise has a big unrealised potential to reduce both mental and physical costs for the patient and to cut costs for society. Exercise should be available to cancer patients on a long-term "blue prescription" partly funded by the state.

Photo: Oslo University Hospital

The concept of quality adjusted life years is often used in health economic analyses as a composite quantification of the health benefit of an intervention, expressed as the increase in lifespan weighted by the quality of this life. A quality adjusted life year accordingly reflects a year of life with perfect health. The health-related quality of life dimension in the quality adjusted life year can be interpreted as the composite effect of an intervention. Where exercise is concerned, for example, the health-related quality of life dimension can be interpreted as the overall health effect of better physical function, body composition and muscle strength, reduced fatigue and other physical and mental health effects. Measuring health benefits in terms of quality adjusted life years presents several challenges, but the method is regarded as the best available.

A study by Norwegian scientists reviewed all health economics analyses published in 2010 which measured the number of quality adjusted life years resulting from a health intervention (Wisløff et al, 2014). It found that health interventions in general provided a modest health benefit. Of the 370 studies reviewed, the median number of quality adjusted life years obtained equalled 0.06, corresponding to three weeks of "perfect health". The study also found that the health benefit varied by type of intervention – the benefit was greatest with those directed at chronic conditions (median gain 0.10 quality adjusted life years) and smallest for preventive interventions (median gain 0.01 quality adjusted life years).

A recently published health economic analysis investigated the value of an exercise programme for patients with breast and bowel cancer who received chemotherapy (May et al, 2017). The analysis was based on results from a randomised controlled trial (the PACT study). It found that the health benefit of the exercise programme (over a nine-month period) was 0.03 quality adjusted life year for bowel cancer patients and 0.01 for those with breast cancer. This means that the exercise programme gave each patient an average of four to 11 extra days of "perfect health" compared with those who did not exercise.

Reduced consumption of health services

For the individual patient, physical activity and exercise can mean more benefit from treatment, smaller side effects and thereby reduced need for sick leave and check-ups, lower use of painkillers and other medications, and less need for other health services (such as psychologists and home nursing).

Chronic disorders are widespread among cancer survivors, and drive up costs for both patients and the health service. An American study related data on exercise in leisure time with health service costs (Yan et al, 2018). It found that patients who followed recommended exercise programmes saved USD 4 686 and USD 2 875 dollar in health costs for one-five and 11 or more years of survival respectively.

Another study investigated the relationship between exercise and health-service consumption and costs among 4 920 adult cancer survivors (16-64 years old) using the Medical Expenditures Panel Survey (Kaul et al, 2017). It found that physically active people had fewer acute admissions and lower health service costs than those who reported a lower level of exercise.

Back to work more quickly

A few studies have investigated the effect of physical activity and exercise on work-related outcomes. However, one conducted at two Dutch hospitals (Leensen et al, 2017) found that a combination of occupational counselling and tailored exercise had an effect on the perceived importance of work, work capacity and quality of life. Once rehabilitation began, 59% of the cancer patients returned to work within six months, 86% within 12 months and 83% within 18 months. The study concluded that a combined rehabilitation programme could help more patients to return to work as well as reducing exhaustion and improving work capacity and quality of life.

Results from PACT, a randomised controlled study of an 18-week exercise programme for breast and bowel cancer patients receiving chemotherapy showed that sickness absence was reduced by just under a week for those who undertook the exercise regime (May et al, 2017). Average sickness absence was down by 23.5 and 29.9 hours among breast and bowel cancer patients respectively in the intervention groups than in the control groups.

A controlled study investigated the effect of an 18-week exercise programme (including strength and interval training as well as home exercise) on 72 cancer survivors (Thijs et al, 2012). The group was compared with 38 survivors from two other hospitals who did not take the programme. People in the intervention group had a significantly smaller reduction in working hours per week (down by five hours compared with 11). Furthermore, those in the intervention group returned to work on average 12 days earlier than people in the control group.

A qualitative study (Groenveld IF et al, 2013) investigated the experience of cancer patients with

(1) returning to work and work performance, (2) exercise after treatment and (3) the perceived relationship between exercise and work. Patients found that exercise had a positive effect on their return to work. The majority of the participants felt that exercise probably had been a factor in returning to work, primarily by increasing their level of energy. Some believed that exercise had improved their capacity for work by increasing their ability to tackle demanding tasks. Participants also stated that their return to work had a positive effect on exercise.

In our interviews with Cancer Fitness Centre staff and users, we received many responses that tailored exercise had been crucial for cancer patients getting back to work.

> *"I'd never have returned to work so quickly without the exercise programme in the Cancer Fitness Centre"*

Cancer Fitness Centre user. Source: Oslo Economics, interview with Cancer Fitness Centre user.

Name: Tormod S Nilsen

Position: Researcher at the Norwegian School of Sport Sciences (NIH).

What is your background?

I have a PhD from the NIH, which was the starting point for my interest in exercise and cancer.

What is the value of exercise for the physical and mental health of cancer patients?

Research shows that exercise can confer a number of benefits in all phases of cancer care. Many patients will experience reduced physical function, changed body composition and not least increasing fatigue, as well as uncertainty and anxiety. In many cases, these changes will not disappear of their own accord when treatment ceases. However, studies show that tailored exercise during treatment can prevent negative effects of the treatment, and that post-treatment exercise can often reverse negative effects which have arisen.

Why is provision of tailored exercise important for cancer patients?

Exercising can be difficult to achieve for many, even if they are not being treated for cancer. In a lot of cases, even more considerations must be taken into account during and after cancer treatment because of side and latent effects. Something many people would regard as quite manageable exercise sessions, and which has even been a manageable session for the patient themselves, could be very burdensome and lead to exhaustion for several days. Well-qualified instructors are therefore essential in ensuring a good introduction to exercise, so that the patient can test their tolerance within reassuring parameters.

Any other comments?

Exercise and cancer is still a young research field, and constantly developing. Viewed from an NIH perspective, we still need more information on how exercise can be tailored for different patients. We need to know more about how we can optimise exercise during and after various forms of cancer treatment, and how exercise affects different acute side and latent effects. Knowing more about this will mean that we can give better (more specific) exercise recommendations to patients during and after cancer treatment.

Photo: Norwegian School of Sport Sciences

3.3 AKTIV patient pathway

To ensure that exercise has a positive effect and does not lead to unwanted outcomes (such as increased exhaustion), tailored exercise provision is required for cancer patients.

AKTIV Against Cancer has established provisions for cancer patients to receive tailored exercise, including Cancer Fitness Centres and guidance from AKTIV instructors. These schemes allow cancer patients to exercise in a reassuring environment under the guidance of people with specialist expertise in the field of exercise and cancer.

AKTIV Against Cancer's aim is to integrate exercise throughout the treatment pathway, before, during and after – known as an AKTIV patient pathway (Figure 3-3). Cancer Fitness Centres are an exercise provision for patients after diagnosis, during treatment and for up to a year post-treatment. The AKTIV instructor service aims to ensure a local exercise provision both in the investigation (pre-diagnosis) phase and after treatment has ended.

We asked Cancer Fitness Centre staff and users as well as AKTIV instructors about the importance of the actual tailoring of exercise. The feedback we received emphasised the importance of a low-threshold provision in a period when the patient is

more weary and exhausted than normal. This provision is seen as having a low threshold for participation because it focuses on people in the same position, the instructors have expertise about and understanding of that position, and the exercise is experienced as "not lavish" and reassuring.

Exercise provision in the Cancer Fitness Centres and with AKTIV instructors, as well as user experiences of this, are described in greater detail in chapters 4 and 5.

Figure 3-3: AKTIV patient pathway

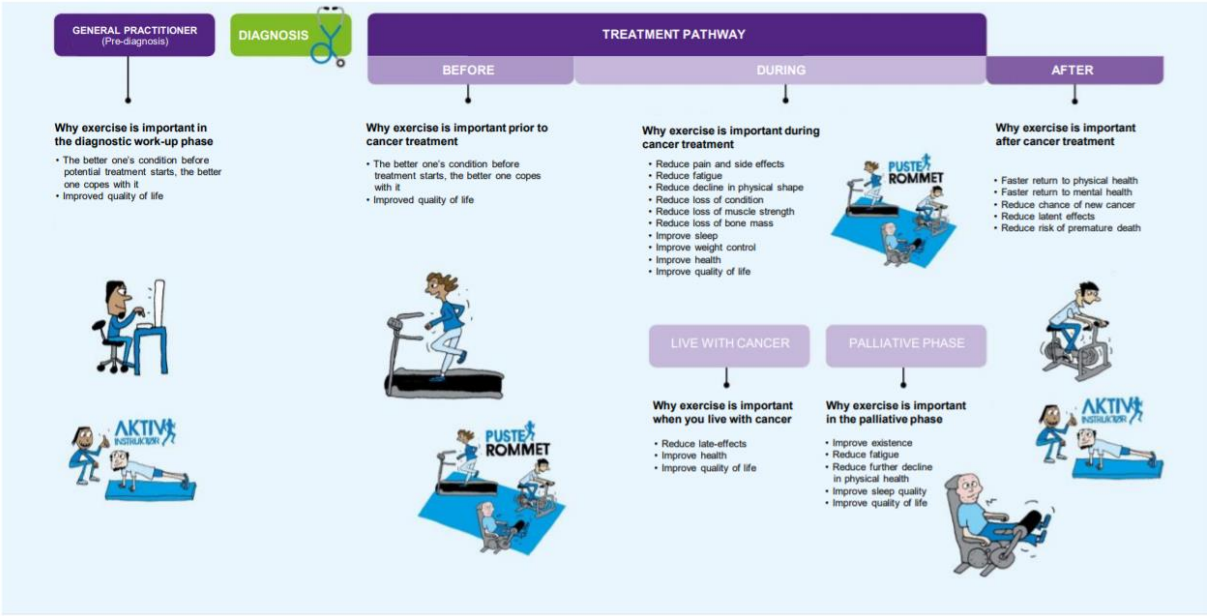


Diagram: AKTIV Against Cancer

4. Exercise in the Cancer Fitness Centre

A Cancer Fitness Centre is an exercise and activity facility in a hospital offering group exercise and tailored exercise programmes for cancer patients during and after treatment. It is also a meeting place and social arena for patients in the same position. Its staff have special expertise in exercise and cancer.

4.1 About the Cancer Fitness Centre

A Cancer Fitness Centre is a low-threshold exercise provision open to everyone being treated for cancer. The only formal requirement to participate is that the cancer patient has been referred to the centre by a physician. This could be their family doctor or a hospital physician.

After a referral has been received, the cancer patient is invited to an initial talk at the Cancer Fitness Centre. This lasts an hour and aims to inform the user about the exercise provision while allowing the staff member to get acquainted with the patient and their physical and mental health. Following the talk, the patient can use the Cancer Fitness Centre as much as needed for as long as they qualify for the scheme.

Rules on how long a cancer patient can use a Cancer Fitness Centre vary from hospital to hospital. The main rule is that the patient has the right to use it for six months post-treatment, but some hospitals extend this to a year. This restriction reflects the fact that capacity in the Cancer Fitness Centres is limited, and that new patients need to be accommodated.

4.2 What Cancer Fitness Centres offer

All Cancer Fitness Centres offer individual exercise guidance and group sessions. The latter often comprise strength and endurance training as well as relaxation activities such as yoga. On average, a Cancer Fitness Centre offers eight-nine hourly group sessions per week.

Ten of the Cancer Fitness Centres also provide individual guidance on coping and mental health, and a third of them offer motivational courses and dietary advice. In addition to courses for their own users, 12 Cancer Fitness Centres report that they hold courses for other patient groups and six that they provide courses for health personnel (survey by Oslo Economics).

Both staff and users at the Cancer Fitness Centres emphasise that the scheme is *more than an exercise facility* for cancer patients. Staff devote much time to talking with users, and are focused on ensuring that all are visible. Several Cancer Fitness Centres have also appointed cancer nurses and/or doctors, who are present to answer questions and to follow up users.

In interviews, the users highlight that the presence of specialist personnel is very important and that the Cancer Fitness Centre contributes to a feeling of a more integrated cancer treatment.

Figure 4-1: Number of Cancer Fitness Centres offering various services

Source: Oslo Economics

A total of 16 Cancer Fitness Centres have so far been established, with 15 located inside a hospital and one out-of-doors in the Gaustadskogen forest outside the women and children's clinic at the Rikshospital campus of Oslo University Hospital. The latter includes an outdoor area and an activity track to help with coping and to provide enjoyment among patients and next-of-kin at the campus, and for use by local children and adults.

Since AKTIV Against Cancer opened its first fitness centre in Bergen during 2008. the number of these facilities has increased steadily. Eight of today's 16 centres have been established in the past three years (Table 4-1).

Table 4-1: Cancer Fitness Centres and exercise provision

Cancer Fitness Centre	Year established	Area (m^2)	Users (to 2017)	Visits (to 2017)	Group sessions per week
Bergen – Haukeland Hospital	2008	178	329	4 680	11
Skien – Telemark Hospital	2010	90	109	1 819	9
Gjøvik	2011	84	35	920	3
Oslo – Ullevål Hospital	2012	50	247	3 097	7
Oslo – Norwegian Radium Hospital	2015	135	228	340	8
Trondheim	2013	70	200 (2015)	2 138 (2016)	–
Ringerike	2014	180	74	2 288 (2016)	12
Tønsberg	2015	200	135	4 464	6
Ahus	2015	200	130	4 558	12
Bærum	2015	245	162	3 623	7
Ålesund	2015	105	_	2 681	7
Kongsberg	2016	270	62	878	11
Kristiansund	2017	220	60	650	7
Drammen	2017	230	171	1 640	7
Stavanger	2017	120	_	363	13

Source: AKTIV Against Cancer. Dash – no information available.

4.3 Inequalities in access to Cancer Fitness Centres

A family physician or hospital doctor can refer patients to a Cancer Fitness Centre. However, user surveys show that family doctors generally know little about them and therefore make few referrals. Other informal referral routes include direct patient request, or nurses or other health personnel at the radiation clinic who send patients to a cancer doctor to request referral.

AKTIV Against Cancer conducts extensive marketing and information campaigns about the provision through various channels. Cancer Fitness Centre staff also work continuously to inform people about them. Since most Cancer Fitness Centre users utilise the provision for a limited period, a constant need exists to market it to potential new clients. A number of our informants noted that, if the aim is to increase user numbers, the way access is controlled should be assessed – whether referral by a physician is necessary, for example.

The Cancer Fitness Centres we have been in contact with have observed that the way cancer patients learn about this provision is, often, by chance. Not all cancer doctors are aware of or provide information on the provision, and details about the Cancer Fitness Centre are not always available in the hospital's information racks. One user, for example, learnt about the provision because she spent the night in the hospital, while another reported that she did not hear about it because she was in a ward not primarily devoted to cancer patients.

> *"I was lucky to learn about the Cancer Fitness Centre. My operation was late in the day, and I had to spend the night at the hospital. Only those staying overnight were visited by a physiotherapist who could tell us about the provision"*

Cancer Fitness Centre user. Source: Oslo Economics, interview with Cancer Fitness Centre user.

In the survey, Cancer Fitness Centre staff list several activities pursued to make patients, health personnel and next-of-kin aware of the provision. These include:

- making information available on notice boards in hospital departments treating cancer patients

- Cancer Fitness Centre staff organising meetings in hospital departments to provide information about and answer questions about the provision
- marketing in patient associations
- organising courses/giving presentations in arenas where attention is focused on physical activities for cancer patients
- tours of Cancer Fitness Centres for personnel from various parts of the health sector, and other stakeholders such as scientists and students

Name: Lars Bestum

Why is exercise important for you?

Apart from its clear health effect, exercise gives me energy, makes me feel well and creates a sense of coping. All this has become much more important for me since receiving a critical brain tumour diagnosis.

Exercise helps me to acquire mental strength at a time when I and my family have been challenged far beyond what we thought were our limits. Regular exercise also gives me better leisure and nature experiences – so that I have more energy for my leisure interests, such as cross country and Alpine skiing, cycling, and hiking.

Why is the Cancer Fitness Centre important for you?

The Cancer Fitness Centre is an essential low-threshold exercise provision for cancer patients. I'd never been inside a gym before, and even further away from a yoga center.

The Cancer Fitness Centre and its instructors manage to create a low psychological threshold, so that I've started and thrive with new forms of exercise which have a positive effect on my health.

This is also a place where I meet many patients in the same position, who contribute to exchanging valuable experience after an exercise session, something we don't get from the medical treatment at the hospital.

What do you find particularly positive about the provision?

It has established an exercise regime which includes a good balance between condition, strength and balance training, yoga and so forth. The AKTIV instructors there have good routines for verifying the exercise against the medical treatment, so that patients feel not only physically challenged but also taken care of.

The instructors know about cancer and how the disease/treatment must be taken into account in the exercise. They "see" the patients, and always take care that nobody becomes too tired or sick, they create a good atmosphere and a culture where everyone can perform to their own level of ability and not compete with each other. Even though it's primarily physical, I find this to be one of the most important provisions for maintaining a key social and mental aspect, so that the health service treats the whole person.

What improvements could be made to the provision?

Unfortunately, the buildings are not best suited for creating a gym, and the hospitals don't seem to give this a sufficiently high priority. At the same time, I must say they've made the best out of things, and the contents and design of a Cancer Fitness Centre seem very well thought out. At the Radium Hospital, where I do my exercise (and which is Norway's leading cancer hospital), the dressing room facilities are very limited and there's no shower or washing possibilities.

Opening hours have unfortunately been limited, and are undoubtedly determined in part by the need to be staffed at all times. With more resources, opening on some afternoons might make it possible for more people to take advantage of the offer.

Any other comments?

I was lucky enough to have a very good coordinator when I received radiation therapy, who was good at promoting the Cancer Fitness Centre and helping me with a referral to it. At the same time, I've understood that not everyone gets equally good guidance, and are left "on their own". There's no coordinator for my integrated treatment as a patient over time, which would really help me to return to work more quickly and to get the best out of my life as it is now.

Photo: Private

Name: Liselotte Bjelke

Photo: Private

Why is the Cancer Fitness Centre important for you?

It's been very important and has given me something else to focus on in an otherwise difficult period. I also experience a substantial change in my physical condition since I started in the Cancer Fitness Centre. For me, this has meant the transition from an electric cart on the golf course to carrying the bag on my back – which feels great.

What do you find particularly positive about the provision?

The Cancer Fitness Centre is a low-threshold provision, where you meet competent staff and do tailored exercise – that's crucial for motivating you during treatment. I dare to exercise harder because I'm in a reassuring setting, and can ask specialists about my own cancer. I receive guidance on the exercise which is good for me as a lung cancer patient.

How could this provision be improved?

I've no complaints about the provision. Adequate staffing to sustain the user's sense of reassurance as well as access to enough equipment are crucial for maintaining the quality of the Cancer Fitness Centre.

I find that many patients dread ceasing to use the Cancer Fitness Centre. It would be positive if they provided more information about what happens after this period and if AKTIV instructors qualified on cancer and exercise were to be found round and about.

Who uses the Cancer Fitness Centres?

A review of patient registration forms for the Cancer Fitness Centres shows that women represent the majority of their users. The average age is 60 years, and most are aged 60-80. Most of them (78%) were receiving ongoing treatment with chemotherapy or radiation therapy. Almost 50% of the user group had previously undergone surgery. The diagnosis picture for users is complex, but breast, prostate and gastrointestinal cancers were the three commonest types. Seventy-two per cent of those polled were either old-age pensioners or on sick leave.

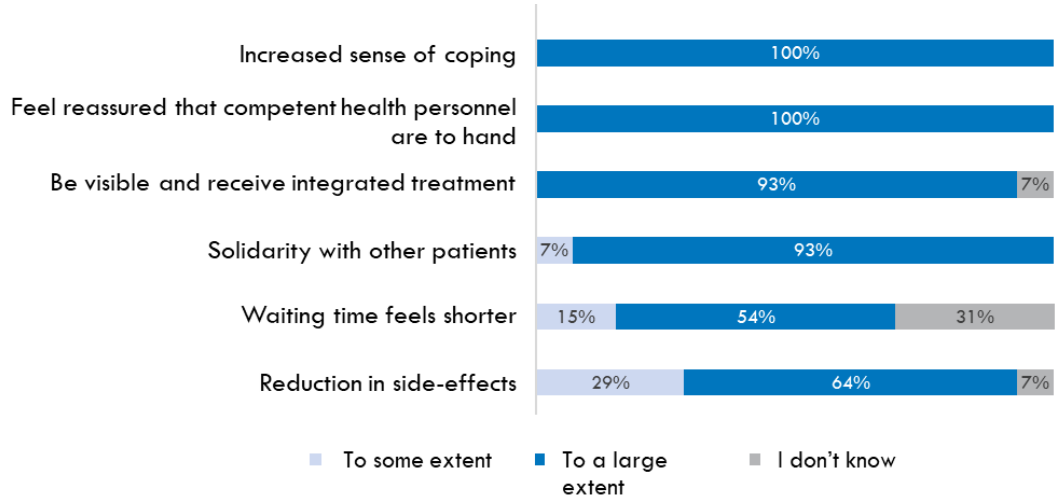
User group and exercise

The relationship with exercise varied greatly among Cancer Fitness Centre users. Staff at the centres estimate that the overall user group exercised once a week before joining a Cancer Fitness Centre, but this varied from less than once a month to more than four times a week. Furthermore, staff estimated that users who had started exercising in a Cancer Fitness Centre exercised twice a week on average.

Figure 4-2: Feedback from Cancer Fitness Centre users on the benefit of the provision

Source: Oslo Economics

Figure 4-3: How staff observed the benefits for Cancer Fitness Centre users



Source: Oslo Economics

User satisfaction

The survey asked Cancer Fitness Centre staff about the benefits they observe for users of the provision (Figure 4-3). All of them find that users experience to a great extent an increased sense of coping and feel more reassured since they are together with competent health personnel. Almost all also find that users receive integrated treatment and that the Cancer Fitness Centre is an important gathering place for cancer patients. Many of the users spend a lot of time in hospital, which involves a great deal of waiting. More than half the Cancer Fitness Centre staff report that users find the waiting time shorter when using the Cancer Fitness Centre.

Where the health benefits of the provision are concerned, all staff respond that the Cancer Fitness Centres make a substantial contribution to improving the physical and mental health of users both during and after treatment. Two out of three staff members find that the exercise helped users to cope better with the treatment and thereby reduce side effects.

Our findings on user satisfaction from the survey are confirmed and reinforced by interviews with Cancer Fitness Centre users. These report that the provision fulfils many principal functions.

One of the most important aspects of the Cancer Fitness Centre is that users feel looked after and seen there. They feel reassured at being able to exercise under the guidance of competent personnel. Users also find it very important that they can ask questions about their illness to Cancer Fitness Centre staff. Many experience the Cancer Fitness Centre as an arena where they can raise queries they do not have time to ask their doctor.

Many also find that the provision is very important for their own coping. Getting a cancer diagnosis can be perceived as losing control over one's own life. In addition to having a very unpredictable illness, patients are often off work for a long time and drop out of their old life. The Cancer Fitness Centre gives many cancer patients a structure in their everyday lives. A lot of those who exercise there describe the importance of having something to do during their treatment. In addition, many report that being able to do something specific to help their body tackle the illness feels positive.

Users say that they could not imagine exercising in a regular gym during their treatment, in part because they would feel insecure and out-of-place exercising in an environment which is not tailored to their illness. They find that such tailoring is of great importance for getting started with exercise. The Cancer Fitness Centre is also an important arena for meeting others in the same position, where they can share experiences, sorrows and joys with other cancer patients.

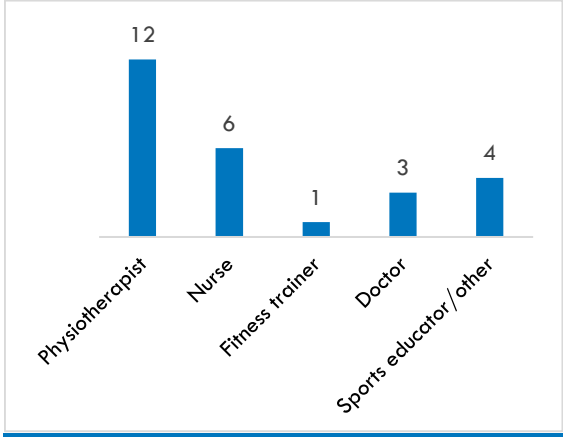
4.4 Capacity, resource use and financing

Cancer Fitness Centre staff

Day-to-day operation of the Cancer Fitness Centres varies, but our impression is that this is done by a physiotherapist who is also a qualified AKTIV instructor. The number of fitness instructors depends on the Cancer Fitness Centre's size. Many centres have also recruited a part-time cancer nurse and/or doctor, who contribute to operation of the Cancer Fitness Centre by answering questions and providing advice for users.

In the user survey, the Cancer Fitness Centres reported that staffing represented 1.25 full-time-equivalents (FTEs) on average. Twelve had more than one employee. Staff backgrounds included physiotherapists, nurses, fitness instructors, doctors and sports educators (Figure 4-4). All but one of the Cancer Fitness Centres had one or two employees who had taken the AKTIV instructor course.

Figure 4-4: Cancer Fitness Centres with staff in different occupational categories



Source: Oslo Economics

Financing and costs

AKTIV Against Cancer finances the establishment of a Cancer Fitness Centre and its operation for the first three years. Subsequent funding is provided over the hospital's budget.

Our calculations of Cancer Fitness Centre costs are based on an average facility with an area of 200m^2 and staffing of 1.25 FTEs (derived from the survey of Cancer Fitness Centre staff conducted by Oslo Economics). Where rental expenses are concerned, we have assumed an average cost per square metre at the hospital, and reduced this to take into account that Cancer Fitness Centres often used premises unsuitable for clinical patient treatment. We therefore assume that the average rent per square metre per month is NOK 1 000. Where the average cost of an FTE is concerned, we have utilised a figure of NOK 697 000 in the health and social care sector (Statistics Norway, 2018). Altogether, this adds up to an annual cost of almost NOK 3.3 million for premises and operation of a Cancer Fitness Centre.

Certain Cancer Fitness Centres charge a fee per user. One possible tariff is "patient exercise and group interventions" (Norwegian Directorate of Health, 2017), charged on the basis of an exercise regime of at least seven hours in the Cancer Fitness Centre, including lifestyle advice (diet, for example). This fee is in the order of NOK 400-500 per patient. Other tariffs used are DRG 862O polyclinic rehabilitation (cost weighting 0.024 = NOK 1 042) and DRG 996O group-oriented patient exercise (cost weighting 0.017 = NOK 738). Roughly half the Cancer Fitness Centres charge fees. These will generate an income for the hospital but do not affect the societal costs of the Cancer Fitness Centre and are therefore not deducted.

Since an average user utilises a Cancer Fitness Centre for one year, we have calculated the total cost per exercise regime per user on the basis of the annual cost of premises and operation divided by the annual number of users – put at an average of 150 per annum. However, activity data from the Cancer Fitness Centres show big variations in user numbers (from 35 to 329 per facility in 2017), staff numbers and area. To take account of these, we have applied an uncertainty range of plus/minus 30% of the best estimate.

The cost per exercise regime in a Cancer Fitness Centre per user is thereby NOK 21 800 (uncertainty range: NOK 15 000-28 400).

Table 4-2: Cost of Cancer Fitness Centre provision

	Costs (NOK, 2018 value)
Premises/operation per annum	3 300 000
Exercise regime per user	21 800

Source: Oslo Economics

Name: Renate Sterud

Position: Manager, Cancer Fitness Centre at Ahus Hospital

What is your background?

I'm a physiotherapist with specialisation in cancer and background in complete physical lymphedema therapy. When I began working at the Cancer Fitness Centre, I took the AKTIV instructor course to strengthen my expertise on cancer and exercise.

Why is your expertise important?

My expertise is important for the patients' reassurance – I tailor the exercise to each individual and evaluate their daily condition. I sometimes send users home if I notice that they're in no condition to exercise. My expertise is also important in meeting the users' need for information. The patient often has many questions both during and after cancer treatment.

Why is exercise so important for the patients?

Exercise is important for maintaining physical condition, strength and balance when one's undergoing treatment. It's an advantage to be well exercised before cancer treatment begins – the body can cope with it much better then.

Why is the Cancer Fitness Centre important for users?

It provides users with a unique arena for being together with others in the same position. They can exchange experiences and build good relationships. The Cancer Fitness Centre also contributes to the patient finding that they can take more control over their own health and do something which feels good for the body.

What are success criteria for a Cancer Fitness Centre to function well?

The Cancer Fitness Centre depends on having staff with expertise on exercise and cancer. It's crucial that each user is seen and looked after in a positive manner.

Any other comments?

Patients are tired of hearing about all the things they can't do. The Cancer Fitness Centre is a low-threshold provision which encourages patients in a positive manner. We focus on coping and having fun!

Photo: Oslo Economics

5. Exercising with AKTIV instructors

AKTIV instructors provide exercise programmes in the local community for people being checked for cancer, undergoing cancer treatment or at the post-treatment stage. They have special expertise on giving exercise guidance to people who have undergone cancer treatment.

5.1 About AKTIV instructors

AKTIV instructors are part of the exercise provision for cancer patients promoted by AKTIV Against Cancer, and an extension of the Cancer Fitness Centre.

These instructors have taken the dedicated research-based course on exercise and cancer at the Norwegian School of Sport Sciences (NIH), which builds on general cancer science, specific knowledge about exercise and practical sessions. The course has been developed by Oslo University Hospital, AKTIV Against Cancer and the NIH. AKTIV instructors are familiar with the way various cancers and cancer treatments can impose restrictions on physical exercise and the challenges various kinds of cancer can cause for such activity, and can tailor the exercise accordingly.

This course is structured both as a part-time programme for physiotherapists, sports educators and personal trainers, and as an optional subject for BSc students at the NIH. It gives five credits. Launched in 2014, the course has so far been completed by 355 AKTIV instructors. Of these, just under 270 are employed in jobs where they can help people who want to exercise. The remainder are either still in education or work in places without the opportunity to assist people who wish to exercise.

AKTIV instructors can be used in various stages of the patient pathway:

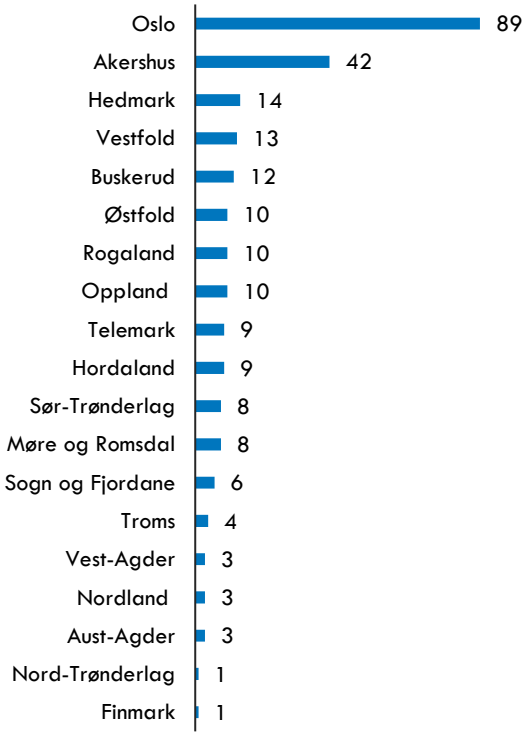
- before diagnosis for people being checked for cancer
- before and during cancer treatment, either as Cancer Fitness Centre staff or as personal trainers for people with no opportunity to use a Cancer Fitness Centre
- after cancer treatment has ended

AKTIV instructors are mainly provided after cancer treatment, and can be regarded as an extension of the Cancer Fitness Centre for those who still want exercise and guidance tailored for cancer patients.

5.2 Inequalities in access to AKTIV instructors

AKTIV Against Cancer's goal is that AKTIV instructors will be available nationwide such that as many cancer patients as possible receive the opportunity to maintain exercise once their treatment has ended. Currently, they are available in every county, yet most are based in Oslo and Akershus (Figure 5-1).

Figure 5-1: AKTIV instructors by county



Source: AKTIV Against Cancer

Workplaces for AKTIV instructors vary widely. In the survey conducted by Oslo Economics, 37% of them responded that they were employed at a commercial gym, 12% in a Cancer Fitness Centre, 8% in a local authority health service (a wellness centre or the like) and 4% (one respondent) at a hospital. Ten percent responded that they were not working as an AKTIV instructor. The low response rate to the survey could also indicate that a substantial proportion of AKTIV instructors do not use their specialist expertise in their day-to-day work – because they are still in education, for

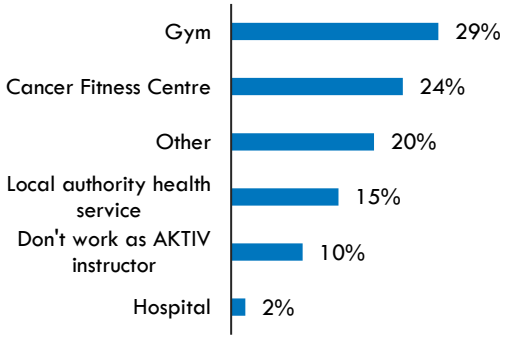
example, or because they have chosen a different career path after graduation.

Recruitment and marketing

AKTIV instructors use many different channels to recruit cancer patients to their exercise provision. They collaborate, for example, with medical practices, wellness centres, various Cancer Fitness Centres, cancer coordinators and nurses and the 'Varde centre' (centre for cancer patients and their next-of-kin), along with having their own websites and social media presence.

Our survey reveals that many users learn about AKTIV instructors from other cancer patients as well as from family and friends. In other words, social networks play an important role in recruiting users.

Figure 5-2: Where do you work as an AKTIV instructor?



Source: Oslo Economics

5.3 Structuring and use of AKTIV instructor provision

Since great variation exists in where and how AKTIV instructors work, it is difficult to provide an overall description of their provision. In the description below, we concentrate on AKTIV instructors who work outside hospitals (in other words, not in Cancer Fitness Centres). They are mainly employed in local authority health services or fitness centres.

AKTIV instructors employed in a commercial gym report that they work with cancer patients for two hours a week on average. Most offer tailored exercise, while some also provide tailored group sessions. The majority report that they have spare capacity to accept more cancer patients.

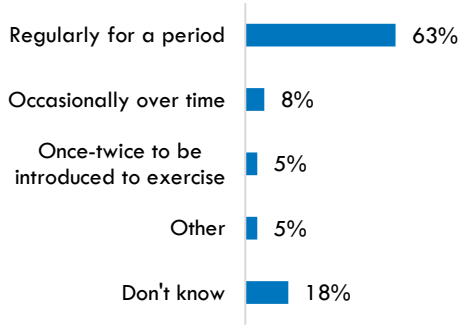
Those employed in local authority health services usually work on prehabilitation/rehabilitation or in a wellness centre. Most offer tailored group sessions once or twice a week. They indicate that they can benefit from their AKTIV instructor course in other parts of their work, and that this makes them more confident in meeting patients.

5.4 Users and user satisfaction

AKTIV instructors who responded to the survey report that the typical user of their services is a woman who exercised to some extent before her diagnosis, and that roughly half of them have earlier exercised in a Cancer Fitness Centre. Where their illness is concerned, most users had a diagnosis of either breast or prostate cancer.

AKTIV instructors at commercial gyms report that users exercise for one-two hours a week over three-six months. Instructors in local authority health services report that users exercise once-twice a week for seven to 12 months.

Figure 5-3: Take-up of AKTIV instructor provision



Source: Oslo Economics

In the survey, 90% of AKTIV instructors responded that they perceive their service to (former) cancer patients to be important and more than 80% said that they found the need for their expertise as AKTIV instructors to be considerable.

They perceive the service they provide to be very beneficial for users in the form of increasing their sense of reassurance at having a health specialist with expertise on hand, solidarity with other patients in the same position, reduced side effects and an increased feeling of coping. They also report that users benefit from the provision in the form of better physical and mental condition.

5.5 Financing and costs

An exercise programme with guidance from an AKTIV instructor is funded partly by fees from patients and partly by the local health service.

Results from the survey conducted by Oslo Economics among AKTIV instructors show that the cost of providing this service varies with the type of employment (private gym compared with local

health service, for example), exercise session (individual coaching compared with group sessions) and the length of the exercise session.

The unit cost of 60 minutes of coached exercise at a gym averages NOK 600 and NOK 200 for individual and group sessions respectively. A group session run by the local health service is estimated to cost NOK 70 per user, based on the cost of an FTE and 10 participants per session.

On the basis of feedback from the survey and interviews, we have also estimated that an average user has six individual and 12 group sessions with an AKTIV instructor. To take account of varying levels of exercise with different users, we assume that a user with low usage of AKTIV instructor sessions utilises two individual and six group sessions, and that a user with high usage utilises a total of 12 individual and 18 group sessions over the period when they need a tailored exercise programme.

The total cost of an exercise session with an AKTIV instructor is put at NOK 5 200 per average user. and varies from NOK 2 000 (low usage) to NOK 9 000 (high usage).

Table 5-1: Cost per user of an exercise programme with an AKTIV instructor

	Hours*	Cost (NOK, 2018 value)*
Individual sessions	6 (2-12)	3 600 (1 200-7 200)
Group sessions**	12 (6-8)	1 600 (800-2 400)
Complete exercise programme	**18 (8-30)**	**5 200 (2 000-9 600)**

Source: Oslo Economics analysis. *Specifies hours/cost for an average user, with hours/cost for a user with low and high usage respectively shown in brackets. **Specifies costs for group exercise based on the average cost for group exercise provided by private gyms and local authorities.

Name: Johanna Kirkengen Espe

Position: Physiotherapist and AKTIV instructor in Oslo's Frogner district.

What is your background?

I'm educated as a physiotherapist and took the AKTIV instructor course in 2014. I now work as a physiotherapist in Frogner, where my responsibilities include leading an exercise group for cancer patients at the wellness centre.

What prompted you to take the AKTIV instructor course?

We were going to launch an exercise group for cancer patients in the district as part of a collaboration with the Cancer Fitness Centre at the Ullevål campus of Oslo University Hospital and AKTIV Against Cancer. The goal was to extend an exercise provision to cancer patients locally in the district after the completion of their follow-up in the Cancer Fitness Centre. Somebody with expertise in exercise and cancer was required. I also have a professional interest in working with this user group, and thought it was interesting to learn more about the field. The AKTIV instructor course was a natural choice, and I'm glad I had the opportunity to take it.

How do you apply the AKTIV instructor course in your work?

The course have given me a detailed understanding of cancer, its treatment and associated side effects, as well as on updated research on post-treatment exercise.

Why is your expertise and AKTIV instructor provision important for the users?

This expertise is essential for the ability to meet the challenges faced by the users, respond to questions, and tailor the exercise in a way which creates a reassuring exercise arena. Participants emphasise the importance of directing the exercise provision specifically to cancer patients, and of the instructors having expertise in this field.

Any other comments?

For those of us who work with exercise and cancer patients, it goes without saying that everyone can enjoy tailored exercise. However, this view is not generally shared in the wider population. That's precisely why it's important to tailor exercise and provide knowledge about such activity. It's particularly important to build expertise about exercise and cancer out in the districts and in the home local authority, so that patients get access to follow-up and expertise when their cancer treatment has ended.

Photo: Private

6. Value of tailored exercise for cancer patients

Tailored exercise for cancer patients enhances physical and mental health and quality of life. The societal value of a tailored exercise programme, reflected here by the AKTIV patient pathway, is estimated to be NOK 15 000 per user and NOK 27.1 million overall for today's 1 750 users. If one in three Norwegian cancer patients used the provision, the societal value would be NOK 171 million.

6.1 Beneficial effects and costs of tailored exercise

Tailored exercise incurs societal costs, but has many beneficial effects for patients, their next-of-kin and society as a whole (Figure 6-1). These include better physical and mental health as well as improved quality of life. Furthermore, better health and quality of life reduce usage of health services and mean that cancer patients can return to work earlier than would otherwise have been the case.

Figure 6-1: Exercise and cancer – costs and benefits

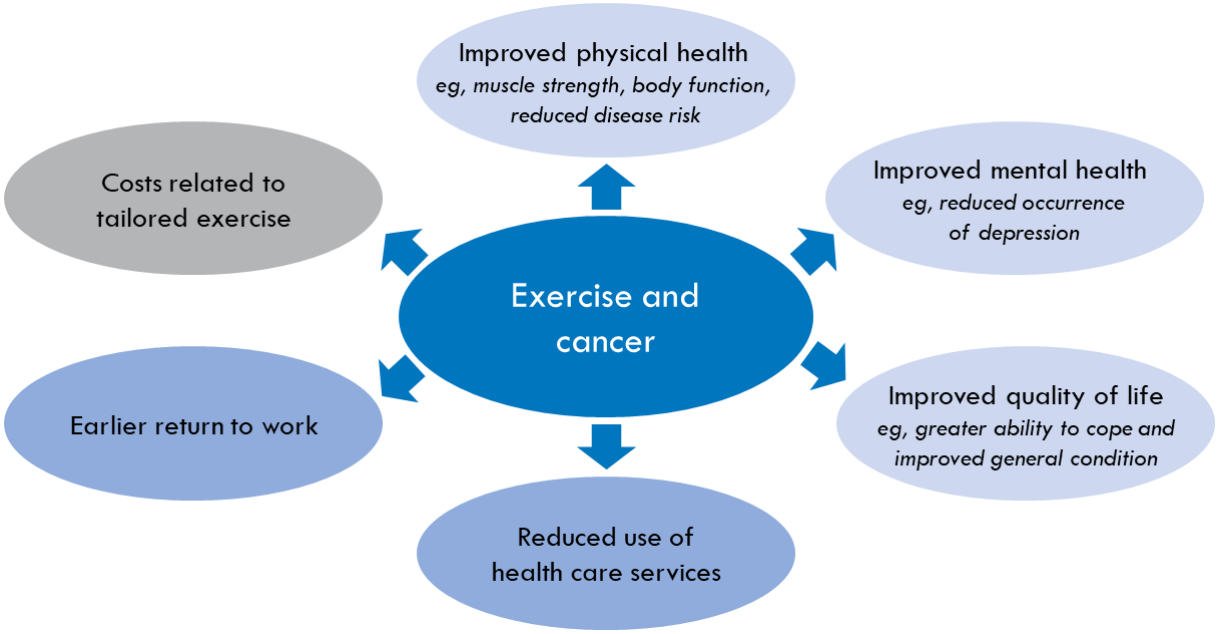


Diagram: Oslo Economics

6.2 Overall assessment of the value of exercise for cancer patients

Costs of tailored exercise

We have calculated the cost of a complete AKTIV patient pathway as an example of an integrated programme for tailored exercise (chapter 5.5) and AKTIV instructors in the local community (chapter 5.5). We have assumed that a cancer patient uses both the Cancer Fitness Centre and an AKTIV instructor, but have taken into account variations in utilisation by reflecting costs for an average user as well as ones with low and high usage of the exercise provision.

The total cost of an AKTIV patient pathway is put at NOK 27 000 for an average user, and varies from NOK 17 300 for a low-usage user to NOK 38 000 for one with high usage.

Table 6-1: Total cost of an AKTIV patient pathway per user, by user type.

User type (degree of access to/ use of tailored exercise)	Total cost of AKTIV patient pathway (NOK, 2018 value)
Average usage	27 000
Low usage	17 300
High usage	38 000

Source: Oslo Economics analysis

Tailored exercise improves health, cuts health service use and increases the prospect of being economically active

Based on the exercise benefits described in chapter 3, we have calculated the overall societal value of tailored exercise. We have estimated the value of exercise and guidance for an average user of the Cancer Fitness Centres and AKTIV instructors. As with our calculation of the costs of the provision, we have specified an uncertainty range which reflects low and high usage respectively, since this is assumed to reflect low and high benefit respectively from the exercise provision. Low and high estimates are given in brackets in the following. All amounts are specified in 2018 kroner.

In line with the findings of a health economics study (May et al, 2017) and an overview of the current state of knowledge (Wisløff et al, 2014), we have assumed that tailored exercise yields 0.03 (0.01-0.05) quality adjusted life years for an average user of the exercise provision. The Norwegian Directorate of Health has estimated the value of one quality adjusted life year achieved as NOK 1 235 000 kroner, pursuant to the Ministry of Finance's estimate of the value of one statistical life (Norwegian Directorate of Health, 2016).[1] The value of one quality adjusted life year achieved thereby amounts to NOK 37 100 (NOK 12 400-61 800).

We assume that exercising helps patients to return more quickly to work after cancer treatment. Norway nevertheless has good sick pay provision, and the effects of such measures on getting back to work faster are often modest. The cost of one week's sick leave has earlier been estimated as NOK 14 250 for the employer and NOK 8 550 for society (Sintef, 2011). Assuming that 40% (20-60%) of cancer patients are in employment, and that these get back to work one week earlier as a result of exercise, the societal saving amounts to NOK 3 400 (NOK 1 700-5 100).

Finally, we have assumed that exercising reduces the use of health services. If we assume that exercising reduces health service consultations by one (zero-two) per patient on average, and that the cost of an average consultation is roughly NOK 2 000, society saves NOK 2 000 (NOK 0-4 000) as a result of reduced usage of health services. Exercise can also affect consumption of medication, which will yield additional cost savings. Since these figures are very uncertain, however, they have not been taken into account in our calculations.

The overall societal value of tailored exercise is calculated to be NOK 42 500 (NOK 14 100-70 900) per user.

Table 6-2: Societal value of tailored exercise per user.

Benefit	Total societal value (NOK)
Quality adjusted life year	37 100[2] (12 400-61 800)
Earlier return to work	3 400 (1 700-5 100)
Reduced health service usage	2 000 (0-4 000)
Total benefit per user	**42 500 (14 100-70 900)**

Source: Oslo Economics analysis

[1] We have assumed that exercise as an intervention has effects across several sectors (health, employment and welfare, culture and sport). If it is regarded purely as a health matter, the value of a quality adjusted life year is estimated to be in the order of NOK 275 000-825 000, depending on the seriousness of the illness which the intervention is directed at (Report no 34 (2015-2016) to the Storting, 2016).

[2] NOK 24 800 if we assume NOK 825 000 for a quality adjusted life year for a very serious illness.

Name: Tone Ikdahl

Position: Chief executive, Lovisenberg Diaconal Hospital, Oslo

What is your background?

I'm a medical doctor with a specialisation in oncology, and have a PhD in molecular breast cancer genetics plus an MSc in management.

Earlier posts include working as an oncologist in the cancer department at Oslo University Hospital. I was the project manager when the very first Cancer Fitness Centre was established at the cancer centre in the hospital's Ullevål campus in 2007.

How far has research come in identifying the value of exercise for cancer patients?

We have good evidence that tailored exercise with guidance is safe and has a positive significance for quality of life, muscle strength and condition both during and after treatment. The exercise programme must be tailored to the treatment and the patient's health condition.

What is the effect of exercise on the physical and mental health of cancer patients?

It's good for patients to also be able to live as normal a life as possible after receiving a cancer diagnosis. The Cancer Fitness Centres give cancer patients inspiration and help to start exercising. They report that this gives them a break from their illness, and that it's good to have a place in the hospital where they can concentrate on opportunities rather than the restrictions imposed by their illness and treatment.

A Cancer Fitness Centre also serves as a social arena, where patients can meet others in the same position. Research results confirm that the exercise improves their quality of life, their energy and their vigour, while allowing them to maintain their physical condition during the treatment period. Physical activity can also help to reduce treatment side effects.

Interesting research results are available which indicate that exercise can reduce the risk of recurrence, at least for certain types of cancer. But we need more good studies in this field before being able to draw conclusions for certain.

Why is tailored exercise provision important for cancer patients?

It's natural for someone to be physically active throughout all phases of their lives. However, those living with cancer or undergoing active cancer treatment can face physical constraints as a result of their illness and treatment. So an individual assessment and tailoring of the exercise programme is important.

What approach should the health service take in the future on providing exercise as part of the treatment provision for cancer patients?

Research shows that exercise tailored to the patient's health condition and treatment programme is safe and has positive significance for quality of life, muscle strength and condition. Making all patients aware of this should be a target, while also building up equally good provision for exercise under reassuring conditions in every part of the country. It would be appropriate if all patients had an information and advice meeting early in their treatment pathway, perhaps as part of the national patient plan?

Any other comments?

This is a relatively new research field, and there's a lot we don't know for certain with regard to exercise and cancer. We should make room for more good research on the effect of exercise on cancer patients.

Photo: Private

Socioeconomic profitability

On the basis of estimated costs and benefits of tailored exercise per user, we have calculated the socioeconomic profitability of this activity – expressed as societal value less cost. Tailored exercise is socioeconomically profitable for a user who has average or high use of the exercise provision – its net benefit per user is put at NOK 15 500 and NOK 32 000 respectively. But it is not socioeconomically profitable for a user in our low usage band, where the negative societal value per user is calculated to be NOK 3 200. However, some patients could receive sufficient information during a single session to exercise subsequently on their own with considerable benefit. Others need substantial follow-up in order to get going with their exercise. The estimates must accordingly be treated with caution.

For society as a whole, the value of tailored exercise was NOK 27.1 million (negative NOK 5.7 million-positive NOK 57.5 million) for today's 1 750 users of the Cancer Fitness Centre provision. If one in three cancer patients utilises a tailored exercise programme, the value of such activity is estimated at NOK 170.2 million (negative NOK 35.6 million-positive NOK 316.7 million).

Table 6-3: Socioeconomic profitability of tailored exercise

Number of new users per annum	Overall value to society (NOK million)
1 750	27.1 (-5.7-+57.5)
11 000	170.2 (-35.6-+361.7)

Source: Oslo Economics analysis

Non-monetised effects

Exercise provides improved health and quality of life for cancer patients. Not all the effects can be measured and valued in monetary terms, but are nevertheless of great value to the cancer patient,

their next-of-kin and society in general. Examples of such non-monetised effects are reassurance and coping, a better structure to daily life, an improved ability to tackle the illness and the feeling of being visible and of receiving integrated treatment for their cancer. (Table 6-4).

Projections – socioeconomic profitability up to 2034

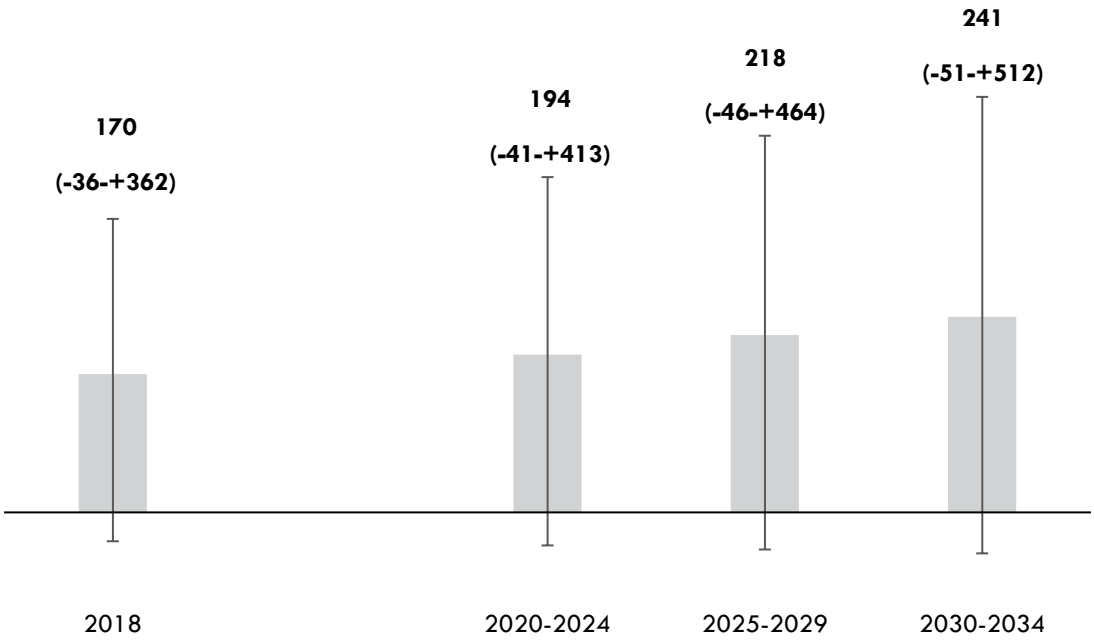
Since the number of cancer patients is likely to increase in the future (NORDCAN, 2017), the socioeconomic benefit of the intervention can also be expected to change. In order to calculate future socioeconomic profitability, we have started from the forecast number of cancer cases up to 2034 and an estimated net benefit per user corresponding to NOK 15 000 (negative NOK 3 200-positive 32 900). If we assume that one out of three cancer patients utilises a tailored exercise provision, the intervention would have a socioeconomic value corresponding to NOK 241 million (negative NOK 51 million-positive NOK 512 million) in 2034 (Figure 6-2).

Table 6-4: Non-monetised effects of tailored exercise for cancer patients

Effect	Description
Reassurance and coping	Exercising with guidance from personnel with expertise on exercise and cancer gives patients reassurance and helps them cope – managing to exercise and do daily tasks despite following a demanding treatment pathway.
Structure in daily life	Cancer patients are often placed on sick leave during treatment, and drop out of their daily routine with work and social activities. Exercising in a Cancer Fitness Centre can provide structure in daily life for those affected by cancer, and can contribute to improved quality of life.
Enhanced ability to tackle the illness	Exercising in a Cancer Fitness Centre with other patients creates an arena for talking to people in the same position as oneself. That opens for conversations on subjects which are not easy to discuss with others. Such conversations can improve quality of life and mean that one functions better at home.
Feeling of being visible and receiving integrated cancer treatment	A number of users of and staff at Cancer Fitness Centres have commented that these facilities are a place where the user is “visible”. Follow-up by competent personnel in a tailored environment contributes to a more integrated treatment pathway, which helps to strengthen reassurance.

Source: Assessments by Oslo Economics based on interviews/surveys with specialists and users

Figure 6-2: Socioeconomic profitability of tailored exercise in 2018-34 (NOK million, 2018 value)



Source: Oslo Economics and NORDCAN (NORDCAN, 2017). Amounts in the oval field above the columns show the socioeconomic profitability of tailored exercise if one in three cancer patients uses the provision. They represent an average user of the provision (height of the columns) with the uncertainty range for low and high estimates in brackets (uncertainty lines in the figure).

Uncertainty analysis

To investigate the robustness of our analyses, we performed several uncertainty analyses where we varied one assumption at a time (one-way sensitivity analysis). We investigated how alternative assumptions influenced the overall societal value of tailored exercise, given that one in three cancer patients uses the provision. The results of the uncertainty analysis are summarised in Table 6-5.

Across the analyses, the results were most sensitive to changes in the rent for the Cancer Fitness Centres and to assuming a higher benefit in the form of quality adjusted life years. When we assumed that the rent was NOK 2 000 per square metre, the intervention was no longer socioeconomically profitable, with a net societal loss of almost NOK 6 million. When we assumed that exercise provided cancer patients with an average of 0.10 quality adjusted life years, on the other hand, the intervention was socioeconomically profitable with a societal value of NOK 1.1 billion.

Table 6-5: Results of the uncertainty analysis

Assumption	Overall societal value (NOK million)
Cancer Fitness Centre rent increases to NOK 2 000 per m^2	-5.9 (-158.8-+132.9)
Number of FTEs in the Cancer Fitness Centre increases to 2.5	106.4 (-79.6-+279.2)
Cost of exercise with AKTIV instructor is reduced by 50% (from base case)	198.8 (-24.6-+414.5)
Cost of exercise AKTIV instructor is increased by 50% (from base case)	141.6 (-46.6-+308.9)
Exercise provides 0.10 quality adjusted life years	1 121.1
Exercise allows cancer patients to return to work two weeks earlier	207.8 (-16.8-+418.1)
Cost per health-service consultation is NOK 4 000	192.2 (-35.6-+405.7)

Source: Oslo Economics analysis. Overall value for society if one in three cancer patients uses the provision

7. Discussion – what should the health service focus on in the future?

Cancer cases are expected to increase in coming years. At the same time, the health service is coming under ever greater pressure and stronger demands are being made for good and integrated patient treatment. Tailored exercise as a supplement to cancer treatment and post-treatment follow-up can have a positive effect – both in coping with the treatment and in countering its latent effects. Patients using a tailored exercise programme experience great benefit from this – and emphasise that more people must have access to a comparable provision.

Exercise as part of cancer treatment

It has been well documented that exercise yields health benefits for all, regardless of their illness and other characteristics. Nevertheless, we have limited this analysis to investigating the value of exercise for cancer patients. The latter are particularly vulnerable to an accelerated ageing process and a worsening in their health condition as a result of the cancer treatment. Exercise can help to moderate or counter this process. As a result, exercise as an integrated part of cancer treatment can contribute to better health and quality of life for cancer patients both during and after treatment.

This is in line with Norwegian health policy. Norway aims to be a leader for cancer treatment and care. The new national cancer strategy emphasises the need for cancer care to be tailored and user-oriented, with the emphasis on prevention, and for patients to be able to live longer and better with a diagnosis. AKTIV Against Cancer and the provision of tailored exercise in the Cancer Fitness Centres and through the AKTIV instructors can help the country to reach these goals – in an accurate and cost-effective manner. Nevertheless, some challenges must be overcome to achieve this.

Potential for reaching out to more users

Specialists and users confirm the societal value of exercise as part of cancer treatment, and many see a big potential to reach out to more users. Many maintain that both Cancer Fitness Centres and AKTIV instructors represent a locally unused resource. Given the national cancer strategy and the home patient pathway, a particular requirement exists to secure the transition between the specialist and local health services. AKTIV instructors can play an important role in this context.

Many want better details and more marketing of tailored exercise. They report it was a matter of chance that they heard about Cancer Fitness Centres, and want health personnel giving treatment to provide more information about this provision. A number of users also say that it was difficult to get started with tailored exercise after their time in a Cancer Fitness Centre, and that it would be useful if these facilities could help in making contact with a local AKTIV instructor. For their part, the latter see a big demand for their service but that it can be hard to recruit enough patients.

In the survey conducted by Oslo Economics, AKTIV instructors say they want a closer collaboration with AKTIV Against Cancer, the Cancer Fitness Centres and their local authority to strengthen recruitment to the service. Some find that their local health service knows little about it and refers few patients to AKTIV instructors, particularly those working for commercial gyms.

Furthermore, specialists note that health provision varies between cancer patients who live near a Cancer Fitness Centre and those who do not. Patients with access to a Cancer Fitness Centre have good exercise provision which is virtually free, while those who live far away must pay for tailored exercise from a personal trainer.

What should the health service do in the future?

Exercise and cancer as a research field remains at an early stage. In our analysis, we have therefore adopted a conservative approach to the effect of exercise. Nevertheless, the analysis shows that exercise has big effects for cancer patients with regard to health and quality of life – and the intervention is regarded as socioeconomically profitable.

In order to ensure a well-coordinated exercise provision for cancer patients, its financing needs to be assured. Establishment of the Cancer Fitness Centres and their operation for the first three years is fully financed at the moment by the private AKTIV Against Cancer foundation. Ensuring continued funding of tailored exercise for cancer patients will be required to maintain a provision which is already well functioning and found to be extremely valuable by cancer patients.

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Appendix: data sources

We have reviewed relevant research literature, reports and other available information (such as annual reports from Cancer Fitness Centres) about exercise and cancer.

In addition, we have conducted in-depth interviews with the following players:

- researchers and other specialists with expertise on exercise and cancer (five people in all)
- staff at AKTIV Against Cancer and in the Cancer Fitness Centres (six people in all)
- Cancer Fitness Centre users (six people in all)

The information we have received through these interviews has provided background data for the study. All conclusions drawn and assessments made in the analysis are our own. We would like to thank our informants for their contribution to the study.

In addition to interviews, we conducted two surveys. One was distributed to managers/operators of the Cancer Fitness Centres to learn more about the operation of these facilities and their exercise provision. Another survey was distributed to AKTIV instructors registered on AKTIV Against Cancer's website in order to find out more about where they work and how they use their expertise as AKTIV instructors.

Seventeen of the 33 Cancer Fitness Centre managers representing 24 of the facilities, responded to the survey. Ullevål and the Radium Hospital provided a joint response. The survey included questions about Cancer Fitness Centre staff and the services they offer users and other groups.

Forty-one per cent of the 241 registered AKTIV instructors responded to the survey. That represents a response rate of 17 per cent. Our survey asked questions about their workplace, for example, how their users have heard about their service, what activities they think are most beneficial for the patient, and how long and how often they get the impression users take advantage of the service.

Questions we asked in both surveys covered such subjects as what the Cancer Fitness Centre staff and AKTIV inspectors did, their present capacity and opportunities to take on more users, financing of the service, their impression of the user group and their experience of the benefit to users.

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