

Work trajectories after a sickness absence due to cancer in Catalonia (Spain)

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To participants of the study, who shared their experience and without whom this thesis wouldn't have been possible. And to every person that has dealt or is dealing with cancer during their working life.

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Abstract

Background: Previous studies on cancer and its effects on work, both qualitative and quantitative, have mainly focused on the moment of return to work (RTW), being scarce those with a life course perspective.

Methods: A mixed method study was carried out. Quantitative analyses were based on a retrospective dynamic cohort of Spanish salaried affiliated workers, residents of Catalonia, who had a sickness absence (SA) due to cancer during 2012-2015. They were matched by sex, age and onset of time at risk to a worker with SA due to other diagnoses and to another worker without SA. The probability of accumulating days of employment and unemployment, employment trajectories (EPTs), and labour market trajectories (LMPP) were measured. Negative binomial models, linear regression models, multinomial regression models, latent class growth models, and sequence and cluster analysis were applied to assess future working trajectories and differences between comparison groups. For the qualitative analyses, a descriptive approach with a socio-constructivist perspective was applied. Theoretical sampling was carried out until saturation. Six discussion groups (4-8 people/group) and an individual interview were conducted with main stakeholders involved in cancer and work. The interviews were transcribed verbatim and analyzed using thematic analysis and mixed coding.

Results: Men and women who had a SA due to cancer had a lower probability of continuing in employment compared to workers with

an SA due to other medical diagnosis and, especially, compared to workers without SA. Male workers with SA due to cancer showed a higher probability of being in the LMPP of death than their counterparts, and in women with an SA due to cancer higher probability of increasing permanent disability and death was observed. Risk of future retirement was lower in workers with no SA. Among detected barriers to RTW and work retention: lack of information and guidance on work and SA, lack of side effect recognition, lack of consideration of job tasks by medical tribunals, and working in a precarious employment. Facilitators included workplace support, psycho-oncologists, patient associations, and working for a public company.

Conclusion: Companies and social security system should be adapted to the needs of working cancer survivors, in order to prevent adverse work outcomes or even early retirement and permanent disability when possible.

Key words: cancer survivorship, sickness absence, employment trajectory, early retirement, permanent disability, qualitative analysis, return to work, barriers, facilitators.

Resumen

Antecedentes: La literatura sobre el cáncer y su efecto en el trabajo, tanto cualitativa como cuantitativa, se ha centrado principalmente en el momento de la reincorporación al trabajo y no tanto en una perspectiva de curso de vida.

Métodos: Se realizó un estudio de método mixto. El diseño de los análisis cuantitativos se basó en una cohorte dinámica retrospectiva de personas trabajadoras asalariadas, afiliadas a la Seguridad Social, residentes en Cataluña, y que tuvieron una incapacidad temporal (IT) por cáncer durante 2012-2015. Estas personas fueron emparejadas por sexo, edad e inicio del tiempo a riesgo con una trabajadora con IT por otros diagnósticos y otra sin IT. Se midió la probabilidad de acumular días en empleo y desempleo, trayectorias de empleo (EPT), y trayectorias en el mercado laboral (LMPP). Se aplicaron modelos binomiales negativos, modelos de regresión lineal, modelos de regresión multinomial, modelos de crecimiento de clases latentes, y análisis de secuencias y conglomerados para evaluar las trayectorias laborales futuras y las diferencias entre los grupos de comparación. Para los análisis cualitativos, se aplicó un enfoque descriptivo con una perspectiva socioconstructivista. Se realizó un muestreo teórico hasta la saturación. Se realizaron seis grupos de discusión (4-8 personas/grupo) y una entrevista individual con los principales agentes implicados en el cáncer y el trabajo. Las entrevistas se transcribieron verbatim y se analizaron mediante análisis temático y codificación mixta.

Resultados: Los hombres y las mujeres con una IT debido a un cáncer mostraron menor probabilidad de continuar empleadas en comparación con las que tuvieron una IT debido a otra causa médica y, especialmente, comparado con las personas trabajadoras sin IT. Los hombres con IT por cáncer mostraron una mayor probabilidad de estar en el LMPP de muerte que sus homólogos, y en las mujeres con IT por cáncer se observó una mayor probabilidad de incapacidad permanente y de morir. En comparación con las personas trabajadoras con IT debida al cáncer, el riesgo de jubilación futura era menor en las trabajadoras sin IT. Entre las barreras detectadas para retornar al trabajo y permanecer en él: falta de información y orientación sobre el trabajo y la IT, falta de reconocimiento de los efectos secundarios, falta de consideración de las tareas laborales por parte de los tribunales médicos y trabajar en empleos precarios. Entre los facilitadores se incluyeron el apoyo en el lugar de trabajo, la existencia de personal de psicooncología, las asociaciones de pacientes y trabajar para una empresa pública.

Conclusiones: Las empresas y el sistema de la seguridad social deben adaptarse a las necesidades de las personas trabajadoras supervivientes de cáncer, para evitar resultados laborales adversos o incluso la jubilación prematura y la incapacidad permanente cuando sea posible.

Palabras clave: Supervivencia al cáncer, incapacidad temporal, trayectoria de empleo, jubilación anticipada, incapacidad

permanente, estudio cualitativo, retorno al trabajo, barreras, facilitadores.

Preface

Cancer is a disease whose incidence has increased over the past decades and is expected to continue to increase. Survival from this disease has also increased significantly due to development of new effective therapies, the identification of risk factors that cause cancer, and early detection. Nowadays survival stands at around 54%, and in some locations such as breast cancer, it is close to 90%. Despite improvements in survival, sequels from treatment affect all dimensions of the lives of those who receive them, even long time after it's finished. The most common adverse effects are pain, chronic fatigue, anxiety and stress or mobility limitations. They can last up to five years after treatment and in some cases 10 or even 20 years. As a result, when the acute phase of the disease is over, an increasing focus is been put on quality of life of survivors.

One of the most affected dimensions is working life. For working survivors, adverse effects translate into reduced work ability. As a result, in many cases the worker is no longer able to fulfil his or her tasks and leaves the workplace. In the current context of high-income countries, where a social protection system is in place, there is an urgent need to extend working life due to the ageing of the population. Estimates predict an extension of working life in the European Union beyond the age of 65, with a 10% increase in the participation of working people aged 64-74 by 2070. Given that age is one of the determinants of cancer, the number of working age people with cancer having to return to work after having a cancer is expected to increase.

Previous studies show higher rates of unemployment, early retirement and inactivity in cancer survivors compared to the general population. However, in Spain there is a lack of research on how cancer affects later working life and re-entry into the labour market. In addition, the Spanish labour market is characterised by high rates of unemployment and temporary work, which could worsen an already complicated return to work process.

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INTRODUCTION

1. INTRODUCTION

1.1. Cancer

1.1.1. Epidemiology of cancer: Incidence, mortality, survivorship and future tendencies

Cancer represents a major portion of the disease burden globally, with 19.3 million new cancer cases in 2020 (1), 10.0 million cancer deaths (1), and an estimated 250 million disability-adjusted life years estimated to be due to cancer (2). Predictions indicate that this burden will increase for at least the next two decades with great variations among world regions, specially attending to income (2). The Sustainable Development Goals (SDGs) of the United Nations (UN) for 2030 includes the reduction of the burden of cancer in their objective 3.4 (3).

In the European context, which also represents the Spanish situation, in the last decades, there has been an increase in cancer rates due to population increase, ageing of the population, exposure to risk factors such as tobacco, alcohol, pollution, obesity, and sedentary lifestyle, among others. Also, in some cancer types such as colorectal, breast, cervix and prostate due to early detection and screening programs (4).

In Spain, 149,509 new cases of cancer were diagnosed in males, assuming an age-standardized incidence rate (ASR) using the new European Standard Population of 691.2 per 100,000. In females, 110,946 new cases were diagnosed with an ASR per 100,000 of 422.4

in the same year. These rates include new cases of all ages. Looking at working age population (20 to 64 years) 53,165 new cases were diagnosed in males (ASR per 100,000: 367.3) and 50,685 in females (ASR per 100,000: 341.1). Though estimations in Spain show an increasing tendency of all ages' new cases for the following years, when looking at the working age population, these tendencies are not expected for both sexes. In fact, by 2040, new cases are expected to reach 57,006 in males, but show no variation in females with 50,340 new cases in population of 20 to 64 years of age. All mentioned new cases exclude non-melanoma skin cancer (5).

Most frequently diagnosed cancers in Spain in 2020 were prostate, breast, colorectal and lung. By sex in working age population (20-64 years); prostate (ASR per 100,000: 74.0), lung (ASR per 100,000: 54.8), colorectal (ASR per 100,000: 53.4), urinary bladder (ASR per 100,000: 25.0) and kidney (ASR per 100,000: 19.5) cancers are the most common sites in men; while breast (ASR per 100,000: 136.7), colorectal (ASR per 100,000: 31.8), lung (ASR per 100,000: 24.4), and uterine corpus and thyroid (both with ASR per 100,000: 20.0) cancers were the most common among women (5).

Recent World Health Organization (WHO) estimates showed that cancer is the first leading cause of premature death (before 70 years of age) in 57 of 183 countries, including Spain (6). By sex, in women cancer is the second cause of mortality in Spain after circulatory diseases, first for men accounting for 19% and 27% of all deaths, respectively (7), and it is expected to increase from 112,000 in 2020

to 159,000 by 2040 (4). However, thanks to therapeutic advances, age-standardized mortality for some cancer types has descended (e.g., stomach cancer) (4). In working age population (20-64 years), ASR per 100,000 is 73.2 in females and 112.4 in males. These mortality rates are below European average which are 89.4 and 124.3, respectively (8).

Regarding cancer survivorship, the dictionary of cancer of the National Cancer Institute and other organizations (e.g., the Centers for Disease Control and Prevention and the National Coalition for Cancer Survivorship), state that is “from the time of diagnosis until the end of life”, according to Mullan first description in 1985 (9). However, in order to operationalize and compare survivorship most scientific community accepts a 5-year survival as a long-term survival, and measures for survival are expressed for this timeline (10). In Spain, it is difficult to estimate the real survival rates of cancer due to the absence of a national population registry or regional by all autonomous communities. The survival of cancer patients in Spain is similar to that of neighboring countries. However, these numbers vary among European regions (western, northern, southern, and eastern) (11), which evidences socioeconomic inequalities and differences in the effectiveness of health care systems (12), even in countries with welfare states with universal or high health care coverage. Moreover, intra country mortality and survival disparities occur due to socioeconomic inequalities (13). Population-based cancer survival, in addition to being a fundamental measure to describe the prognosis of cancer patients, is an indicator of the overall

performance of health services across the patient pathway, from early detection and diagnosis to treatment and follow-up (14).

In Spain, cancer overall 5-year survival has been estimated to have doubled in the last decades, and it's likely to continue to rise in some cancer types, albeit slowly, in the coming years (14). Survival increases have been particularly large for colon and rectum cancers, probably related to earlier diagnosis due to population-based organized screening programs, and better patient management (15). An increase in survival was also observed for breast cancer, for which there are well-established screening programs in all Spanish regions. Estimations on the 13 population-based registries of cancer available in Spain (Asturias, Castellón, Ciudad Real, Cuenca, País Vasco, Girona, Gran Canaria, Granada, La Rioja, Mallorca, Murcia, Navarra, Tarragona and Tenerife) show that net survival (after controlling for other causes of death) of patients up to 5 years is 54% in men and 62% in women, similar to other countries in western Europe (14). Differences in net survival between sexes are probably due to cancer type incidence differences. A possible biological advantage mediated by sexual hormones or other considerations such as stage at diagnosis, tumor subsite and histology, and comorbidities (16). Most incident cancer types' net survival up to 5 years were in men: prostate 89.8%, urinary bladder 73.8%, colon 63.1% and rectum 60.4%, stomach 26.0%, and lung 12.7%. Whereas in women: breast 85.5%, uterine corpus 65.5%, colon 63.9%, rectum 62.7%, and lung 17.6% (14).

1.1.2. Cancer treatments and side-effects

Cancer treatment depends on the type of cancer, its stage at diagnosis (I, II, III, IV), and individual characteristics of the tumor and patient-related factors (sex, age, comorbidities, etc.). Most common cancer treatment protocols are surgery, radiation therapy, and systemic therapy, including chemotherapy, targeted therapy, hormonal therapy, and immunotherapy (17).

There is a gap of knowledge in treatment's side effects, on the short-term in the case of new therapies, and on the long-term for well established treatments. Besides, among side effects there are also the late or latent side effects which appear months to years after the completion of treatment (18). Cancer has long been a disease with a very high mortality rate. Thus, great investment has been put into research on treatment development in the last few decades, with the consequent improvement in survival rates. However, cancer treatments are characterized by their toxicity, and health burden of novel treatments on the long-term and their impact on survivors' quality of life remains unknown. Also, many cancer types remain with a high mortality rate. Hence, treatment with early phase of development therapies or participation in clinical trials are commonly used in cancer survivors when other options are not working. In these cases, long-term side effects and late toxicity has still not been well documented. Moreover, when new treatments are approved for clinical practice, long-term follow-up of patients receiving these treatments is not planned, so prevalence of physical and psychosocial

morbidity, and premature death in the long run caused by them remains unknown and thus unrecognized (19).

Generally, chemotherapy results in acute toxicities that can persist, whereas radiation therapy leads to side effects that are not immediately apparent. Combinations of chemotherapy and radiation therapy are more often associated with late effects. Risk of late death from causes other than recurrence is greatest among survivors treated with a combination of chemotherapy and radiotherapy (18). Hereunder, a summary of the most common cancer types' side effects. Among the side effects caused by the treatment of breast cancer lymphedema of the arms, numbness, tingling, or tightness of the chest wall, arms, or shoulders have been reported. Persistent pain is one of the most common side effects after surgery or radiation therapy in breast cancer, and younger women and those who undergo axillary lymph node dissection have the highest risk. In addition, chemotherapy can lead to premature menopause, osteoporosis, impaired fertility, sexual dysfunction, neuropathy, cardiomyopathy, and congestive heart failure. Reports of sexual dysfunction are common in breast cancer survivors yet often go unaddressed. Breast cancer survivors may also experience cognitive impairments and chronic fatigue. Among colon and rectum survivors, neuropathy is a common side effect of the chemotherapy regimens typically used for colorectal cancer. Chemotherapy-related diarrhea occurs in many patients treated for colorectal cancer but usually resolves. Also, increased stool frequency, incontinence, radiation proctitis, and perianal irritation is common, especially those treated with pelvic

radiation. Likewise, bladder dysfunction, sexual dysfunction, infertility, and negative body image. Lung and bronchus suffer from impaired pulmonary function, severe acneiform rash, immune mediated toxicities. Prostate cancer treatment adverse effects include urinary incontinence, erectile dysfunction, bowel complications, loss of libido, hot flashes, night sweats, irritability, and gynecomastia. In the long term, hormone therapy also increases the risk of osteoporosis, obesity, and diabetes. Urinary bladder includes urinary frequency and incontinence. And uterine corpus, infertility, menopause in premenopausal women, bladder and bowel dysfunction, atrophic vaginitis, vaginal stenosis, and leg lymphedema (if pelvic lymph nodes removed). Sexual problems are commonly reported (17, 20, 21).

1.1.3. Survivorship research and strategic plans against cancer

Due to the increase in survival rates, cancer is considered not only an acute disease anymore but also a chronic disease with long term survival (22). In this paradigm change, survivorship research appears in the face of the need to study its impact on health on the long term, but also on every aspect of the survivor's life beyond the acute diagnosis and treatment phase; economic, psychological, and functional aspects (18).

This has resulted in a growing interest in evaluating which are the determinants of health-related quality of life (HRQOL) of cancer

survivors. The literature shows a wide range of factors related to HRQOL: feelings of uncertainty about the future, fears related to recurrence of cancer, fears and worries concerning family members, feelings of depression and anger, feelings that others do not understand the impact of cancer, positive impact on social relationships, perceived positive changes in life, negative body image, cognitive problems, fatigue, sleeping problems, pain, sexual problems, and dealing with the chronic physical consequences of cancer (23).

Many of the physical health issues and psychosocial issues affecting HRQOL are specific to cancer type. These differences may be related to survival rates between the cancer types, age at diagnosis, type of treatments, and whether a cancer diagnosis is sex-specific (23). A recent metaanalysis evaluating the quality of life of cancer survivors found that the worst effects on quality of life were found in the role-physical health which includes survivors' ability to work and perform normal activities of daily living other than eating, bathing, or dressing. As they showed, cancer survivor's ability to work continues to be significantly negatively impacted at an average of 6 years after diagnosis. This same study found treatment and the presence of comorbidities as potential moderators of quality of life of survivors (24). Moreover, HRQOL of cancer survivors has been related to higher socioeconomic status, older age, and longer time since last treatment in physical and mental domains; while comorbidities, and unhealthy lifestyle have been associated with poorer HRQOL (21,

25). These results emphasise the holistic understanding of the disease and treatment, and prevention of the adverse effects.

Studies looking at mental and emotional health in cancer survivors show varying results in prevalence of depression, anxiety, and distress. A systematic review in breast cancer survivors found a range of prevalence of depression and anxiety. Differences with general female population were only found in depression, but not anxiety, and risk was higher one year after diagnosis and diminished overtime (26). However, when looking at long term effect, five or more years from survivorship for all cancer types, prevalence of depression and anxiety among survivors are not clear. On the one hand, they were found comparable with those in general population by a systematic review (27), contrasting with higher prevalence rates found among cancer patients during and shortly after diagnosis and treatment (28). They argued several reasons for differences in their results, such as 1) that survivors may have been treated in the short term when symptoms arose; 2) that maybe survivors with symptoms of depression were less likely to participate in studies; and 3) that as depression has been related to premature mortality in cancer survivors, those with depression may not have been captured before this fatal event (26, 27). On the other hand, another study looking only at survivors' depression and anxiety prevalence at 5- and 10-years from diagnosis suggested higher prevalence than general population. This study reported 17% of depression and 9% of anxiety in survivors, with no differences in prevalence between two timelines (29).

Furthermore, HRQOL has also been related to occupational status. A study carried out on working and non-working cancer survivors found that non-working cancer survivors had significantly lower HRQOL than working cancer survivors. Non-workers were more likely to have low level of education, low income, and being single rather than married compared to working survivors. Low education was related to physically demanding and low-paying work. Moreover, comorbidities and depressive symptoms and suicidal ideation in the previous year was found to be a significant predictor of HRQOL of non-workers (30). Similar results have been found in other studies (31,32).

As work after cancer is associated with quality of life, return to work (RTW) is increasingly being related to rehabilitation of cancer survivors (32). Traditionally, rehabilitation has been more directed to physical functioning impacted by cancer treatment (33). However, as survivors are affected by both physical and psychological distress, a rehabilitation plan provided by the health care system has been pointed as important for job loss prevention and to help individuals find adequate strategies to be able to RTW. Also, such plan could strengthen the patients' feelings of security and coping strategies (31). Besides, this plan should develop a more holistic approach that considers all survivors' needs, including functional, psychological, cognitive, social, sexual, and nutritional symptoms. Rehabilitation should also focus on going back to their previous life, thus including a work perspective and RTW on it with a person-centered approach (21, 33).

Given the evidence, high-income countries are starting to make recommendations towards the development of survivorship care plans to overcome difficulties in providing quality long-term care. Pioneer countries on long-term care include the US, Australia, Canada and the UK (34–36), which already incorporate in their guidelines, “social rehabilitation including employment issues”. In fact, in 2017, the European Guide on Quality Improvement in Comprehensive Cancer Control, a project aimed to contribute to reduction of cancer burden in the European Union from prevention to treatment and survivorship was developed. This guide provides good practice recommendations to improve national cancer care planning and care delivery. Among its recommendations on survivorship and rehabilitation, it recognizes that deterioration of physical, mental and social quality of life in survivorship is strongly connected to a precarious working situation (i.e., low income, unemployment). Besides, it states that RTW support should be integrated early into the cancer care pathway and highlights the importance of communication with employers and health care providers. It specifies that ideally RTW support should be provided immediately after diagnosis and during treatment, with a person-centered approach. Hence, apart from clinical factors, intra- and interpersonal factors, patient values, aspirations and priorities, the attitude of colleagues, job demands, and so on should be considered. And receptors of these interventions can be employees, work environment and employers (37).

In 2021, the European Union announced the Europe's Beating Cancer Plan, a comprehensive plan that includes a whole set of measures that include primary to tertiary prevention and support beyond end of treatment (38). They recognize obstacles faced by survivors in the RTW process and the need of measures to facilitate reintegration. However, when it comes to specific actions it doesn't include any, RTW is included under the group of measures "Improving the quality of life for cancer patients, survivors and carers" as "Launch a study addressing issues related to the return to work".

In Spain, a new Strategic Plan Against Cancer was published in 2021. However, survivorship care is still to be integrated in cancer care. As the plan recognizes, quality of life, psychosocial care, and assessment of the needs of patients who survived cancer are unmet challenges of Spanish National Health System. The great majority of the survivorship support is performed by patient and volunteer associations rather than by the National Health System. Thus, survivorship care together with the improvement of rehabilitation and the feasibility of return to work for those patients who wish to do so, are recognized as major challenges for the Spanish National Health Care System (39).

1.2. Cancer in the working life trajectory

Cancer impact on work remaining unsolved has implications in terms of losses for the individual but also for society.

For the individual, cancer, as a life event, supposes a disruption of the life course by changing plans and expectations (40). At the time of diagnosis one of the disruptive events is stopping work to go through treatment. Besides, ending treatment supposes a milestone, and RTW, as part of going back to normality, repairs the disruption associated with cancer and reinforces the sense of recovery rewarding the individual both economically and socially (41). Moreover, being able to work means a sense of purpose and of identity and belonging. It also means a contribution to higher purpose and feeling valued by society (42).

However, as described before, short and long-term side effects are still present after the treatment stage which can last until years after ending the treatment. The risk is multifactorial and has been reported across all cancer sites. These side effects can elongate until 5 years after treatment and in some cases 10 or even 20 years after (20). In working survivors, clinical sequels (pain, fatigue, depression, etc.) translate in a reduction in work productivity and ability to work. As consequence, in many cases, this will end up with the worker no longer being able to fulfil their tasks and leaving their workplace (43). In other cases, as an adverse life event, surviving a cancer has life-changing implications that imply a paradigm shift that leads the patient to decide not to RTW (44).

Finally, another aspect of cancer's impact on work is the economic consequences on survivors as most patients interrupt work to go through the treatment and recover. Hence, throughout the treatment survivors experience a drop on income which varies with the type of job, with higher income levels being more cushioned. This situation directly affects their ability to pay bills (41). This impact on finances has been coined as financial toxicity (45).

1.2.1. Work interruption and sickness absence

Interruption of working life is one of the main life changes when a worker is diagnosed with cancer. There is practically no research quantifying how many workers diagnosed with a cancer decide to continue or stop working while being treated, though existing ones show that most patients stop working to go through treatment (46–48), due to the immediate impact on health state and work ability. A study carried out in Italy based on work interruption data one month after diagnosis found that the decision was influenced by sociodemographic (i.e., number of children), employment conditions (i.e., type of work contract), clinical (i.e., type of treatment and cancer type), and psychosocial (i.e., work-health incompatibility) factors. However, and contrary to other studies, they found that almost 70% of patients didn't stop working, at least on the first month after diagnosis (48). The difference may be due to the short follow-up period of the study.

In countries with a strong social protection system, work interruption to go through treatment is subsidized by sickness absence (SA)

benefit. This benefit is a temporary economic subsidy, provided by the social protection system, its generosity varies between countries and it's paid while the worker is absent from work and presumed to return to her/his job when recovered (49). Regardless of differences among health-care systems and social insurance across countries, the experience of countries that have a SA benefit scheme is that most cancer survivors go on SA if they have access to it, at least in the first stage of the treatment (50–52). Moreover, some studies have shown how, even at a pre-diagnosis stage, SA days are higher in cancer patients than in the general population, probably due to the manifestation of early symptoms of the disease (53). SA due to cancer duration in Europe has been shown to be in average 6–12 months, while the median timeframe between diagnosis and RTW 2 years (range 0.2–23.4 years) (54). These data coincides with a report from the Institution of Occupational Safety and Health's according to which most employees are able to resume normal work tasks within 18–24 months after diagnosis (55).

1.2.2. Work participation after cancer

Impact on work ability

Work ability, defined as an individual's ability to achieve expected work goals, is affected by the adverse effects of cancer and its treatment (56). This is a concept that integrates demands of work, the worker's health status, and resources (57). Work ability is dependent on mental and somatic health status as well as on social skills, level

of education, motivation, work demands, the work environment, and the organization of the work (58).

An in-depth review of the impact of cancer and cancer-related issues on work ability, Munir et al. observed that most cancer survivors have lower work ability compared to those without a history of cancer or those with other chronic conditions (on average 2 years post-diagnosis). Those with a recent history of cancer reported either lower work productivity, and impairments in physical and mental work ability compared to a comparison group of those employed and without cancer. However, according to their results, work ability of those with cancer improves over time: it's reduced at 6 months post-diagnosis but increases at 18 months post-diagnosis, although they remain lower when compared to a healthy comparison group (59). Another review quantified the decrease in work ability in cancer survivors after diagnosis and treatment and found a reduction in physical or mental work ability of up to 26% (58).

Treatment protocols are also associated to work ability. For example, chemotherapy is linked to poor work ability in comparison to other treatments, irrespective of cancer type. Several specific side-effects associated with cancer treatment which affect work ability have likewise been reported, like fatigue, sleep problems and cognitive thinking, among others, and have been related to been absent from work and changes in job role (59).

Other confounding factors related to work ability are co-morbidities, re-occurrence of cancer, and female gender. A study comparing breast, prostate, and testicular cancer survivors with good prognosis 2-6 years post treatment, showed that work ability was higher among males than among females. Also, that work ability was similar in male survivors and controls, whilst female cancer survivors had significantly lower work ability (60). Regarding age, for most cancers, work ability improves over time since diagnosis, irrespectively of age (59).

Return to work

As the overwhelming majority of survivors stop working during treatment, most research on cancer survivorship and work has focused on RTW. Certainly, unsuccessful RTW has a significant impact on direct and indirect social costs paid by healthcare systems or insurance, by patients and their families, employers, and, lastly, society. In Italy, 5 years after diagnosis, the missed overall income for the failed reintegration into work of cancer survivors has been estimated to be of 3.2 billion euros (54). Anyhow, RTW definition can greatly vary among studies. For example, studies may consider different time of RTW (e.g., 1 week, 1 month, 1 year, and so on), or may consider RTW as returning with the same working hours or reduced working hours, even returning to the same or a different job. Hence, different casuistries may be considered under RTW concept. Another aspect to consider when talking about successful RTW is the fact that some survivors may not be able to work anymore, in which case, not returning is the only reasonable option. The International

Social Security Association focuses RTW on persons who are on SA from work, either on a short-term or long-term basis, and who retain an attachment to a specific employer. This is, on employees working while being diagnosed that go on SA temporarily with the idea of resuming work (61). However, this concept is built on the assumption that everybody has a job to which they can return, that losing one's job while being absent is not a possibility, and that every worker has access to SA benefits. In any case, RTW after SA could be considered as a part of a continuum of processes aimed at protecting and promoting the health, well-being, and work ability of the workforce. It could even be considered part of a tertiary prevention approach (61), when it's possible and desired by the worker, as it reduces the impact of the disease by eliminating or reducing disability, minimizing suffering, and maximizing potential years of quality life.

Among RTW research, a systematic review and meta-analysis published in 2020 in people who were working at the time of diagnosis, showed that RTW rates of cancer survivors were around 73%. This study included studies from the USA, the Netherlands, Brazil, Canada, France, Norway, Ireland, Israel, Sweden, and the UK. Europe's RTW rates were 74% (95%CI 69%–79%). Lowest prevalence of work retention after cancer were found outside North America and Europe (56). Another study with the same methodology found RTW rates in Europe of 57% (95%CI 50%–65%) (62). Differences may be because De Boer et al. used longer term survivors (≥ 2 years) who may have higher probability of having returned. Moreover, Tanva et al. only included studies from the Netherlands

and Denmark representing European region. When analyzing only European region, a systematic review including studies from the UK, France, the Netherlands, Denmark, Norway, Finland, and Iceland showed RTW rates ranged from 39% to 77% (54). In Spain, research on RTW is scarce, it has been estimated that around 55% of the SA episodes due to cancer in Spain will end in permanent disability or won't RTW due to other circumstances (63). Also, a very recent study carried out in the Spanish context showed that among a sample of 772 cancer survivors of working age, only 55% were working (64). The latter didn't specify whether working age survivors were working at the time of diagnosis or if they took a SA, so results are difficult to compare.

As mentioned before, variations on RTW measurement and report limit comparisons between studies. As a summary, there are three main reasons behind the differences. Firstly, lack of a systematic measurement of RTW. Paltrinieri et al., for example, proposed looking at RTW at specific time points. As they found, at 6 months after diagnosis, 24% of patients returned to work; at 12 months 50% and at 18 months 64% (54). Secondly, rates and time to RTW vary greatly between types of cancers. Long-lasting SA (≥ 2 years) has been associated with blood, lung, and gastrointestinal cancers for 30% of individuals affected and, to a lesser extent (20%), with upper aerodigestive tract and breast cancers (54). Another study found that male and female genital cancer, skin cancer and breast cancer had the highest RTW rate 2 years after a cancer diagnosis (65). Regarding other cancer types, liver, pulmonary, brain, blood, gastrointestinal,

pancreatic, head and neck, and gynaecological cancers are all significantly correlated with not returning to work (66,67). Thirdly, RTW could be from a full-time contract to a part-time contract, as long-term health impairments from the disease itself or the treatment can delay or prevent individuals from returning to full capacity. Other casuistries could also include going from a full-time SA to a part-time SA supposing a partial RTW. In conclusion, many possibilities may arise in the RTW process depending on the social protection benefits, entitlement to benefits of each worker, or even the willingness of the company. It has been estimated that between 12 and 52% of survivors who had returned to work had reduced their working hours compared to before diagnosis, and it has been reported that survivors work fewer hours than similarly aged people without cancer (68).

Factors affecting RTW and permanence in the labour market

The European Agency for Safety and Health at Work (EU-OSHA) carried out a report based on a review of the existing literature and concluded that although there is not enough quality evidence to draw strong conclusions, the following factors would be related to a less successful RTW (69):

- socio-demographic factors, such as older age or lower educational level.
- work-related factors, such as high physical work demands, a non-supportive work environment, no flexible working

arrangements or no reduced working hours, company size or ownership.

- disease-related factors, such as having head/neck, brain, pancreatic, lung or liver cancer, or an advanced disease.
- treatment-related factors, such as having chemotherapy, extensive surgery or endocrine therapy.
- other miscellaneous factors, such as having comorbidities, fear of unemployment, no advice from a doctor regarding work or low quality of life.

The report summarizes the existing evidence of factors related to RTW until 2017 in the following table. The table below replicates the same table of the report from 2017 updating it until today, and classifies prognostic factors of RTW in the five categories mentioned above.

Table 1 Summary of prognostic factors of RTW after cancer.

Category	Factors listed and described in the articles	Evidence base
Socio-demographic factors	Older age (-) Higher education (?/+) Male gender (?/+) White ethnicity (+) Higher socioeconomic status (+/-) Marital status (+/-)	<u>Systematic reviews</u> (70), (71), (72)(73) <u>Observational study</u> (74) (75)(76) (77) (78) <u>Qualitative syntheses</u> (79)

<p>Work-related factors</p>	<p><u>Type of work</u> Manual occupation/blue collar workers (-) High work demands (-) Self-employment (-) Precarious employment (-) <u>Work setting</u> Clear workplace policies and protocols for insurance and employer support (+) Flexibility of schedule (-) Flexible RTW conditions (+) <u>Social factors of work</u> Supportive colleagues (+) Supportive supervisor (+)</p>	<p><u>Systematic reviews</u> (70), (71), (72)(73) <u>Observational study</u> (76)(78) <u>Qualitative syntheses</u> (79) <u>Qualitative study</u> (80)</p>
<p>Disease-related factors</p>	<p>Advanced stage of disease (?/-) Cancer site (-) <u>Symptoms</u> Cancer symptoms (-) Functional limitations (-) Pain, anxiety, fatigue (-) Adverse side-effects (-)</p>	<p><u>Systematic reviews</u> (70), (71), (72) (73) <u>Observational study</u> (74) (75)(76) (77)(78) <u>Qualitative syntheses</u> (79) <u>Qualitative study</u> (80)</p>
<p>Treatment-related factors</p>	<p><u>Type of treatment</u> (Neo)adjuvant therapy (-) Type of surgery (-/?) Chemotherapy (-) Radiotherapy (-) Postoperative complications (-)</p>	<p><u>Systematic reviews</u> (70), (71), (72)(73) <u>Observational study</u> (75) (77)(78) <u>Qualitative syntheses</u> (79)</p>

Other factors	Comorbidities (-)	<u>Systematic reviews</u>
	Higher health-related quality of life (+)	(70), (71) (73)
	Previous unemployment (-)	<u>Observational study</u>
	Perceptions of incapability to work (-)	(81)
	Feeling incapable of returning to the former job (-)	<u>Qualitative syntheses</u>
	Insufficient insurance coverage (-)	(79)
	Intention to apply for a disability pension (-)	<u>Qualitative study</u>
	Job self-efficacy (+)	(82)
	Value of work (+)	<u>Intervention study</u>
	Re-evaluation of meaning of work (-)	(83)
	Job self-efficacy (+)	
	Lower self-rated health (-)	

Factors were considered by the authors as barriers (-), facilitators (+), having no relevant association with RTW (0) or having an unspecified/inconclusive association with RTW (?).

Evidence on adapted RTW interventions

De Boer et al. in their latest narrative review (84), proposed the approach to planning interventions based on the *Arena in work disability prevention model* by Loisel et al. (85), adapted to cancer survivors by Greidanus (86). In this model, all stakeholders and factors involved in survivors' relation to work are mapped, from more proximal (closer to the core) to more distal factors in four dimensions or systems: workplace, health care, personal, and legislative and insurance systems.

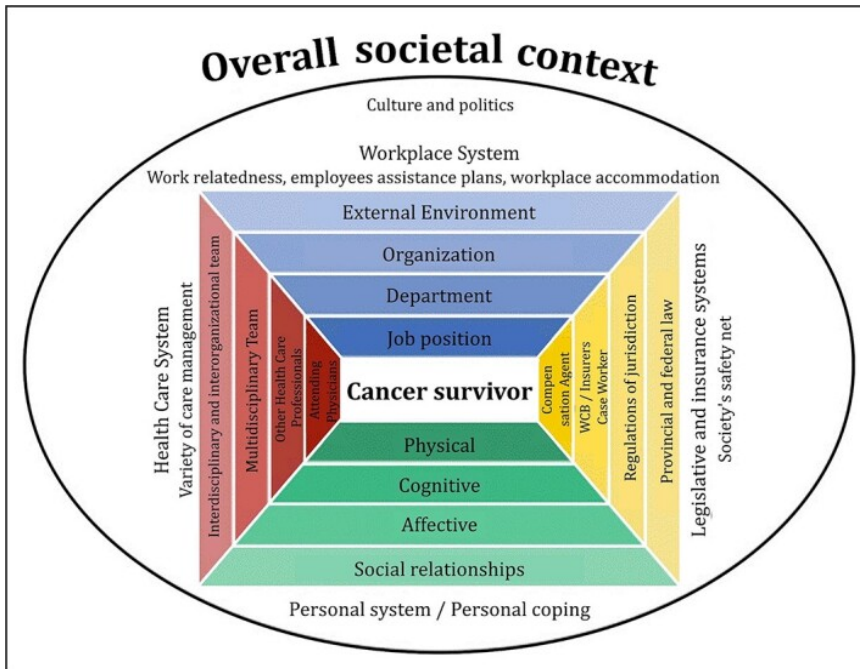


Figure 1: Arena in work disability model in cancer survivors (86).

This review identifies two types of interventions. On the one hand, unidimensional interventions targeting one component of the model: psycho-educational, vocational, and physical interventions and multidimensional interventions. Psycho-educational interventions are focused on personal factors of the model with the aim buffering adverse work outcomes by targeting the negative psychological consequences of cancer and its treatment. Vocational interventions focus on workplace factors with the aim diminishing adverse work outcomes by supporting cancer survivors with work modifications. Lastly, physical interventions are focused on personal factors, and their aim is to improve the cancer survivors' physical functioning and counteract the negative physical consequences of cancer and its treatment. Regarding multidimensional interventions, they combine

elements of psycho-educational, vocational and/or physical interventions (84). However, integrating all dimensions of the RTW process have been found as an important aspect of RTW interventions, being multidimensional interventions more effective than unidimensional interventions.

A systematic review in 2019 showed that interventions aimed at maintaining or enhancing RTW for cancer patients are still scarce and are methodologically weak. As the review concludes, interventions don't significantly improve RTW compared to usual care. Authors justify these results in the design and the methodology followed to build the interventions as sociodemographic and medical factors associated with less likelihood of returning to work are not taken adequately into account. Also, integration of the concept of recovery when designing an RTW intervention has been recommended; thus, RTW should be recognized as one of the components of survivors' recovery. This concept of recovery means that survivors can regain a meaningful life despite persistent symptoms. Cancer survivors should be guided on how to manage the multiple hurdles that they go through after treatment (e.g., late adverse effects, how and when to announce they were diagnosed with cancer, how to manage follow-up exams, physical activity and RTW) (87).

Another issue detected by authors is that employers/workplaces are generally not involved in the interventions developed (87). In this sense, a report by the Institution of Occupational Safety and Health on health and safety implications of returning to work after focusing on workplace factors, found that cancer RTW policies were not used

by most organisations. As they found, work ability concept can help identify job factors that require modification, including physical and mental demands. And they identified that key elements of any critical illness or cancer policy were: respect for the employee's dignity and privacy; maintenance of employee involvement and engagement; assurance that the employee suffers no financial detriment; provision of employee benefits; adoption of a flexible approach; continues provision of information and support; and support from the rest of the team, including the manager (55).

In light of the lack of consistent evidence, De Boer et al. made general recommendations in their narrative review. One of them is the importance of tailoring interventions, putting survivors' needs at the center of the intervention as treatment side-effects, type of cancer, RTW timing, etc., can considerably vary RTW needs. The second is the detection of vulnerable groups, such as low income, low level of education, minoritized ethnic background and/or being unemployed, work disabled, or in precarious employment at the time of diagnosis. These groups experience the most adverse work outcomes and are at higher risk of marginalization. Third, aim for a better understanding of the impact of the health care and legislative system and cultural context on adverse work outcomes of cancer survivors (84). Welfare States and employment reincorporation policies differ between countries (88). In Europe, there are various countries that perform interventions to adapt the workplace for cancer survivors, such as Scandinavian countries and the United Kingdom (89,90). Also, there are other countries like USA and Canada. However, in Spain, there is a lack of research on cancer survivors' return to work (80).

Drop out from work: unemployment, early retirement, and permanent disability

As the RTW rates show, they do not capture the entire spectrum of the relationship between cancer-related health and work situations. Among workers who don't RTW, some may be receiving a permanent disability pension, declare unemployment with or without benefits, or exit the labour market through an early retirement. Furthermore, even if survivors' RTW treatments yield periods of both high and low levels of work ability, a survivor may RTW but experience late side-effects that affect their ability to work time after returning, so complementary longitudinal indicators may be needed. The measurement of working trajectory after cancer should reflect adverse and long-term work-related social consequences in the population. As the literature shows, work retention may be higher in the second, third and fourth year after diagnosis, followed by a modest decline in later periods (68). Moreover, a study on Japanese male survivors showed that the rate of work continuation after RTW decreases steadily over time and that according to their results, on average, survivors continue working for only 4.5 years after work resumption (91). The decline in work trajectories could reflect people dropping out of the workforce due to cancer-related symptoms such as long or late effects, or cancer recurrence.

Cancer survivors have been found to be at greater risk of unemployment than the general population. A meta-analysis considered as a reference on the field, found overall cancer survivor risk of unemployment to be 40% higher than healthy control

participants. When authors looked at cancer types separately, breast cancers (30%), gastrointestinal cancers (44%) and cancers of the female reproductive organs (30%) maintained the trend; but not blood, prostate, or testicular cancers (92). However, this meta-analysis, as most studies, didn't discern between unemployment with benefits or without benefits. A nationwide population-based study in the Netherlands looking at unemployment with benefits in breast cancer survivors showed they experienced 20% higher risk in the interval 2–5 years after diagnosis (93). In the Spanish context, literature looking at unemployment in cancer survivors (with or without benefits) is still very scarce, but recently Picazo et al. published a paper looking at unemployment and early retirement. Their results showed that the only disease-related variable that was associated with employment level was the type of cancer, being the diagnoses in which the proportion of unemployed/pre-retired survivors exceeded that of those employed were: colorectal (43%), multiple (36%), and head and neck (35%). In prostate diagnosis, it was the same. The diagnoses with higher proportion of employment were melanoma (71%), gynaecological (67%), breast (60%), and hematologic (58%) (64).

Some survivors face adverse effects that disable them to carry out their work. This is a very important matter related to financial toxicity and social exclusion. In countries with a strong social protection system, when RTW is not possible due to health state of the survivor, Social Security has permanent disability benefits to protect the worker with a serious cancer disease from economic vulnerability. A study looking at colorectal cancer survivors found a 70% higher risk

for a permanent disability pension for survivors with localized cancer, three times higher risk for regional cancer, and 10 times higher for distant cancer, than their matched controls (94). Permanent disability rates are higher than in general working population but there are differences between cancer types, treatments and stage at diagnosis (95,96). The risk for permanent disability pension has been most studied in the Scandinavian countries. However, in these and other countries, due to the difficulties in Social Security System sustainability, especially due to ageing population, some laws have been reformed towards a stricter criterion to have access to a permanent disability pension. Anyhow, studies show that, even if the permanent disability pension rate has been reduced among cancer survivors, it remains higher than in the general working population (97).

For survivors who are diagnosed close to retirement, early retirement appears in the literature as an alternative of choice among older cancer survivors as they show higher rates compared to the general population of the same age. The risk of early retirement pension was found to be 55% higher in women and 60% in men cancer patients compared to a matched control group in a Danish population-based cohort study. The risk was higher for leukaemia, prostate and ovary survivors. They also observed that the risk was maintained even 8 years after diagnosis (98). Other studies with smaller study samples and without a control group have been carried out. A more recent one assessed 750 cancer survivors at the beginning of rehabilitation, and two other time points. They saw how the desire of early retirement

was higher at the beginning of rehabilitation than at the end, and that 13% of survivors ended up retiring early. This decision was based on physical limitations, but also they found that SA periods, less favourable workplace environments, lower work ability, higher psychological distress and lower quality of life were also associated with this decision (99). The same prevalence was found in a study on breast cancer survivors who found that 11% retired early, and that low education, low physical quality of life, co-morbidity and pain were associated with the decision (100). A study on a sample of prostate cancer survivors saw higher early retirement risk in older men (>50) with stage IV disease, full-time employment, and caring responsibilities (101).

1.3. The Spanish setting

1.3.1. Labour market

Spain has a population of over 47 million. The Spanish economy is the fourth largest in the European Union and the 14th largest in the world in terms of nominal gross domestic product. Spain's business structure, as many other countries, is highly fragmented, consisting of small independent businesses. In fact, 8 out of every 10 companies in Spain have two or less employees. Most small businesses are in the services sector, especially in trade. In contrast, most large companies operate in the industrial sector. By economic sector, services sector including hotels and catering, transport and retail, information and communications, financial and insurance activities, real estate, professional, scientific and technical activities,

administrative and auxiliary services, education, health and social work and other social activities is the most prominent in the categories of businesses, accounting for approximately 61% of the total. Trade which includes wholesaling, in retail and trade brokers, is also significant, accounting for 20% of the total. Lastly, companies in the construction sector accounted for around 10% of the total, while industry represents 5% (102).

The country's economic situation completely changed because of the COVID-19 health crisis and the impact of the measures taken to contain it. However, since 2021 and 2022 it has improved following the initial impact of the pandemic. The increase in economic activity in general and, above all, the revival of the services sector, was felt in the labour market, with an increase in employment and a decrease in unemployment (102).

Nowadays, Spain's active population is conformed by more than 20 million of workers (103) and employment rate is around 50.8% (57% men and 46.0% women) (104). Spanish labour market shows several structural problems, the main ones are high unemployment rates combined with high share of temporary contracts, job insecurity and wage inequality (105). Moreover, there is a gender breach in these indicators which are disproportionately higher in women (106).

Unemployment has historically been a problem in Spain. However, the recession in 2008 aggravated this problem. It reached 19% in 2009 and peaked at about 27% in early 2013. Since then, it has been

on decline (107). However, unemployment rates are still nowadays very high in comparison to the rest of the European Union countries. In 2022, the unemployment rate in the European Union for people aged 15-74 years reached a historic low of 6.2% (6.4% women, 5.8% men), marking the lowest rate since 2009. In Spain it was 12.9% (14.8% women, 11.3% men) for the same year, the highest in the European Union despite significant reductions in the previous year (108). In Catalonia, the unemployment rate in 2022 was 9.7% (10.3% women, 9.1% men) (109), even though it was below the average in Spain the same year, still would be high compared with EU average (110).

Unemployment rates, however, show differences by age, sex, level of education, and migration status. Regarding level of education, unemployment increases as level of education decreases. Spain has one of the highest unemployment rates among workers with low education (17.5%), after Slovakia (37.7%) and Sweden (19.2%). Although Spain's labour market, and indeed Catalanian as well, is improving in terms of unemployment, still has severe structural problems (111). Unemployment as well as both temporary and long-term unemployment remain significant problems in the young population of Spain. Although in the European Union unemployment rate for young people aged 15-29 years consistently exceeded the overall unemployment rate (for people aged 15-74 years) since 2009, Spain has considerably higher youth unemployment than Europe's average (around 24% in 2022 versus 11.3% in the European Union). (108). These high rates of unemployment add to the share of

temporary contracts in this population. The dual nature of the Spanish labour market, in which temporary contracts with low firing costs and open-ended contracts with high firing costs coexist (107) it's likely to explain the strong volatility of youth unemployment. Also, the attempt to recover employment level has relied on the growth of part-time employment, nonstandard work, and temporary employment (111).

In Spain, high unemployment in women remains unaddressed (111) as shown in unemployment rates above. Unemployment gender gap was decreasing before the Great Recession. However, it started widening again after 2012 (107). Not only do women have one of the largest differences among European Union countries, but women also show the highest differences in long term unemployment (6.1% women, 4.1% men in 2022) (108).

Another structural problem in the Spanish labour market is it's high temporary employment rates. Before the Great Recession the overall share of temporary jobs was above 30%, almost three times the Organization for Economic Cooperation and Development (OECD) countries' average, with temporary employment being more prevalent among women and youth. After 2008 it declined due to job destruction during the crisis. By 2018, the gender gap in temporary employment appeared to reopen (107). A report released in 2019 by the ILO (International Labour Organization), positioned Spain on the highest number of temporary work contracts lasting six months or less, accounting for more than half of all temporary contracts, being

more likely to be involuntary. They also stated that this involuntariness accounted for up to 60% of part-time contracts in Spain (112).

Data on temporary employment in 2022 show a 12.1% of temporary employment in the European Union, with the highest shares recorded in the Netherlands (23.2%) and in Spain (18.1%). These rates in Spain were higher among people aged 15-29 (39.2%), and decreased in older individuals until 9.1% in 55-64 age group (113). In Spain, as in other OECD countries, many young people enter the labor market through this form of employment. However, Spanish youth tend to stay on temporary contracts much longer. Anyhow, temporary employment rates have decreased since the entry into force of Royal Decree-Law 32 2021 of 28 December, on urgent measures for labour reform, the guarantee of employment stability, and the transformation of the labour market (114).

Experts have pointed out how Spain's levels of long- and very long-term unemployment are so unsustainably high that they suppose a risk for social cohesion, and that public employment services should give priority to the early activation of the unemployed in order to avoid their addition to the ranks of the long-term unemployment and temporary employment rates (107). This issues disproportionately affect vulnerable populations such as cancer survivors or workers with other chronic diseases, apart from the ones mentioned above and urgent attention should be put on them.

1.3.2. Social Protection System and cancer

A welfare State is defined as a form of government which guarantees the protection of basic needs, reducing social and health inequalities and promoting social justice through redistributive social transfers and social and health benefits (115). In countries with a strong social protection system, like Spain, there are several mechanisms of wealth distribution. For the interest of this thesis social protection benefits related to working population will be highlighted, which are conformed by sickness absence, unemployment benefits, permanent disability, early retirement and retirement benefits.

Sickness absence benefit coverage is one of the most important elements of the Welfare State. In Spain, as in other high-income countries, provided by Social Security, SA is defined as an absence from work due to a medically certified health-related problem which is unbalanced with work demands. It's a tool of social protection that recognizes economic (i.e., sickness absence benefits by the Social Security System) and medical support from the National Healthcare System during the episode. SA can be work-related or caused by a common disease or a non-occupational accident, this is, non-work related (116). For the thesis interest will from now on the description will only refer to non-work related SAs, which are the great majority of the SA in Spain (117). To be entitled to this subsidy, workers must be affiliated to Social Security for 180 days or more in the last five years, and there must be medical examination and SA is certified by the family practitioner from the National Healthcare System.

Maximum duration of sick leave is 365 days, which can be extended for another 180 days if recovery and return of the worker to workplace are expected at that time (116). Although the maximum duration of SA in Spain is similar to other neighboring countries such as Germany, Belgium or Austria, the economic amount of the subsidy varies comparing to these countries (49). In Spain, the employer, when received the medical certificate, is responsible for paying the benefits of the first fifteen days of the allowance. Thereafter, the social security system pays. Regarding the amount the first three days of sick leave the worker doesn't receive any economic compensation, from the 4th to 20th day the payment will correspond to the 60% of their regulatory bases, and 21st day onwards the 75% of the regulatory basis (116). Among all cause SA episodes, the longest duration is for oncological diseases (especially breast cancer), musculoskeletal and mental disorders. For oncological diseases, the average duration by worker in Spain is 117.59 days. Moreover, the incidence, prevalence and average duration increase with age, and is higher in women as in other European countries (117).

A worker can apply for a **permanent disability** benefit if, the duration of SA benefits expires, and on completing any treatment prescribed, continues to have serious functional or physical disabilities that prevent the worker from returning to work. Benefits vary depending on the degree of disablement (118):

- Partial permanent disability: the worker's normal performance is impaired by 33% or more, but he/she can carry

out the basic tasks of his/her normal job. In order to be entitled to this benefit, the worker must have paid contributions for 1,800 days for 10 years before SA became a permanent disability. The economic compensation is 24 monthly payments of the calculation basis of the SA benefit.

- Total permanent disability: prevents the worker from carrying out basic tasks of their normal profession, but he/she can do another job. To be entitled, the workers must have paid contributions for a set period, which varies depending on whether he/she is over or under 31 years of age. The economic subsidy is 55% of the corresponding calculation basis and up to 75% of the corresponding calculation basis for people who are 55 or more years old with difficulty in finding work.
- Absolute permanent disability: completely disqualifies the worker from any profession. Contribution requisites vary with age and economic subsidy is 100% of the corresponding calculation basis.
- Severe disability: completely disqualifies the worker, who furthermore, requires assistance from other persons to carry out their daily basic activities. Contribution requisites vary with age and economic subsidy is 100% of the calculation basis. Also, a supplement to compensate the carer of the invalid: calculated by adding 45% of the current minimum basis for contributions and 30% of the basis of last month's contributions, depending on the cause of invalidity.

It has been estimated that approximately 30% of the processes of SA due to cancer reach or exceed the 365 days. Around 55% of the SA due to cancer will become permanent disability or there will be no return to work due to various circumstances. Some of these SA will be extinguished by death, 47% of deaths of working age (63).

Both SA and permanent disability pensions have a huge impact on the health care system, social and economic expenditures (119, 120), accounting for 13.8 billion euros for SA and 13.7 for PD in Spain in 2022 (121). In Catalonia, the number of people perceiving a disability pension reached 160,464 in 2019 accounting for around 171 million euros (122).

Regarding the **unemployment benefit**, in Spain, to have access to contributory unemployment benefit, workers must be affiliated with the Social Security, must have had contributed to Social Security at least one year over the last six years, and must be registered as a job seeker. The length of entitlement depends on the length of contribution periods to the Social Security until a maximum of two years. The amount of the benefit is based on the average salary prior of becoming unemployed and the replacement rate (the first six months is 70% and then 50%) (123).

In Spain, workers can voluntarily **retire early** if they are no more than 2 years younger than the legal retirement age and have contributed for at least 35 years to social security. Also, workers are entitled to early retirement if they have a disability (45% or 65%),

have been a mutuality member, have an occupation with higher mortality, or if their contract ended involuntarily and is four years younger than the legal retirement age. All of these have additional requirements. The economic amount of the pension varies depending on the aforementioned scenarios (124).

1.4. Justification

The incidence of cancer is growing rapidly in our affluent society: a 21% increase has been estimated in Europe from 2020 to 2040, according to the European Cancer Information System (ECIS). This increase is partly explained by the ageing of the population and exposure to risk factors such as tobacco, alcohol, pollution, obesity, and sedentary lifestyle, among others. In 2023, Spain expects 279.260 new cancer diagnoses.

However, the management of life after cancer, as a life-changing event, still remains unsolved. Due to the rise in the incidence and the context of delay of the legal retirement age in Spain (65 to 67 years after 2013 reform), almost half of the diagnoses are made in the working age population. Working age diagnoses added to considerable improvements in survival translates into part of the workforce affected by a life-changing disease that determines the future course of their life, including work. Cancer survivors find big difficulties in the transition after ending treatment due to long-term impairments that may last their whole life. These side effects can elongate until 5 years after treatment and in some cases 10 or even 20 years after, directly determining working life.

One of the missions of Social Protection System is to help these patients throughout the acute stage of the disease and later. After the acute period, patients recover their former life including employment, when possible, but with these persistent, long-lasting symptoms. The existence of a cancer diagnosis can increase the probability of leaving the labor market without the social and health protection system facilitating its continuity in employment.

The literature shows evidence of high rates of unemployment, early retirement and inactivity in cancer survivors in developed countries. High unemployment, early retirement, and inactivity rates suppose an unexpected way of exiting labor market. This early exit points out inefficiencies in social security system policies on helping workers prevent financial adversities and impoverishment. Prognostic factors of return to work, such as age, treatment and cancer site, occupational category or previous unemployment periods have been scarcely studied in countries with similar welfare state.

In Spain, the labor market is characterized by its high rates of unemployment and temporary employment, which could worsen an already complicated RTW process. To our knowledge, there is no published evidence on the burden of unemployment and early exit of the labor market that cancer survivors face compared to the general working population with the same socio-demographic characteristics in the Spanish context. Optimizing the return to work of those who survived cancer is important to improve the well-being of this

vulnerable group, and to reduce the individual and societal impact of cancer which could widen social inequalities.

HYPOTHESIS AND OBJECTIVES

2. HYPOTHESIS AND OBJECTIVES

2.1. Hypothesis

Workers who have had a cancer diagnosis, recognized by an SA episode, will have a higher risk of a future adverse working life in terms of employment instability or dropping out of the labour market through early retirement, permanent disability, or premature death, than the general working population or workers with a SA due to other diagnoses.

2.2. Objectives

Objective 1, Study I

To evaluate differences in the probability of accumulating days of employment and employment trajectories (EPTs) in a sample of salaried workers in Catalonia (Spain) who had an SA due to cancer and compare them to workers who had an SA due to other diagnoses or no SA.

Objective 2, Study II

To assess employability in a sample of salaried women in Catalonia, Spain, who had an SA due to breast cancer compared with those without an SA and those with an SA due to other diagnoses, by evaluating the probability of accumulating days in employment and of being unemployed with benefits.

Objective 3, Study III

To compare future labour market trajectories (LMPPs) of a sample of salaried workers after an SA due to cancer, considering nine possible labour market states (temporary and permanent employment, unemployment, inactivity, permanent disability, early retirement, retirement, inactivity, and premature death), to those of a sample of workers without SA and to workers with an SA due to other diseases.

Objective 4, Study IV

To identify barriers and facilitators associated with RTW and sustainable work participation of salaried workers perceived by stakeholders, including survivors. We wish to identify factors related to work from the diagnosis and SA to reincorporation and permanence for improvement RTW after an SA due to cancer.

METHODS

3. METHODS

3.1. Quantitative approach

3.1.1. Data sources

Study I, Study II and **Study III** are based on administrative register data sources: Spanish Continuous Working Life Sample (CWLS) and SA records from Catalonia.

CWLS is an annual random representative sample of 4% of the Spanish Social Security affiliates (contributors and beneficiaries) from 2004 to 2021 (roughly 1,3 million people), provided by the General Directorate of Social Security (DGOSS by its acronym in Spanish). Based on algorithms, each annual sample update allows the selection of the same individuals from previous years if they continue affiliated. If the worker loses contact with Social Security or dies, people from the target population with similar characteristics replace them until the sample reaches a 4% (125).

From annual sample extractions of the CWLS, the Spanish WORKing life Social Security (WORKss) cohort was built including those affiliates who had at least a registered employment history (~ 83% of the CWLS, 1.5 million individuals), and excluding those who were only beneficiaries (126). WORKss cohort individuals were linked to records of SA episodes medically certified by general practitioner in Catalonia from 2012 to 2015 and provided by Catalan Institute for Medical and Health Evaluations (ICAM by its acronym in Catalan). The records linkage has been possible thanks to an

agreement signed between DGOSS, ICAM and CiSAL-UPF, under data confidentiality compromise.

From the record linkage procedure described, the retrospective cohort was made up of workers aged from 16 to 70 affiliated with at least one day to the Spanish social security general regime (salary workers) and residents in Catalonia between 2012 and 2015 (first and last year available with ICAM data). For these workers, information about SA episodes were available. In total, the cohort included 145,614 workers, 55,495 of them have had at least one episode of SA during the study period. The characteristics of the workers from CWLS, and their follow-up in the WORKss cohort have been previously described in detail (126,127).

For each of the selected salaried workers, we had their labour history including dates of registration and termination of each employment contracts and subsidised unemployment periods, the beginning of the collection of benefits -permanent disability, ordinary and early retirement- and the date of death, when it was applicable. In addition, there is information on the annual and monthly contribution base (directly related to salary), economic activity (according to the company's contribution account in agriculture, industry, construction, or services), the social security contribution group (proxy of the occupational category: non-manual skilled, non-manual non-skilled, manual skilled, manual non-skilled), working time (full-time, part-time, or short and marginal part-time), company size as number of workers registered in a company, and legal form of the

company (proxy of private and public company ownership). From ICAM, for each episode of SA, we have the starting and ending date, the medical diagnosis (ICD-10, 4 digits) and the reason of the discharge for the period 2012-2015.

For those workers who have been recognized a permanent disability, we have the degree of severity (except from partial permanent disability which is not available at the CWLS): total, absolute and great disability.

3.1.2. Study design and population

In **Study I**, **Study II** and **Study III** a dynamic retrospective cohort study between 2012 and 2018 was conducted, with an observational period between 2012 and 2015, and a follow up period between 2012 and 2018.

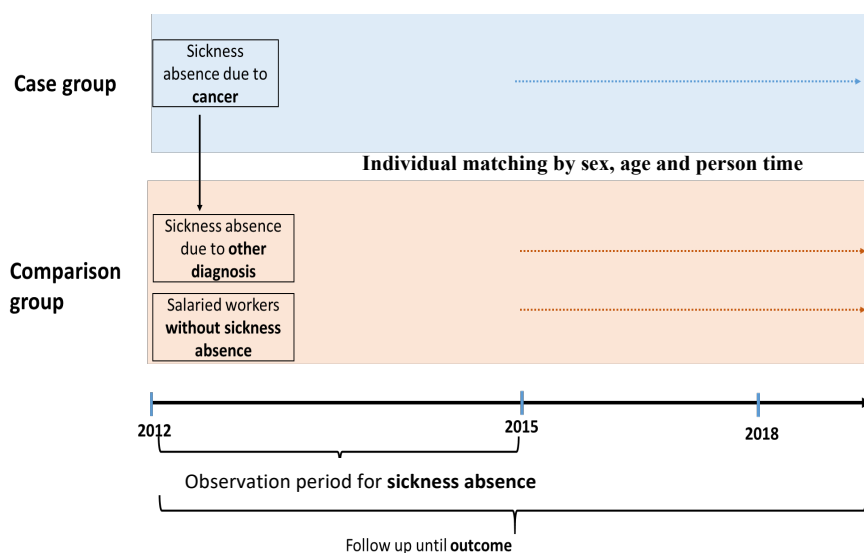
In **Studies I** and **III**, all workers who had a first episode of SA due to a malignant neoplasm (ICD-10, C00-C97) between 2012 and 2015 (N=516, 225 men and 291 women) were selected. For each worker with an SA due to cancer two comparison subjects were picked: i) a worker with a first SA episode due to other medical diagnosis different to cancer ending the same week as the episode of SA due to cancer, and ii) a worker without an SA. The selection of the both comparison groups followed the same criteria: same age (within a 5-year range), sex and availability in the same week of the end of the SA episode due to cancer (Figure 1). In summary, the study population included a final sample of 1548 workers (57% women).

Follow-up period in both studies went up to six years, depending on the time of entrance to the cohort (2012-2015).

In **Study II**, only women who have had a first episode of SA due to breast cancer (ICD-10 code: C50) between 2012 and 2015 were selected (N=113). Following the same criteria as in **Studies I** and **III**, women with an SA due to breast cancer were matched with 113 women who had an SA due to other medical diagnosis during the same period, and 113 did not have any SA during this follow-up. The study population of this study included a final sample of 339 workers.

The reason for selecting this specific diagnosis was to see the effect of breast cancer separately considering that it's the most frequent diagnosis in our sample but also one of the most incident and prevalent diagnosis in society, with its consequent higher prevalence of survivors working with this diagnosis.

Figure 1: Selection of comparison groups and follow-up of the retrospective cohort study.



3.1.3. Study variables

Outcomes

In **Study I**, two outcomes were defined: the total number of days accumulated in employment (in one or more episodes) throughout the follow-up period since entrance to the cohort, and employment trajectories (EPTs) built from the annual accumulated days (six time points, one by year). Since all workers were not followed-up for the same time, in years in which participants were not in the cohort were considered as missing values.

In **Study II** the outcomes were the total number of days accumulated in employment and unemployment (in one or more episodes) throughout the follow-up period since entrance to the cohort.

In **Study III** the outcome was labour market trajectories (LMPPs), the result of reconstructing individual working lives by generating an ordered list of weekly labour states: temporary employment, permanent employment, unemployment with benefits, inactivity (considered as not having contact with social security longer than 15 days), permanent disability (including total, absolute and severe degrees), early retirement, ordinary retirement, and death. If a worker was in two different states in the same week, that worker was assigned the state where he/she spent the longer time. Same as with the EPT, in weeks in which some participants were not in the cohort, these were considered as missing values.

Explanatory variable

The general explanatory variable was having an SA due to cancer or not. In **Studies I** and **III** was due to any cancer, and in **Study II** was specifically due to breast cancer. Comparison groups were categorised in having an SA due to other medical diagnosis and not having any SA during the follow-up period.

Covariables

The following covariables were taken into account to measure the association between having an SA due to cancer and the corresponding future working outcomes according to the study: occupational category (non-manual skilled, non-manual non-skilled, manual skilled, or manual non-skilled); working time categorised as a percentage of weekly hours (full-time [$>87.5\%$], part-time [$50\%-87.5\%$], or short and marginal part-time [$\leq 37.5\%-49\%$]); monthly average income in tertiles (calculated from total monthly remuneration from work and unemployment benefits); company size (small/medium [up to 100 employees] and big [>100 employees]); company ownership (private and public); and the company's economic activity (primary sector [agriculture, hunting, forestry, fishing, mining, and quarrying]; manufacturing [including construction and energy], and services). We also considered the previous 5-year employment ratio expressed as a percentage of employed days to the total potential working days, including working or unemployed or not affiliated days, to assess attachment to the labour market before the SA due to cancer. Workers who changed categories over time were assigned the category in which they spent most of the follow-up period.

Employment-related conditions were assessed as descriptive variables of EPT (**Study I**), and of future LMPPs (**Study III**), and potential confounders for the association between having an SA due to cancer and future measured working outcomes (**Study I, II and III**).

3.1.4. Statistical analysis

All analyses were stratified by sex.

Pearson's Chi-square tests (or Fisher's exact test when applicable) were used to assess differences in employment-related conditions across comparison groups.

Study I

Probability of accumulating days in employment in workers who have had an SA due to cancer versus comparison groups was assessed through negative binomial logistic regression models after testing for overdispersion through goodness-of-fit, which reports deviance, and Pearson chi-squared statistics. Models were adjusted for employment-related conditions, and time spent in employment during the five years prior to entering the cohort.

EPTs based on annual accumulated days in employment were estimated by Latent Class Growth Analysis (LCGA). Latent class growth modelling (LCGM) is a statistical technique used to identify distinct groups or classes within a population based on their growth trajectories over time. It is a form of longitudinal data analysis that allows for the identification of different patterns of change in a variable of interest among individuals or groups. In LCGM, the data used for analysis typically consist of repeated measures of the same variable collected over multiple time points. The goal is to determine whether there are distinct latent classes or groups within the

population that exhibit different patterns of growth or change in the variable of interest. LCGM estimates the probabilities of individuals belonging to each latent class and assigns them to the class with the highest probability.

Annual days in employment was the repeated measured used. This approach can be used for exploratory purposes and to uncover hidden trajectories within the population (128). The number of classes was selected based on the Bayesian Information Criteria (preferable as lower the best) and two likelihood ratio tests (LRT), the Lo-Mendell-Rubin adjusted LRT and the Bootstrapped LRT, to assess the goodness of fit. The final number of trajectories was determined considering the previous fit indicators, the visual analysis of figures, and the research criteria.

Pearson's Chi-square tests (or Fisher's exact test when applicable) were used to assess differences in age, comparison groups and employment-related conditions across EPTs.

Multinomial logistic regression models were used to assess the association between having had an SA due to cancer and EPTs.

Study II

Probability of accumulating days in employment and unemployment in workers who have had an SA due to breast cancer versus comparison groups was assessed through negative binomial logistic

regression models after testing for overdispersion through goodness-of-fit, which reports deviance, and Pearson chi-squared statistics.

Linear regression models were applied to compare the average number of days accumulated in employment and unemployment among comparison groups.

Models were adjusted for employment-related conditions, and time spent in employment during the five years prior to entering the cohort.

Study III

The reconstruction of future LMPPs was based on sequence analysis to identify individual participation on the labour market over the working life. Sequence analysis is a statistical technique used to analyze and explore sequences of events or states over time. The main goal of sequence analysis is to identify meaningful patterns, regularities, or structures within the sequences. This includes understanding the order in which events or states occur, the duration or timing of each event, and the transitions between events. By analyzing these patterns, researchers can gain insights into the underlying processes or dynamics that generate the sequences. Thus, once the first descriptive analysis is done, optimal matching assesses the dissimilarity of ordered arrays of labour states that represent a time-ordered sequence, and those distances are calculated among all individuals in the cohort. After these calculations, optimal matching allows the comparison of sequences by counting the minimum

number of transformations required to each pair of them to be identical. Finally, hierarchical cluster analysis was used to group similar typologies of sequences of labour states. The number of clusters was selected using the index average silhouette width, which assesses the quality of the clustering and measures the intra-group and inter-group variability. ASW values between 0.5-0.7 show reasonable well-separated clusters, with a higher value showing higher homogeneity of the groups (129).

Pearson's Chi-square tests (or Fisher's exact test when applicable) were used to assess differences in employment-related conditions across future LMPPs. Multinomial logistic regression models were used to assess the association between having had an SA due to cancer and future LMPPs.

3.2. Qualitative approach

3.2.1. Design and study participants selection

In **Study IV**, we conducted qualitative research with a socio-constructivist perspective (130).

Participants were cancer survivors working at the time of diagnosis and who took a period of SA due to cancer, health care professionals involved in cancer treatment and care (oncology, primary care and psycho-oncologists) and company representatives (human resources and health and safety at professionals). All participants resided in Catalonia (Spain).

Discussion group technique was used for data collection, in accordance with the theoretical perspective used, for the different profiles (survivors, oncology professionals, and company representatives). Groups were complemented with an individual interview with a primary care physician.

For survivor groups' participants sample selection, we first considered a theoretical sampling until saturation (131) considering sociodemographic information (sex, age, having dependants, and marital status), health information (type of cancer and cancer stage), and employment-related conditions (type of contract, occupational category). The reach out for survivors was conducted through the Catalan Federation of Organizations Against Cancer (FECEC), an entity that brings together the main organizations working to improve the quality of life of cancer patients and their families in Catalonia.

Snowball sampling was used for oncology professionals and company representants. Oncology professionals were all recruited through Hospital del Mar (Barcelona), a third-level public hospital. Lastly, company representatives were recruited through the professional network of the investigators.

3.2.2. Data collection

Discussion groups were organised considering their role proximity to the work dimension. A total of six discussion groups were carried out with four to eight participants per group: three groups of survivors, one group of oncology professionals, and two groups of company

representants. On the aim to complementing some aspects of information, we conducted an individual interview with a primary care physician.

The discussion group and interview guide were organized into questions grouped based on the stage of the process, and factors involved in each stage (diagnosis, approval of SA, treatment time absent from work, end of SA, and return to work) were listed based on investigators' knowledge and previous literature about factors affecting RTW, policies, and guideline. The interview guide was adapted to each group, considering their involvement in the work dimension and their unique view of factors affecting RTW.

The discussion groups were performed by an interviewer and an observer online. They were video-recorded and transcribed verbatim by the same researchers who attended the interviews.

3.2.3. Data analysis

The content of each discussion group interview and the individual interview were separately analysed in seven reports to capture relevant concepts and themes (132). After the agreement of the two analysts involved in the interviews, the results of each interview were triangulated by all co-authors. Thematic analysis and mixed coding of the data were performed. Triangulation was used in all study process (133).

3.3. Ethics approval

This thesis was performed in accordance with the standards of Good Clinical Practice and the principles of the Declaration of Helsinki. The study protocol guaranteed the fulfilment of Regulation (EU) 2016/679 of the European Parliament and the Council of 27 April 2016 on the protection of natural persons regarding the processing of personal data and the free movement of such data. It also fulfilled Spanish Organic Law 3/2018 of 5 December on the Protection of Personal Data and the Guarantee of Digital Rights.

Quantitative part of the study (Study I, II and III) was approved by the Parc de Salut Mar Ethics Committee in Barcelona (Research Protocol no. 2020/9119) and exempted from informed consent requirements owing to its register-based design. The research team committed itself to the strict use of data for the present study. In addition, a linkage protocol agreement between the Centre for Research in Occupational Health at Pompeu Fabra University, the National Social Security Institute, and the Catalanian Institute for Medical Evaluations guaranteed the maintenance of confidentiality in providing the identified datasets to the authors.

The Parc de Salut Mar Ethics Committee in Barcelona evaluated and approved the qualitative study separately (Research Protocol no. 2021/10036). All participants signed an informed consent form. The confidential transcripts were handled with care (not distributed outside the team). In the results section, the anonymity of the participants was preserved.

RESULTS

4. RESULTS

4.1. Study I: Returning to work after a sickness absence due to cancer: a cohort study of salaried workers in Catalonia (Spain)

STUDY I

Ayala-Garcia A, Serra L, Hernando-Rodriguez JC, Benavides FG. Returning to work after a sickness absence due to cancer: a cohort study of salaried workers in Catalonia (Spain). Sci Rep. Nature Publishing Group UK; 2021;11:1–11.

Returning to work after a sickness absence due to cancer: a cohort study of salaried workers in Catalonia (Spain)

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Cancer incidence and survival rates have increased in the last decades and as a result, the number of working age people diagnosed with cancer who return to work. In this study the probability of accumulating days of employment and employment participation trajectories (EPTs) in a sample of salaried workers in Catalonia (Spain) who had a sickness absence (SA) due to cancer were compared to salaried workers with SA due to other diagnoses or without SA. Each individual with SA due to cancer between 2012 and 2015 was matched by age, sex, and onset of time at risk to a worker with SA due to other diagnoses and another worker without SA. Accumulated days of employment were measured, and negative binomial models were applied to assess differences between comparison groups. Latent class models were applied to identify EPTs and multinomial regression models to analyse the probability of belonging to one EPT of each group. Men and women without SA or with SA due to other diagnoses had at least a 9% higher probability of continuing in employment compared to workers who had a SA due to cancer, especially among men without SA (adjusted IRR 1.27, 95% CI 1.06–1.53). Men without SA had the highest probability of having high stable EPT compared to workers who had a SA due to cancer (adjusted RRR 3.21, 95% CI 1.07–5.50). Even though workers with SA due to cancer continue working afterwards, they do it less often than matched controls and with a less stable employment trajectory. Health and social protection systems should guaranty cancer survivors the opportunity to continue voluntary participation in the labour market.

The effect of cancer on paid work is a growing problem that needs adequate collaborative responses between health and social protection systems. Cancer is becoming a highly prevalent chronic disease with a 28% increase in its global incidence in the past few decades^{1–3}. The survival rate is also increasing 3% per year^{4,5}, but cancer survivors suffer from long-lasting symptoms after the acute stage due to the disease and its treatment. In 2017, cancer caused an estimated 3,204,000 disability-adjusted life-years (DALYs)^{6,7}, impacting all dimensions of survivors' life including their future working life.

Almost half of individuals diagnosed with cancer are of working age⁸. According to IARC estimations, the number of new cases among individuals aged 15–69 years worldwide was 221.6 per 100,000 in 2020⁹. Although cancer is more likely to appear in older populations, the risk increases from 45 years of age¹⁰. Therefore, the steady increase in working age individuals diagnosed with cancer are expected to increase the number of people returning to work after treatment. Especially considering the delay in legal retirement age and the increasing tendency of workers to work beyond it¹¹, although for workers with cancer after or close to legal retirement age, ending their working life is more likely than for cancer free workers¹².

Return to work (RTW) could be beneficial for survivors' health due to an increased sense of purpose, higher self-confidence, and stronger sense of social belonging associated with employment¹³. RTW after a cancer diagnosis and treatment is considered a good prognostic sign. A successful RTW process is influenced by disease and treatment-related factors^{14–16}, sociodemographic variables (age, sex, education level, marital status), and work and employment conditions, such as size and ownership of the organisation, physical and emotional job

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demands, working hours, type of job, attitudes of colleagues, type of contract, sick leave duration, and previous periods of unemployment¹⁷⁻¹⁹. Most cancer survivors attempt to RTW after treatment²⁰, and studies have shown a steady increase in RTW as time after diagnosis increases²¹.

There is a growing consensus that work after cancer-survivorship research should address long-term work-related factors to understand the impact of cancer on the whole labour trajectory²². Previous studies have shown how surviving cancer has negative effects on labour market participation and employability. For example, compared to cancer-free controls of similar age, cancer survivors present reduced work ability, leading to higher unemployment rates²³. Moreover, a recent study found that, among cancer survivors, low-educated males and workers employed in jobs requiring manual skills have the lowest probability of employment 4 years after diagnosis²⁴. However, the future long term employment consequences and their shape over time hasn't been addressed with life course approach methodologies while comparing the future working life after cancer with both workers with and without a disease.

Our hypothesis is that salaried workers who had cancer, recognised by a sickness absence (SA), are less likely to accumulate employment days in a stable trajectory when RTW than workers with SA due to other diagnoses or workers without SA. The objective of the present study was to evaluate differences in the probability of accumulating days of employment and employment participation trajectories (EPTs) in a sample of salaried workers in Catalonia (Spain) who had a SA due to cancer and compare them to workers who had a SA due to other diagnoses or no SA.

Methods

We performed a register-based cohort study among 1,548 salaried workers living in Catalonia (675 men and 873 women) from the Spanish WORKas cohort²⁵, which is part of the Continuous Working Life Sample (CWLS), an annual random representative sample of 4% of affiliates of the Spanish social security system. Data available from the CWLS enables reconstruction of working life since 2006 based on the known information, such as occupational category, economic activity, employment status, and employment conditions (i.e., employment, unemployment, type of contract, income, and working time), social benefits (i.e., unemployment, permanent disability, and retirement), other work-related variables (i.e., company ownership and size), and date of death. Moreover, the Catalan Institute for Medical and Health Evaluations provided information related to SA records, including the medical diagnosis of the episode coded according to the 10th edition of the International Classification of Diseases (ICD-10), as well as the starting and ending date²⁶.

The final sample included salaried workers who had had a SA due to a malignant neoplasm (ICD-10, C00-C97) between 2012 and 2015 (N = 516, 225 men and 291 women). For each individual from the WORKas cohort, we selected two comparison workers from the same week of that the SA due to cancer ended (i.e., similar onset of time at risk) and also matched by age (within a 5-year range) and sex. First, a salaried worker with a SA due to a medical diagnosis different from cancer (ICD-10: A00-U99, except C00-C97; N = 516, 225 men and 291 women) was selected, and then another salaried worker without a SA at that moment (N = 516, 225 men and 291 women; Supplementary Table 1). The average age of each of the three comparison groups in 2012 was 49.8 for men (standard deviation: 9.96) and 47.0 for women (standard deviation: 9.44).

The study period covered from the date the workers entered the cohort until December 31, 2018. The length of the study period for salaried workers who RTW after SA ranged from 3 to 6 years considering complete years (the final part of the period was censored). Each worker was followed until they ended employment because they became unemployed, retired, were recognised as having a permanent disability, or died, or until the end of the follow-up. If workers had discontinued employment periods during the study, all of them were added. We also had information about working life since 2006 until the end of the follow-up period.

RTW was assessed by the accumulated days of employment during the follow-up period (entrance to 31/12/2018). Potential confounders considered in our analysis were the occupational category (non-manual skilled, non-manual non-skilled, manual skilled, or manual non-skilled); working time categorised as a percentage of weekly hours (full-time [$> 87.5\%$], part-time [$50-87.5\%$], or short and marginal part-time [$\leq 37.5\%-49\%$]); type of contract (permanent or temporary); monthly average income in tertiles (high [> 2370.0 €], medium [$1450.0-2370.0$ €], or low [≤ 1450.0 €]); company size (small/medium [up to 100 employees] and big [> 100 employees]); company ownership (private and public); and economic activity (primary sector [agriculture, hunting, forestry, fishing, mining, and quarrying]; manufacturing, and services). We also considered the previous 5-year employment ratio expressed as a percentage of employed days to the total potential working days, including working or unemployed or not affiliated days. Workers who changed categories over time were assigned the category in which they spent most of the follow-up period.

Patients were not involved in any stage of the study. Confidentiality was maintained in both databases. The authors received data that were previously anonymised.

Statistical analysis. The sample was described according to response, explicative variables, and covariates mentioned above, and the chi-squared test was applied to assess significance between comparison groups. Negative binomial regression models were used to compare the probability of accumulating days of employment in salaried workers with SA due to cancer to workers with SA due to other diagnoses and without SA after testing for overdispersion through goodness-of-fit, which reports deviance, and Pearson chi-squared statistics. The estimator of this analysis, taking SA due to cancer as the reference group, was the incidence rate ratio (IRR), either the crude ratio or the ratio adjusted by all potential confounders mentioned above, and its 95% confidence interval (CI).

A second analysis was carried out to assess employment participation trajectories (EPTs) during follow-up in the three groups, applying latent class growth analysis (LCGA)²⁷. The EPTs were obtained based on annually

accumulated days of employment and estimated by assuming that they followed a quadratic function because it fit our data better than a linear function²⁰. The optimal number of trajectories was chosen by considering the lowest Bayesian information criterion (BIC) and using the Lo-Mendell-Rubin adjusted and bootstrap likelihood ratio test (LMR-LRT)²⁰. These tests indicated that the 4- and 3-trajectory model well-represented the EPT of our sample in both sexes. Nevertheless, due to the size of some of the trajectories and the principle of parsimony, we chose 3-trajectory models (Supplementary Table 2). The resulting EPT trajectories were described according to all potential confounders mentioned above, and chi-squared was applied to assess significance between EPTs. Finally, to measure the association between having a SA due to cancer and EPTs versus the comparison groups, we applied multinomial logistic regression with its relative risk ratio (RRR) and 95% CI.

All analyses were stratified by sex. Stata v.13 software was used for negative binomial models and multinomial regression models, and R version 4.1.0 and Mplus v.7 software were used for LCGA.

Ethics approval and consent to participate. This study was performed in accordance with the standards of Good Clinical Practice and the principles of the Declaration of Helsinki. The study protocol guaranteed the fulfilment of Regulation (EU) 2016/679 of the European Parliament and the Council of 27 April 2016 on the protection of natural persons regarding the processing of personal data and the free movement of such data. It also fulfilled Spanish Organic Law 3/2018 of 5 December on the Protection of Personal Data and the Guarantee of Digital Rights. This study was approved by the Parc de Salut Mar Ethics Committee in Barcelona (Research Protocol no. 2020/9119) and exempted from informed consent requirements owing to its register-based design. The research team committed itself to the strict use of data for the present study. In addition, a linkage protocol agreement between the Centre for Research in Occupational Health at Pompeu Fabra University, the National Social Security Institute, and the Catalanian Institute for Medical Evaluations guaranteed the maintenance of confidentiality in providing the identified datasets to the authors.

Results

Workers with SA due to cancer accumulated the fewest number of days of employment (3.2 years average for men and 3.7 years for women), whereas salaried workers without SA accumulated the highest number of days of employment (4.0 years average for men and 4.1 for women; Table 1). Salaried workers without SAs had a higher crude probability of continuing employment than those who had a SA due to cancer, especially among men (IRR 1.25, 95% CI 1.03–1.52 vs. 1.10, 95% CI 0.97–1.25 in women). A higher probability of continuing employment was also found among salaried workers who had a SA due to other diagnoses compared to those with SA due to cancer (men IRR 1.09, 95% CI 0.90–1.32; women IRR 1.08, 95% CI 0.95–1.23; Table 2). When IRR was adjusted individually, as well as by all potential confounders, the probability of employment remained higher in both men and women, but was only significant for men without SA.

When we assessed trends of the annual accumulation of days of employment, men and women exhibited different EPTs. Among men, the three EPTs were: Low (28.1% of workers), Decreasing (11.6%), and High Stable (60.3%; Fig. 1, Table 3). The Low EPT was characterised by the lowest accumulation of days of employment during the follow-up period, which coincided with the lowest 5-year previous employment (87.2%), the lowest ratio among trajectories and the highest proportion of temporary workers (26.2%), and working in small-medium companies (72.7%). The Decreasing trajectory represented the smallest group of people (11.6%), who tended to have a decreased number of annual accumulated days until reaching zero, with the highest proportion of short part-time arrangements (16.7%), manual non-skilled occupations (12.8%), and lowest income (28.2%). In contrast, the High Stable trajectory depicted high accumulation of days annually, with the best employment conditions among the three trajectories. In women, we identified three EPTs: Low Fluctuating (6.4% of workers), Middle Fluctuating (18.8%), and High Stable (74.8%; Fig. 1, Table 3). Unlike the trajectories found in men, women exhibited patterns of accumulation of days with steeper U shapes in both Low Fluctuating and Middle Fluctuating EPTs, which started with a higher accumulation of days that decreased steadily and then increased yearly. The Low Fluctuating trajectory was the least common EPT among women (6.4%) and showed the lowest accumulation of days of employment during the follow-up period, coinciding with the lowest 5-year previous employment (83.1%), the lowest proportion of high income (16.1%), and non-manual skilled workers (7.1%). The Middle Fluctuating trajectory represented older women, with the highest proportion of short and marginal part-time arrangements (17.9%) and the highest proportion of low-income workers (65.6%). Similar to the observation in men, among women, the High Stable trajectory was the most frequent EPT (74.8% of women) with the best employment conditions.

In Table 4, we examine the probability of belonging to each EPT for individuals who had a SA due to other diagnoses or no SA compared to those who had a SA due to cancer. Among men, we found that individuals without a SA had 2.78 (95% CI 1.77–4.36) times the probability of belonging to the High Stable EPT than the Low EPT compared to men who had a SA due to cancer, and 2.52 (95% CI 1.31–4.85) times the probability of belonging to the Decreasing EPT than the Low EPT (Table 4). When adjusted for all potential confounders, the probability of men without a SA belonging to the High Stable EPT rather than the Low EPT was found 3.21 (95% CI 1.87–5.50) times higher than for men who had a SA due to cancer. In contrast to men, women without a SA had less probability of belonging to a Middle Fluctuating EPT than to a Low Fluctuating EPT than women who had a SA due to cancer (RRR 0.45, 95% CI 0.24–0.97). Adjusting for potential confounders did not vary the direction of the association. Workers with SA due to other diagnoses followed the same trend as workers without SAs but had lower estimates and weaker evidence, especially when adjusted for potential confounders.

	Men			Women		
	IRR	95% CI	p value	IRR	95% CI	p value
Crude						
SA cancer	1			1		
SA other diagnoses	1.09	(0.90–1.32)	0.386	1.08	(0.95–1.23)	0.234
No SA any diagnoses	1.25	(1.03–1.52)	0.022*	1.10	(0.97–1.25)	0.134
Individually adjusted by:						
Contract type						
SA other diagnoses	1.06	(0.89–1.28)	0.503	1.08	(0.95–1.22)	0.226
No SA any diagnoses	1.21	(1.01–1.46)	0.037*	1.09	(0.96–1.24)	0.167
Working time (% weekly hours)						
SA other diagnoses	1.06	(0.88–1.27)	0.564	1.08	(0.95–1.22)	0.233
No SA any diagnoses	1.22	(1.02–1.47)	0.032*	1.09	(0.97–1.24)	0.161
Income (tertiles)						
SA other diagnoses	1.12	(0.94–1.35)	0.203	1.07	(0.95–1.20)	0.253
No SA any diagnoses	1.30	(1.09–1.56)	0.004**	1.11	(0.99–1.25)	0.071
Occupational category						
SA other diagnoses	1.05	(0.87–1.27)	0.605	1.10	(0.97–1.26)	0.134
No SA any diagnoses	1.20	(0.99–1.45)	0.051	1.11	(0.98–1.27)	0.101
Economic activity						
SA other diagnoses	1.06	(0.88–1.28)	0.533	1.07	(0.94–1.21)	0.297
No SA any diagnoses	1.25	(1.04–1.50)	0.020*	1.09	(0.96–1.24)	0.164
Company size						
SA other diagnoses	1.05	(0.88–1.26)	0.594	1.07	(0.94–1.21)	0.307
No SA any diagnoses	1.23	(1.02–1.45)	0.026*	1.10	(0.97–1.25)	0.141
Company ownership						
SA other diagnoses	1.05	(0.87–1.27)	0.585	1.11	(0.97–1.26)	0.134
No SA any diagnoses	1.23	(1.02–1.48)	0.034*	1.09	(0.95–1.24)	0.220
Previous 5-year employment time (ratio)						
SA other diagnoses	1.11	(0.91–1.34)	0.299	1.07	(0.94–1.21)	0.317
No SA any diagnoses	1.26	(1.04–1.52)	0.018*	1.10	(0.97–1.24)	0.155
Adjustment by all variables						
SA other diagnoses	1.09	(0.91–1.30)	0.376	1.10	(0.97–1.24)	0.130
No SA any diagnoses	1.27	(1.06–1.53)	0.009**	1.09	(0.97–1.23)	0.162

Table 2. Probability of employment among salaried workers with a SA due to cancer (reference) and comparison groups adjusted individually by company characteristics and employment-related factors. SA, sickness absence; IRR, incidence rate ratio; CI, confidence interval.

Men with SA due to other diagnoses present a gradient of future employability that is more favourable in terms of future employment accumulation than in workers with a SA due to cancer but worse compared to workers without SAs. Very few studies have addressed differences in work consequences among other diseases versus cancer. Nonetheless, there is a growing body of literature about chronic diseases as a whole, including cancer and RTW^{32,33}, which is much more action oriented (i.e., comparison of RTW interventions) than cancer research. Our results suggest differences between cancer and other chronic diseases. Furthermore, a qualitative study of employers' perspectives of RTW among cancer survivors, found that this condition has a different status than others due to a lack of questioning the diagnosis, the immediate thought of the risk of death, and high psychological demands of the disease³⁴. In this study, we considered all types of diagnoses in the comparison group regardless of the chronicity or duration of the SA to assess the overall effect of SA on future employment.

Studies carried out in northern European countries have found that younger age, higher levels of education, absence of surgery, fewer physical symptoms, shorter duration of sick leave, male gender, and Caucasian ethnicity are variables associated with RTW²¹, but their effect on employment in the long-term has not been studied. Regarding work-related factors, perceived employer accommodation has been found to be a strong predictor³⁰.

EPTs revealed differences regarding employment trajectories after RTW. Most workers with a SA due to cancer, both men and women, go back to their jobs and stay employed, which is in agreement with previous literature³¹. The trajectory that represented the most stable labour life in our study (High Stable trajectory) included the highest proportion of young workers with a more stable working life in terms of the type of contract and employment before the follow-up period, which could explain the continuation in employment. Younger patients with cancer, even with side effects, may have remained in the labour market longer because they were too young to retire or to give up their professional career compared to older people. In addition, this stable labour

	Men (N = 675)			Women (N = 873)			
	SA cancer (N = 225)	SA other diagnoses (N = 225)	No SA any diagnoses (N = 225)		SA cancer (N = 291)	SA other diagnoses (N = 291)	No SA any diagnoses (N = 291)
Follow-up period							
Total accumulated days of employment	262,869	286,245	328,939		393,825	425,556	434,249
	N (%)	N (%)	N (%)	p value	N (%)	N (%)	N (%)
Contract type							
Permanent	178 (79.1)	188 (83.6)	194 (86.2)	0.003**	243 (83.5)	233 (80.1)	243 (83.5)
Temporary	40 (17.8)	37 (16.4)	31 (13.8)		46 (15.8)	58 (19.9)	48 (16.5)
							0.206
Working time (% weekly hours)							
Full-time (> 87.5%)	184 (81.8)	195 (86.7)	190 (84.4)	0.037*	206 (70.8)	213 (73.2)	218 (74.9)
Part-time (50–87.5%)	12 (5.3)	13 (5.8)	11 (4.9)		59 (20.3)	48 (16.5)	45 (15.5)
Short and marginal part-time (< 37.5–49%)	22 (9.8)	17 (7.6)	24 (10.7)		24 (8.2)	30 (10.3)	28 (9.6)
							0.188
Monthly income average (tertiles)							
High (> 2370.0 €)	105 (48.2)	90 (40.2)	91 (40.8)	0.364	79 (27.7)	70 (24.2)	74 (25.6)
Medium (1451.0–2370.0 €)	61 (28.0)	79 (35.3)	78 (35.0)		97 (34.0)	107 (37.0)	87 (30.1)
Low (< 1450.0 €)	52 (23.9)	55 (24.6)	54 (24.2)		109 (38.3)	112 (38.8)	128 (44.3)
							0.360
Occupational category							
Non-manual skilled	67 (29.8)	38 (16.9)	51 (22.7)	<0.0001****	94 (32.3)	53 (18.2)	68 (23.4)
Non-manual non-skilled	74 (32.9)	69 (30.7)	69 (30.7)		129 (44.3)	129 (44.3)	121 (41.6)
Manual skilled	59 (26.2)	91 (40.4)	82 (36.4)		29 (10.0)	57 (19.6)	44 (15.1)
Manual non-skilled	14 (6.2)	21 (9.3)	15 (6.7)		28 (9.6)	40 (13.8)	38 (13.1)
							<0.0001****
Economic activity							
Agriculture, hunting, forestry, fishing, mining, and quarrying	1 (0.4)	*	4 (1.8)	0.002**	1 (0.3)	*	2 (0.7)
Manufacturing, energy construction	52 (23.1)	89 (39.6)	67 (29.8)		26 (8.9)	48 (16.5)	39 (13.4)
Services	162 (72.0)	132 (58.7)	146 (64.9)		258 (88.7)	237 (81.4)	242 (83.2)
							0.130
Company size							
Small-medium (< 100 workers)	129 (57.3)	135 (60.0)	153 (68.0)	0.001**	158 (54.3)	143 (49.1)	170 (58.4)
Big (> 100 workers)	89 (39.6)	90 (40.0)	72 (32.0)		131 (45.0)	148 (50.9)	121 (41.6)
							0.058
Company ownership							
Private	161 (71.6)	179 (79.6)	175 (77.8)	0.001**	193 (66.3)	203 (69.8)	197 (67.7)
Public	44 (19.6)	29 (12.9)	28 (12.4)		64 (22.0)	57 (19.6)	53 (18.2)
							0.314
5 years previous to follow-up							
Employment time ratio (mean (SD))	90.9 (20.6)	93.1 (17.1)	93.2 (16.1)	0.019**	91.8 (17.7)	92.7 (17.2)	93.1 (16.1)

Table 1. Employment-related characteristics among a sample of salaried workers with a SA due to cancer, SA due to other diagnoses, or no SA at all in Catalonia during the follow-up period (2012 and 2018), and previous employment 5 years prior to cohort entrance. SA, sickness absence; Follow-up period ranged from 3 to 7 years from entrance to the cohort until end of 2018; Previous 5 years refers to each individual's entrance; SD, standard deviation. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Discussion

This study shows that salaried workers with a SA due to cancer were less likely to accumulate employment days after ending the absence than those without a SA. This association exhibited a clearer positive pattern in men than in women. In women, we found weaker evidence with lower estimates than men. Similarly, both men and women with SA due to other diagnoses were more likely to be employed than workers with SA due to cancer. Furthermore, trajectories of employment showed that male salaried workers without a SA were 3-times more likely to be part of a stable employment trajectory than men with a SA due to cancer. These association patterns persisted after adjusting for company characteristics and employment-related factors.

Employability differences between cancer survivors and comparison groups were what we expected. The RTW population that has survived cancer have a lower probability of maintenance and accumulation of days of employment than the rest of the working population. These results did not substantially vary when adjusted for employment-related factors and company characteristics, which indicates that the lower employability is probably due to side effects provoked by cancer and its treatment (physical and psychological). Previous studies have shown that most cancer survivors RTW after treatment^{26,31}, but not whether they continued employed in the long-term after RTW. One prior review found that cancer survivors are more likely to be unemployed than the general working population²⁷. However, the authors also found that the unemployment rate among cancer survivors was 34%, meaning that, even though it was higher than in the general working population, most of them continue in employment after a cancer diagnosis.

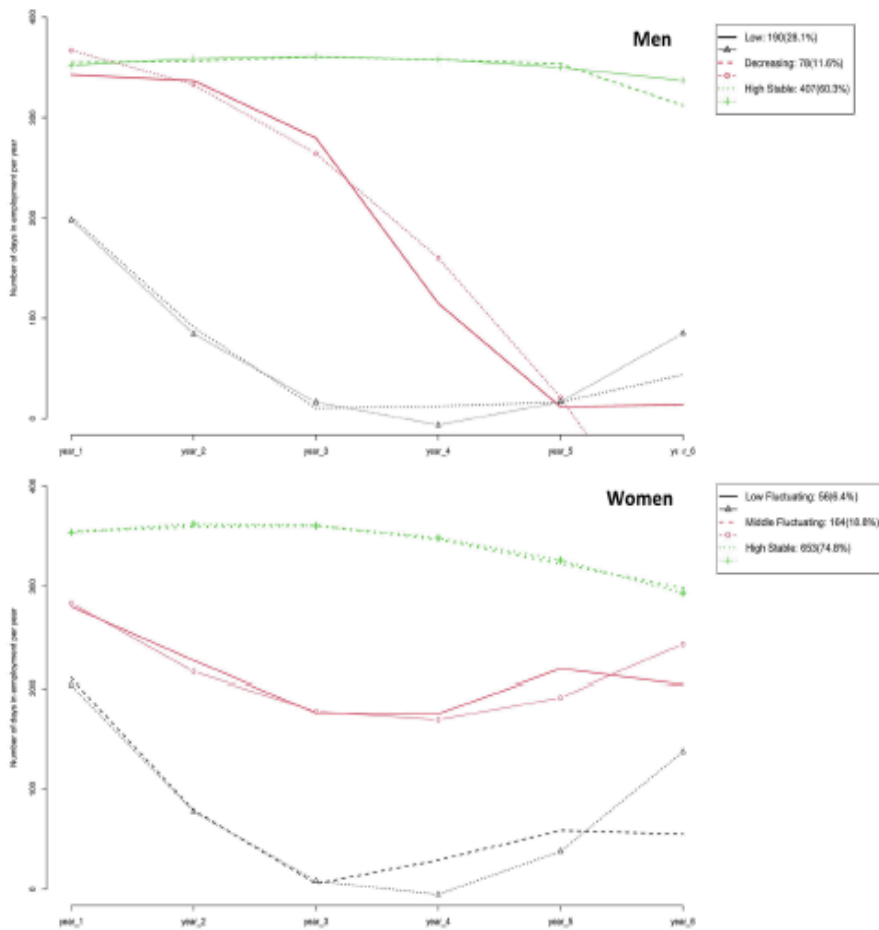


Figure 1. Observed and expected trajectories considering number of days in employment per year in a sample of salaried men (top) and women (bottom) in Catalonia (2012–2018).

life after cancer could represent less severe cancer, less aggressive treatments, and a better response in younger cancer patients. Other studies have found that younger age and locations associated with younger ages are factors associated with the likelihood of being employed and RTW³⁰. We found higher levels of stable employment among women compared to men with SAs due to cancer, which is not what we expected. Previous studies have shown that female gender is a barrier to employment after cancer³⁰. One explanation could be that some female cancer survivors may discontinue work because their partner is the main wage earner and provider of health insurance³⁰, or can ensure the household's financial stability alone³⁰, so this results may vary by socioeconomic status. Existing literature shows discrepancies on the effect of survivors' marital and relationship status, while some studies claim that marital status and gender don't affect the probability of RTW^{37,38}, others find that marriage affects RTW positively in men. A recent study found that married women with breast cancer returned more to work than non-married ones, only among women over 50 years of age. In this same study, living with a partner showed decreasing trends of RTW and working time after RTW among women with equal household, highlighting the important role of financial support through higher freedom for a more flexible process of RTW³⁹. Furthermore, there is also literature that has found higher odds of divorce when cancer diagnoses affected female comparing to men⁴⁰, which could also be affecting women's choice to go back and remain employed. Differences found with previous literature could be partly explained by age, as the women in our sample were younger, and as previously mentioned younger age is related to a greater employment likelihood. Previous research on the field

	Employment Trajectories							
	Men (N=675)				Women (N=873)			
	Low (28.1%)	Decreasing (11.6%)	High Stable (66.3%)	p value	Low Fluctuating (6.4%)	Middle Fluctuating (18.8%)	High Stable (74.8%)	p value
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	
Comparison groups								
SA cancer	82 (36.4)	25 (11.1)	118 (52.4)		15 (5.2)	71 (24.4)	205 (70.5)	
SA other diagnoses	69 (30.7)	23 (10.2)	133 (59.1)		20 (6.9)	48 (16.5)	223 (76.6)	
No SA any diagnoses	39 (17.3)	30 (13.3)	156 (69.3)		21 (7.2)	45 (15.5)	225 (77.3)	
Follow-up period								
Age in 2012 (years)								
<25	*	2 (2.6)	4 (10.0)	<0.0001***	1 (1.8)	1 (0.6)	7 (1.1)	<0.0001***
26-35	10 (5.3)	9 (11.5)	53 (13.0)		10 (17.9)	15 (9.2)	77 (11.8)	
36-45	19 (10.0)	9 (11.5)	92 (22.6)		21 (37.5)	29 (17.7)	232 (35.5)	
46-55	43 (22.6)	11 (14.1)	174 (42.8)		15 (26.8)	38 (23.2)	253 (38.8)	
>55	118 (62.1)	47 (60.3)	84 (20.6)		9 (16.1)	81 (49.4)	84 (12.9)	
Contract type								
Permanent	135 (73.8)	59 (75.6)	366 (89.9)	<0.0001***	40 (71.4)	111 (68.5)	568 (87.0)	<0.0001***
Temporary	48 (26.2)	19 (24.4)	41 (10.1)		16 (28.6)	51 (31.5)	85 (13.0)	
Working time (% weekly hours)								
Full-time (>87.5%)	146 (79.8)	61 (78.2)	362 (88.9)	0.013*	43 (76.8)	101 (62.4)	493 (75.5)	0.003**
Part-time (50-87.5%)	14 (7.7)	4 (5.1)	18 (4.4)		10 (17.9)	32 (19.8)	110 (16.9)	
Short and marginal part-time (<37.5%-49%)	23 (12.6)	13 (16.7)	27 (6.6)		3 (5.4)	29 (17.9)	50 (7.65)	
Monthly income average (tertiles)								
High (>2370.0 €)	57 (31.7)	22 (28.2)	207 (50.9)	<0.0001***	9 (16.1)	29 (18.8)	185 (28.3)	<0.0001***
Medium (1451.0-2370.0 €)	52 (28.9)	25 (32.1)	141 (34.6)		16 (28.6)	24 (15.6)	251 (38.4)	
Low (<1450.0 €)	71 (39.4)	31 (39.7)	59 (14.5)		31 (55.4)	101 (65.6)	217 (33.2)	
Occupational category								
Non-manual skilled	42 (23.0)	14 (18.0)	100 (24.6)	0.199	4 (7.1)	35 (21.6)	176 (27.0)	0.001**
Non-manual non-skilled	59 (32.2)	23 (29.5)	130 (31.9)		31 (55.4)	60 (37.0)	288 (44.1)	
Manual skilled	57 (31.2)	28 (35.9)	147 (36.1)		13 (23.2)	26 (16.1)	91 (13.9)	
Manual non-skilled	18 (9.8)	10 (12.8)	22 (5.4)		4 (7.1)	32 (19.8)	70 (10.7)	
Economic activity								
Agriculture, hunting, forestry, fishing, mining, and quarrying	2 (1.1)	2 (2.6)	1 (0.3)	0.001**	1 (1.8)	1 (0.6)	1 (0.2)	0.013*
Manufacturing, energy construction	55 (29.0)	29 (37.2)	124 (30.5)		6 (10.7)	15 (9.2)	92 (14.1)	
Services	119 (62.6)	44 (56.4)	277 (68.1)		48 (85.7)	139 (84.8)	550 (84.2)	
Company size								
Small-medium (<100 workers)	133 (72.7)	46 (59.0)	238 (58.5)	0.004**	30 (53.6)	102 (63.0)	339 (51.9)	0.041*
Big (>100 workers)	50 (27.3)	32 (41.0)	169 (41.5)		26 (46.4)	60 (37.0)	314 (48.1)	
Company ownership								
Private	135 (73.8)	61 (78.2)	319 (78.4)	0.003**	42 (75.0)	118 (72.8)	433 (66.3)	0.006**
Public	22 (12.0)	11 (14.1)	68 (16.7)		6 (10.7)	19 (11.7)	149 (22.8)	
	Mean (SD)	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	Mean (SD)	
5 years previous to follow-up								
Employment time (ratio)	87.2 (24.4)	90.8 (18.1)	95.1 (13.4)	0.001**	83.1 (24.8)	86.0 (23.7)	95.0 (13.1)	<0.0001***
Total	190	78	407		56	164	653	

Table 3. Employment-related characteristics measured in the follow-up period (2012 and 2018) and previous employment measured 5 years before cohort entrance among a sample of salaried workers living in Catalonia across employment participation trajectories (EPTs) (2012-2018). SA, sickness absence; Follow-up period ranged from 3 to 7 years, from entrance to the cohort until end of 2018; Previous 5 years was calculated from each individual's entrance; SD, standard deviation. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

	Men						Women					
	Decreasing vs. Low			High Stable vs. Low			Middle Fluctuating vs. Low Fluctuating			High Stable vs. Low Fluctuating		
	RRR	95% CI	p value	RRR	95% CI	p value	RRR	95% CI	p value	RRR	95% CI	p value
Crude												
SA cancer	1			1			1			1		
SA other diagnoses	1.09	(0.57–2.10)	0.788	1.34	(0.89–2.01)	0.157	0.51	(0.24–1.09)	0.081	0.82	(0.41–1.64)	0.566
No SA any diagnoses	2.52	(1.31–4.85)	0.006**	2.78	(1.77–4.36)	<0.0001***	0.45	(0.21–0.97)	0.041*	0.78	(0.39–1.56)	0.489
Individually adjusted by:												
Contract type												
SA other diagnoses	1.00	(0.52–1.92)	0.997	1.21	(0.80–1.84)	0.374	0.51	(0.24–1.11)	0.089	0.86	(0.43–1.74)	0.682
No SA any diagnoses	2.30	(1.19–4.44)	0.013	2.50	(1.56–3.93)	<0.0001***	0.46	(0.22–0.99)	0.048*	0.80	(0.40–1.60)	0.527
Working time (% weekly hours)												
SA other diagnoses	1.01	(0.52–1.94)	0.976	1.21	(0.80–1.83)	0.371	0.50	(0.25–1.21)	0.081	0.81	(0.40–1.62)	0.549
No SA any diagnoses	2.30	(1.19–4.43)	0.013*	2.57	(1.63–4.07)	<0.0001***	0.46	(0.21–0.98)	0.044*	0.78	(0.39–1.55)	0.475
Income (tertiles)												
SA other diagnoses	1.00	(0.52–1.93)	0.993	1.32	(0.86–2.03)	0.206	0.53	(0.25–1.15)	0.108	0.84	(0.42–1.69)	0.625
No SA any diagnoses	2.41	(1.24–4.67)	0.009**	2.96	(1.83–4.78)	<0.0001***	0.45	(0.21–0.98)	0.043*	0.85	(0.42–1.70)	0.643
Occupational category												
SA other diagnoses	0.94	(0.48–1.82)	0.856	1.26	(0.83–1.91)	0.286	0.52	(0.23–1.16)	0.108	0.95	(0.46–1.79)	0.888
No SA any diagnoses	2.23	(1.15–4.33)	0.017*	2.60	(1.64–4.11)	<0.0001***	0.44	(0.20–0.98)	0.043*	0.86	(0.42–1.79)	0.695
Economic activity												
SA other diagnoses	0.90	(0.46–1.76)	0.764	1.23	(0.81–1.87)	0.331	0.50	(0.23–1.08)	0.079	0.78	(0.39–1.57)	0.491
No SA any diagnoses	2.33	(1.18–4.61)	0.015*	3.01	(1.87–4.85)	<0.0001***	0.49	(0.23–1.06)	0.070	0.82	(0.41–1.64)	0.570
Company size												
SA other diagnoses	1.01	(0.52–1.95)	0.976	1.24	(0.82–1.88)	0.314	0.53	(0.25–1.14)	0.106	0.81	(0.41–1.63)	0.561
No SA any diagnoses	2.50	(1.28–4.84)	0.007**	2.75	(1.73–4.37)	<0.0001***	0.46	(0.21–0.98)	0.045*	0.79	(0.39–1.57)	0.495
Company ownership												
SA other diagnoses	0.98	(0.50–1.92)	0.949	1.25	(0.81–1.93)	0.317	0.43	(0.19–0.98)	0.046	0.76	(0.35–1.62)	0.472
No SA any diagnoses	2.15	(1.07–4.35)	0.032*	2.82	(1.72–4.63)	<0.0001***	0.41	(0.18–0.94)	0.034	0.73	(0.34–1.56)	0.419
Previous 5-year employment time (ratio)												
SA other diagnoses	1.07	(0.56–2.06)	0.834	1.29	(0.85–1.94)	0.233	0.51	(0.24–1.09)	0.081	0.80	(0.40–1.63)	0.541
No SA any diagnoses	2.50	(1.29–4.79)	0.006**	2.67	(1.69–4.22)	<0.0001***	0.44	(0.20–0.94)	0.035	0.75	(0.37–1.51)	0.421
Adjustment by all variables:												
SA other diagnoses	0.82	(0.41–1.66)	0.583	1.09	(0.77–2.00)	0.379	0.53	(0.22–1.29)	0.164	0.97	(0.43–2.18)	0.944
No SA any diagnoses	2.14	(1.04–4.43)	0.040*	3.21	(1.87–5.50)	<0.0001***	0.46	(0.19–1.11)	0.083	0.90	(0.40–0.01)	0.794

Table 4. Probability of belonging to employment participation trajectories (EPTs) among salaried workers with a SA due to cancer (reference) and comparison groups. SA, sickness absence; RRR, relative risk ratio; CI, confidence interval. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

has been carried out in countries where labour market dynamics and welfare state characteristics differ from the Spanish one, such as northern European countries. In fact, the gender gap in workforce participation is higher in Catalonia, as in the rest of Spain, than in these countries. In 2020, in Catalonia women employment rate was 63.3% and 70.9% in men⁴¹, contrasting Nordic countries such as Sweden with 78.3% in women and 83.2% in men⁴². This lower participation of women in employment could explain the differences with other studies since the ones that are on the labour market may have a higher engagement.

In men, we found a trajectory of reduced days of employment throughout the years until accumulating none (Decreasing trajectory). This trajectory represented the smallest proportion of the sample but comprised a group of manual workers. We think that they probably tried to return and maintain their jobs but cancer and its treatment affected their physical capacity, so they reduced their working time until they decided to exit the labour market. Previous studies have shown less probability of being employed in lower occupational categories due to high physical demands^{43,44}, and probably also due to more unstable employment trajectories. In women, this pattern exhibited a different evolution and depicted a more frequent future labour market trajectory characterised by women in a more precarious employment situation in terms of shortest working time and manual non-qualified occupations which could have made them reduce employment in the early years of cancer and increase it later, maybe because they needed the jobs in the first place.

We also identified a third trajectory comprising a group of men and women who accumulated the fewest number of days (Low and Low Fluctuating trajectories, respectively). In men, this sample stopped accumulating days of employment the third year, with a slight increase in the sixth year from the end of the SA due to cancer, probably because workers who were older preferred an exit from the labour market because working with side

effects when they are just about to reach retirement age is not worthwhile. In this sense, a study carried out in the UK in men who survived prostate cancer found early retirement to be 9-times more likely in older men (aged 55–60 years) than men aged < 50 years⁴⁶.

The main limitation of the present study is that the only information that we had regarding cancer is the SA diagnosis for the period 2012–2015. Therefore, we could not account for clinical features, such as type of treatment, stage of cancer, and the effects of prior health status regarding other comorbidities or cancer (first diagnosis, previous cancers, etc.) on the course of future employability. In addition, many individuals shifted between categories over the follow-up period and, in these cases, we assigned them to the category of explanatory and adjustment variables in which they spent most of their time during the follow-up. This could have led to a misclassification bias that underestimates the accumulation of SA days in other categories.

We also lacked information on workplace accommodations or support that have been proven to be determinant factors in employment sustainability and RTW³⁰. Our sample size is small in relation to cancer cases certified by SAs, which could compromise the significance of our results. The self-employed were not included in the study, since by not being included in the general social security scheme, they are not entitled to sickness benefits. In addition, the methodology applied to employment trajectories involved group-based analyses that classified individuals according to similar characteristics. Consequently, some of the resulting groups had a very small number of observations, and these results should be interpreted with caution. However, some authors argue that a minimum of 5% should be enough to consider a pattern, and our results are above these recommendations⁴⁸. The comparison groups resulted from matching show higher differences in men than in women regarding employment conditions and company characteristics. These differences shouldn't be affecting our results since models are adjusted by them.

Our study also has numerous strengths. The study was conducted using a large administrative database, allowing us to select diagnosis subgroups and longitudinally study their trajectories with an extensive time window. Moreover, the size of the database allowed us to match our workers with SAs due to cancer to two comparison groups by age, sex, and follow-up time. This match allowed us to compare the working life of cancer survivors to the general working population with or without SAs, allowing us to account not only for the disease, but for the effect of SA. The diagnoses causing SAs were medically certified by primary doctors rather than self-reported, enhancing the validity of our results⁴⁷.

To the best of our knowledge, employment continuation in a longitudinal sample of workers up to 6 years after the end of the SA has not previously been compared to the general salaried working population and workers who had a SA due to cancer for the same follow-up length and calendar days. More research is needed to understand the consequences of the disease and design interventions that address working difficulties caused by chronicity of cancer in the long-term, not only at the beginning of the process of RTW.

Conclusions

Focusing on RTW after cancer treatment as a binary decision ignores the complexity of relationships between health and work in the development of working life at a later stage of survivorship. Our study shows that workers with SA due to cancer continue working after SA, though in a lower proportion than matched controls and with a less stable employment trajectory. Thus, this study constitutes a step towards further understanding the relationship between cancer and employment in the long-term and encourages future research in this area.

Data availability

The data that support the findings of this study are available but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Administrative data come from an annual sample of Spanish Social Security affiliates that are part of the Continuous Working Life Sample (CWLS) provided by the General Directorate of Social Security (DGOSS) and linked records of sickness absence episodes certified in Catalonia provided by Catalan Institute for Medical and Health Evaluations (ICAM). The record linkage was possible thanks to an agreement signed between DGOSS, ICAM, and CISA-UPF, maintaining data confidentiality.

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Author contributions

All listed authors fulfil authorship criteria. A.A.G. and F.G.B. participated in the study conception and design. A.A.G. and L.S. performed the main data management and analysis with support from J.C.H.R., A.A.G., F.G.B., L.S., and J.C.H.R. interpreted the data. A.A.G. drafted the first version of the manuscript with close help from F.G.B. L.S. and J.C.H.R. made subsequent revisions to the manuscript and all authors revised the final version, agreed with the text and findings, and approved this final version. L.S. and J.C.H.R. contributed equally to the manuscript. The corresponding author certifies that all listed authors meet authorship criteria. A.A.G. is the guarantor.

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Competing interests

The authors declare no competing interests.


Additional information

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4.2. Study II: Employment and unemployment in breast cancer survivors between 2012 and 2018 in Catalonia (Spain)

STUDY II

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Employment and unemployment in a cohort of breast cancer survivors between 2012 and 2018 in Catalonia (Spain)

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Abstract

Background: Breast cancer (BC) is expected to become more prevalent among working women. BC survivors are at higher risk of unemployment than the general working population. We aimed to compare occupational stability among 3 groups: salaried women with a BC-related sickness absence (SA), women with an SA due to other medical diagnoses, and women with no SA from 2012-2018 in Catalonia, Spain.

Methods: Retrospective cohort study of 339 women affiliated to the social security system. Each woman with a BC-related SA (N=113) was matched by age and time at risk with another woman with an SA due to other medical diagnoses and a woman without SA. Participants were followed up from the end of the SA until the end of 2018. Negative binomial Poisson models were applied to calculate the probability of being employed or unemployed with social security benefits. Linear regression models were applied to assess differences in the mean number of days in employment and unemployment among the comparison groups.

Results: Women without an SA had a higher probability of remaining employed than those with a BC-related SA (IRR 1.18; 95%CI: 0.98-1.42; $p = 0.07$) and worked on average 213 more days ($p < 0.1$). On regression analysis adjusted by all variables, BC survivors had a higher, but non-significant, probability of being unemployed.

Conclusions: The non-significant results for unemployment with benefits could indicate a two-fold vulnerability, with BC survivors being less likely to be employed and more likely to be unemployed without benefits.

Keywords: breast cancer, employment, unemployment, sickness absence, life-course-approach, work retention

Introduction

Breast cancer (BC) poses a significant global challenge for health care systems, as well as for work and social security systems. BC is the most commonly diagnosed cancer globally, with an estimated 2.26 million cases in 2020, and is the leading cause of cancer mortality among women (1). In the last few decades, the incidence rates of BC have increased in Spain and other middle- and high-income countries, as has the 5-year age-standardised survival rate, which is around 86% and rising (2). Most diagnoses are made during the working life (3), with a major impact on survivors' employment trajectory. Indeed, BC is the leading cause of disability-adjusted life-years in women (1).

Women diagnosed with BC commonly take a sickness absence (SA), mainly due to intensive treatments and the subsequent convalescence period (4). Estimates of return to work (RTW) after SA vary from 43% in the Netherlands to 93% in the USA after 1 year, but the timing of RTW varies among survivors, ranging from 6 months to several years after diagnosis (5). Most cancer survivors in employment before diagnosis return to work (6). However, evidence suggests that women with BC have a 30% higher risk of unemployment than healthy controls (7), and that some of them take early retirement (8), have future SA episodes, or receive permanent disability benefits (4). These outcomes are attributed to difficulties in transitioning after the end of treatment due to long-term impairments affecting survivors' ability to work (9). The adverse effects in BC survivors include cognitive impairment, fatigue, lymphedema, and arm and shoulder

problems. Survivors also face other challenges common to all persons with cancer, regardless of type, such as depression, anxiety, and chronic pain (10).

The literature indicates several prognostic factors related to RTW, both positive and negative. Major facilitators for RTW are working in a white-collar job, early tumour stage, self-motivation, higher educational level, support from friends, family and workplace, and financial pressure. Potential barriers to RTW are older age, ongoing chemotherapy, mastectomy, the presence of comorbidities, fatigue and psychological constraints, intense work pressure, and poor support from colleagues and employers (5,11).

Most prior studies have focused on RTW and factors related to the end of SA episodes. However, the long-term effects of BC on health may also affect survivors' future ability to remain employed, as the disease impacts work ability and performance (12). Measuring receipt of benefits (SA and permanent disability) without a life-course approach may not completely capture the potential effects of cancer on employability. Our research questions were whether surviving BC reduces the subsequent probability of being employed and whether surviving BC increases subsequent unemployment with social security benefits. Our main objective was to assess employability in a sample of salaried women in Catalonia, Spain, who had a BC-related SA compared with those without an SA and those with an SA due to other diagnoses, by evaluating the

probability of accumulating days in employment and of being unemployed with benefits.

Methods

This retrospective cohort study is based on the Continuous Working Life Sample, which has taken an annual random representative sample of 4% of affiliates of the Spanish social security system since 2004 (13). This database contains each affiliate's full employment history, social security benefits, other work-related variables, and date of death. Using this database, we reconstructed the working life of the Spanish WORKss cohort (14). We also linked the Catalan Institute for Medical and Health Evaluations database, which provides details on SA records between 2012 and 2015, including the medical diagnosis of the episode coded in accordance with the 10th edition of the International Classification of Diseases (ICD-10).

We performed a retrospective age-matched cohort study of 339 women. We included all cases (N=113) of BC-related SA (ICD-10 code: C50) included in WORKss cohort between 2012 and 2015, and individually matched them with individuals from the same cohort: 113 women with an SA due to other medical diagnoses during the same period (Supplementary table 1), and 113 without an SA during the period. These women were selected in the same week as the end of the BC-related SA to ensure they were matched by age and time at risk. The mean \pm standard deviation age of the three comparison groups in 2012 was 47.1 ± 8.0 years.

To measure accumulated days in employment and unemployment, individuals were followed up from the end of the SA episode until December 31st, 2018. The dependent variable was the number of days in employment and unemployment with benefits, which were measured from the date that each participant ended the SA episode, and thus entered in the cohort, until the end of the follow-up period in 2018. The main independent variable was having a BC-related SA or not. The covariates included in our analysis were occupational category (non-manual skilled, non-manual non-skilled, manual skilled, and manual non-skilled); working time, categorised as a percentage of weekly hours (full-time [$>87.5\%$], part-time [$50\%-87.5\%$], or short and marginal part-time [$\leq 37.5\%-49\%$]); type of contract (temporary or permanent); average monthly income in tertiles (high [$>€2370.0$], medium [$€1450.0-2370.0$], or low [$\leq €1450.0$]); company size (small/medium [up to 100 employees] and large [>100 employees]), ownership (private and public), and the company's economic activity (primary sector [agriculture, hunting, forestry, fishing, mining, and quarrying], manufacturing, and services).

To assess attachment to the labour market before entry to the cohort, we also considered the previous 5-year employment ratio, expressed as the percentage of employed days to the total number of potential working days. Workers who changed categories over time in any covariates were assigned to the category in which they spent most of the follow-up period.

Patients were not directly involved in any stage of the study, and confidentiality was maintained in both databases. The authors received anonymised data.

A descriptive analysis was conducted to determine the distribution of total days in employment and unemployment by person for each comparison group. The minimum, maximum, mean, quartiles, and total number of accumulated employment days for each comparison group were also calculated for each group.

To compare the probability of accumulating days in employment and unemployment with benefits in the comparison groups, we applied a negative binomial regression model with relative risk and 95% confidence interval (95% CI). This approach was used after verification of the highly restrictive assumption made by the Poisson model, that the variance is equal to the mean, was not met; therefore, the popular generalisation of Poisson regression was applied instead. Linear regression models were applied to assess differences in the mean accumulation of days in employment and unemployment among the comparison groups. Finally, a survival analysis was conducted to analyse the probability of accumulating fewer days in employment in the three comparison groups. Stata v.13 software was used for all statistical analyses.

This study was performed in accordance with the standards of Good Clinical Practice and the principles of the Declaration of Helsinki. The study protocol guaranteed the fulfilment of Regulation (EU)

2016/679 of the European Parliament and the Council of 27 April 2016 on the protection of natural persons regarding the processing of personal data and the free movement of such data. It also fulfilled Spanish Organic Law 3/2018 of 5 December on the Protection of Personal Data and the Guarantee of Digital Rights. The study was approved by the Parc de Salut Mar Ethics Committee in Barcelona (Research Protocol no. 2020/9119) and was exempted from informed consent requirements owing to its register-based design. The research team committed itself to the strict use of data for the present study. In addition, a linkage protocol agreement between the Centre for Research in Occupational Health at Pompeu Fabra University, the National Social Security Institute, and the Catalanian Institute for Medical Evaluations guaranteed the maintenance of confidentiality in providing the identified datasets to the authors.

Results

The highest number of accumulated days in employment (minimum, maximum, mean, and quartiles) was found in women without an SA. In these women, the mean number of days in employment was 1609.0 followed by 1475.0 in women with an SA due to other medical diagnoses and 1354.9 in those with BC. The median for women without an SA was 1577 days vs 1568 days for women with other medical diagnoses, and 1421 days for women with BC (Table 1).

Table 1 Employment-related characteristics among a sample of salaried women residing in Catalonia with a sickness absence (SA) episode due to breast cancer, SA due to other medical diagnoses or no SA, measured during the follow-up period (2012 and 2018) and previous employment measured 5 years prior to their entry to the cohort.

	SA breast cancer (N=113)	SA other medical diagnoses (N=113)	No SA (N=113)	
Follow-up period				
Total days accumulated in employment	153,100	166,662	181,821	
Minimum	0	0	31	
Maximum	2,536	2,532	2,529	
Mean	1,354.9	1,475.0	1,609.0	
Median (p25; p75)	1,421 (790; 1,936)	1,568 (1,083; 2,008)	1,577 (1,212; 2,040)	
Total days accumulated in unemployment	9,749	16,013	9,186	
Number of women with an episode	21	32	23	
Minimum	46	28	6	
Maximum	731	1,754	1,690	
Mean	464.2	500.0	399.4	
Median (p25; p75)	608 (240; 669)	393 (181; 730)	306 (150; 669)	
	N (%)	N (%)	N (%)	p value
Contract type				
Permanent	101 (89.4)	93 (82.3)	97 (85.8)	
Temporary	12 (10.6)	20 (17.7)	16 (14.2)	0.312
Working time (%weekly hours)				
Full-time (>87.5%)	85 (75.2)	83 (73.5)	85 (75.2)	
Part-time (50.0%-87.5%)	19 (16.8)	19 (16.8)	19 (16.8)	0.989
Short and marginal part-time (≤37.5%-49.0%)	9 (8.0)	11 (9.7)	9 (8.0)	
Monthly income average (tertiles)				
High (>€2370.0)	29 (26.4)	27 (23.9)	29 (25.7)	
Medium (€1451.0 - 2370.0)	40 (36.4)	36 (31.9)	37 (32.7)	0.880
Low (€≤1450.0)	41 (37.3)	50 (44.3)	47 (41.6)	
Occupational category				
Non-manual skilled	35 (31.0)	16 (14.2)	30 (26.6)	
Non-manual non-skilled	53 (46.9)	48 (42.5)	46 (40.7)	0.036
Manual skilled	11 (9.7)	27 (23.9)	18 (15.9)	
Manual non-skilled	11 (9.7)	18 (15.9)	15 (13.3)	
Economic activity				
Agriculture, hunting, forestry, fishing, mining and quarrying	1 (0.9)	-	0.072*	
SA, sickness absence; IRR, incidence rate ratio; 95% CI, 95% confidence intervals; *: p value < 0.1	13 (11.7)	15 (13.6)	15 (13.6)	0.876
Services	97 (87.4)	95 (86.4)	95 (86.4)	
Company size				
Small-medium (≤ 100 workers)	71 (62.8)	59 (52.2)	59 (52.2)	0.179
Big (>100 workers)	42 (37.2)	54 (47.8)	54 (47.8)	
Company ownership				
Private	76 (67.3)	85 (75.2)	77 (68.1)	0.531
Public	22 (19.5)	15 (13.3)	54 (21.2)	
5 years previous to follow-up				
Employment time ratio (mean (SD))	93.2 (14.7)	91.8 (19.3)	94.5 (14.7)	

The follow-up period ranged from 3 to 6 years, from entry to the cohort until end of 2018; Previous 5 years, refers to each individual's entry; SD, standard deviation. *p<0.05; **p<0.01; ***p<0.001.

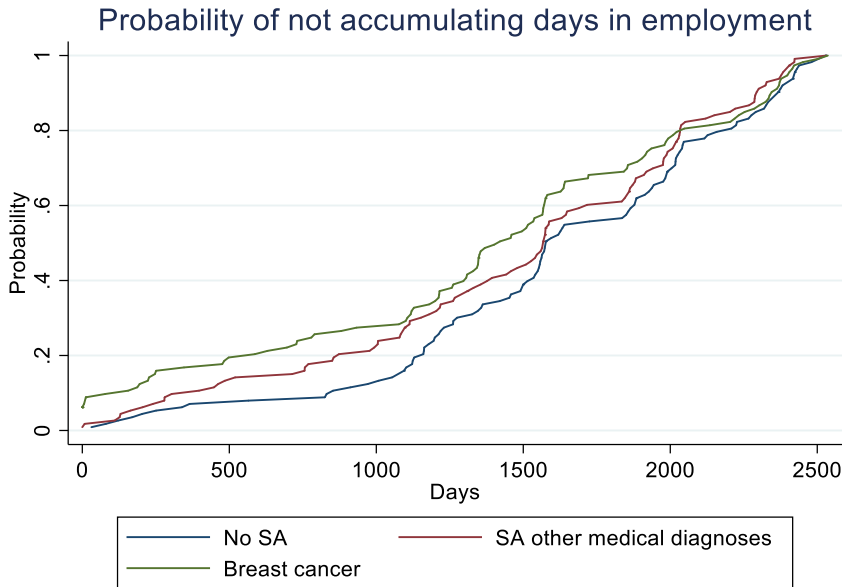
On negative binomial regression model with adjustment for all covariates (Table 2), women without an SA had the highest probability of being employed (18%; 95% CI: 0.98-1.42). The linear regression model, also adjusted for all covariates, showed that women without an SA worked an average of 212 more days (95% CI: 47.8-377.9) than those with BC (Table 3). Women with an SA due to other medical diagnoses also had a higher probability of being employed than women with BC (10%; 95% CI:0.91-1.32). The survival analysis showed that women with a BC-related SA had a higher probability of accumulating fewer days in employment throughout the follow-up period than the comparison groups; this difference was higher in women without an SA (Figure 1). However, the difference among groups disappeared at 5.5 years of employment day accumulation.

Table 2 Probability of days in employment and unemployment among salaried women with a sickness absence (SA) episode due to breast cancer (reference) and comparison groups adjusted individually by company characteristics, employment and working conditions

	Employment			Unemployment		
	IRR	95% CI	P value	IRR	95% CI	P value
Crude						
SA breast cancer	1			1		
SA other medical diagnosis	1.09	(0.91–1.32)	0.421	1.64	(0.40–6.76)	0.492
No SA	1.19	(0.89–1.34)	0.103	0.94	(0.23–3.88)	0.934
Individually adjusted by:						
Contract type						
SA other causes	1.09	(0.89–1.34)	0.421	1.51	(0.35–6.48)	0.576
No SA	1.20	(1.97–1.47)	0.088	0.89	(0.21–3.73)	0.870
Working time (% weekly hours)						
SA other causes	1.10	(0.90–1.36)	0.348	1.67	(0.39–7.12)	0.486
No SA	1.20	(0.97–1.47)	0.088*	0.95	(0.23–3.92)	0.939
Income (tertiles)						
SA other causes	1.10	(0.91–1.33)	0.321	1.39	(0.34–5.71)	0.651
No SA	1.20	(0.99–1.44)	0.060	0.79	(0.19–3.28)	0.746
Occupational category						
SA other causes	1.11	(0.90–1.37)	0.350	1.25	(0.28–5.56)	0.767
No SA	1.21	(0.98–1.48)	0.076	0.56	(0.1–2.95)	0.496
Economic activity						
SA other causes	1.09	(0.89–1.33)	0.427	1.73	(0.41–7.33)	0.454
No SA	1.19	(0.97–1.45)	0.103	0.97	(0.22–4.34)	0.969
Company size						
SA other causes	1.08	(0.87–1.33)	0.485	1.80	(0.43–7.45)	0.419
No SA	1.18	(0.96–1.45)	0.122	0.88	(0.21–3.65)	0.865
Company ownership						
SA other causes	1.09	(0.89–1.34)	0.406	1.61	(0.40–6.41)	0.502
No SA	1.19	(0.97–1.46)	0.101	1.09	(0.27–4.39)	0.905
Previous 5 year employment time (ratio)						
SA other causes	1.08	(0.88–1.32)	0.443	1.50	(0.37–6.13)	0.575
No SA	1.17	(0.96–1.43)	0.130	0.85	(0.21–3.48)	0.819
Adjustment by all variables:						
SA other causes	1.10	(0.91–1.32)	0.334	0.70	(0.15–3.33)	0.656
No SA	1.18	(0.98–1.42)	0.072*	0.34	(0.05–2.24)	0.264

IRR, incidence rate ratio; 95% CI, 95% confidence intervals; *: p value < 0.1

Figure 1: Probability curve of not accumulating days in employment in women with a sickness absence (SA) due to breast cancer (BC) compared with women with an SA due to other medical diagnoses and women without an SA.



The total number of unemployed women receiving benefits, henceforth unemployment, during the follow-up period differed among the 3 groups (Table 1). Unemployment was lowest among women with a BC-related SA (21 women vs 32 women with an SA due to other diagnoses and 23 women without an SA). Women with BC accumulated more days of unemployment ($n = 9,749$ days) than those without an SA ($n = 9,186$) but fewer days than women who had an SA for other medical diagnoses ($n = 16,013$). However, the high mean in the group indicated the presence of outlier values and an asymmetrical distribution with only a few women accumulating a large number of days (data not shown). Application of the negative binomial regression model adjusted for all covariates (Table 2)

revealed non-statistically significant trends towards a higher probability of unemployment among the BC group. The linear regression model, also adjusted for all covariates, yielded no statistically significant results (Table 3).

Table 3 Comparison of average days in employment and unemployment among salaried women who suffered a SA due to breast cancer (reference) and comparison groups adjusted individually by company characteristics, employment and working conditions.

	Employment			Unemployment		
	Coef	95% CI	p value	Coef	95% CI	P value
Crude						
SA breast cancer	1			1		
SA other causes	120.0	(-66.8–306.8)	0.207	41.0	(-23.6–105.7)	0.213
No SA	254.1	(74.6–433.8)	0.006*	-19,3	(-71.0–32.4)	0.462
Individually adjusted by:						
Contract type						
SA other causes	149.9	(-32.6–332.4)	0.107	39.6	(-25.3–104.5)	0.231
No SA	269.1	(88.5–449.7)	0.004**	-20,2	(-71.6–31.2)	0.441
Working time (% weekly hours)						
SA other causes	125.7	(-59.8–311.1)	0.183	41.5	(-71.2–32.5)	0.464
No SA	254.2	(77.3–431.0)	0.088*	-19,3	(-23.4–106.4)	0.210
Income (tertiles)						
SA other causes	117.4	(-53.9–288.8)	0.179	34.4	(-30.0–98.7)	0.294
No SA	239.7	(74.9–404.5)	0.004**	-24	(-76.2–28.3)	0.367
Occupational category						
SA other causes	149.8	(-38.8–338.4)	0.119	33.4	(-34.9–101.7)	0.337
No SA	268.5	(88.0–449.0)	0.004**	-22	(-73.8–29.9)	0.405
Economic activity						
SA other causes	109.5	(-75.7–294.7)	0.246	47.6	(-18.2–113.3)	0.156
No SA	230.9	(52.8–409.0)	0.011**	-13,5	(-65.4–38.4)	0.610
Company size						
SA other causes	108.0	(-78.8–294.8)	0.256	44.2	(-20.5–109.0)	0.180
No SA	242.1	(61.2–423.1)	0.009**	-16,1	(-68.5–36.2)	0.545
Company ownership						
SA other causes	127.2	(-58.6–312.9)	0.179	35.0	(-28.7–98.7)	0.280
No SA	248.1	(67.7–428.5)	0.007**	-17,5	(-68.8–33.7)	0.502
Previous 5 year employment time (ratio)						
SA other causes	127.2	(-58.6–312.9)	0.179	37.9	(-25.5–101.3)	0.240
No SA	248.1	(1.04–1.52)	0.007**	-13,7	(-64.6–37.2)	0.596
Adjustment by all variables:						
SA other causes	129.2	(-44.7–303.0)	0.145	36.4	(-32.9–105.8)	0.302
No SA	212.9	(47.8–377.9)	0.072*	-12,6	(-65.0–39.8)	0.637

SA, sickness absence; IRR, incidence rate ratio; 95% CI, 95% confidence intervals.

Discussion

This study shows that women with a BC-related SA had a significantly lower probability of being employed than those without an SA or with an SA due to other diagnoses. These women also had a higher probability of being unemployed than the other groups, especially compared with women without cancer, although this difference was non-significant. Because this group represented a very small number of women, these findings may indicate a two-fold vulnerability; that is, women with BC not only worked less than the general working population but also received less social security when they were unemployed.

These results are consistent with those of previous research highlighting that most women with a BC-related SA return to work (6). However, we focused on differences in the medium- to long-term probability of employment among salaried BC survivors after RTW compared with women absent due to another diagnosis and those without an SA. The literature on future labour life primarily focuses on RTW. Studies assessing long-term employment after RTW are scarce and consequently there is a lack of knowledge on whether survivors remain in paid work and, if they do, for how long. Although some publications indicate that BC survivors remain employed from diagnosis to certain long-term time points (e.g., 8 years) (16, 17, 15, 18), they did not consider overall employment stability over time.

In our study, we did not evaluate the quality of employment but rather measured the total time in employment. Our findings indicate that employability was consistently higher in workers without an SA than in those with a BC-related SA over approximately 7 years of follow-up. After 2 years, the differences versus women with an SA due to other medical diagnoses decreased. After approximately 5.5 years (2,000 days) the trend in women with a BC-related SA improved versus that in women with an SA due to other medical diagnoses. This finding suggests that the longer the time since the most intense treatment phase, the higher the probability of remaining in stable employment.

We also found nonsignificant trends towards a higher accumulation of days in unemployment with benefits among BC survivors than in women without cancer. However, this trend was observed in only a minority of women with BC. Examination of the distribution of unemployment in these two groups revealed that more women with an SA due to other medical diagnoses received unemployment benefits at least once (32 women vs 21, respectively), but the distribution was more asymmetrical. Specifically, women with a BC-related SA tended to accumulate a higher number of days in unemployment than women with SA due to other medical diagnoses. Given that these women worked less than the comparison groups, this result was to be expected. Previous literature shows that cancer survivors are 1.4 times more likely to be unemployed than non-cancer controls, though these estimates include survivors with and without benefits but eligible to work (7), even 10 years after diagnosis (19).

We hypothesised that the low number of days in employment observed in BC survivors would be in line with trends in unemployment accumulation. However, this pattern was in evidence in only a minority of BC survivors. Therefore, it is reasonable to assume that most women in this group lacked access to unemployment benefits. Most studies on this topic have been performed in the USA and Scandinavia, which have different labour markets and benefit coverage provided by social security systems in terms of accessibility, duration, and level of support (20). Additionally, in Spain, individuals can only access unemployment benefits if their contract ends involuntarily (e.g., if they have temporary contracts) or if they are dismissed. Workers voluntarily terminating the contractual relationship do not have the right to receive benefits (21). Therefore, women with a BC-related SA in our study may have experienced periods of unemployment without benefits or may have received other benefits, such as permanent disability or early retirement. This situation has been reported in previous studies (22), but information is lacking in the present study. Further studies should analyse the quality of employment before BC diagnosis (precarious versus high quality employment) and its impact on receiving unemployment or other benefits.

The main limitation of the present study is its relatively small sample size, which could compromise the significance of our results. However, the sample was derived from a large administrative database with data on social security benefits and a long follow-up, including information on labour market states from a life-course

approach, which is needed to obtain a sufficient overview of the RTW process. In addition, the diagnoses causing SAs were medically certified by primary care physicians rather than being self-reported, enhancing the validity of our results (23). Another limitation is that we lacked information on the periods when participants were neither employed nor unemployed with benefits. They could have been unemployed without receiving any benefits or receiving other benefits such as SA or permanent disability benefits, or partially or early retired. Unlike other studies (24,25), we included two comparison groups, which allowed us to distinguish between women with BC, those with other diseases and women free of disease. However, further studies are needed to analyse how these unemployment rates are articulated in terms of the number of SA episodes during the course of cancer survivorship until retirement age.

In summary, the results of this study demonstrate that women with BC had the lowest average number of employment days among the comparison groups. These women also had less access to unemployment benefits and required them for a longer period than the general population. As a result, they could be at risk of labour market marginalisation. These findings may indicate that BC survivors have greater difficulty in keeping their jobs or in finding new jobs due to their health status or discrimination. There may also be shortfalls in the social security system in Spain since these results could indicate that BC places women in a vulnerable position with limited social security from unemployment benefits.

Conclusions

Women with BC had a lower probability of being employed than those without SA and those with SA due to other diagnoses, and also had the lowest average number of days in employment compared with the two other groups. This study also shows that only a small number of women with BC receive unemployment benefits, even though this group accumulated a high number of days not working. Although the representativeness is low, our findings reveal worrying trends in relation to the working life of women with BC, which should be addressed.

Further studies with longer follow-up periods and large sample sizes are required to better understand the working life-course of BC survivors. However, our results demonstrate the need take action to provide greater support to women who have undergone BC treatment to enhance their employability and offer assistance and feasible alternatives for their RTW. It is essential to regulate workplace programmes that cater to the needs of BC survivors, which often overlap with those of individuals with other diagnoses, so that these women may continue to work, when possible and desired. Improvements in the social security system are required to guarantee that women with BC have access to unemployment benefits when necessary.

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Competing interests

The authors declare no competing interests.

Key points:

- Women with a breast cancer-related sickness absence (SA) were less likely to be employed in the long term than women with an SA due to other diagnoses or with no SA.
- Women with breast cancer had a lower probability of receiving unemployment benefits than women with an SA due to other diagnoses or without an SA.
- Health and social security systems should guarantee cancer survivors the opportunity to continue voluntary participation in the labour market by providing information, training, opportunities for employment, and unemployment benefits when required.
- Women with breast cancer should be guaranteed temporary benefits until they are able to return to work or permanent benefits if they are unable to do so.

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4.3. Study III: Labour market participation after a sickness absence due to cancer: a dynamic cohort study in Catalonia (Spain)

STUDY III

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Labour market participation after a sickness absence due to cancer: a dynamic cohort study in Catalonia (Spain)

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Abstract

Background: The consequences of cancer on working life until retirement age remain unclear. This study aimed to analyse working life considering all possible labour market states in a sample of workers after an sickness absence (SA) due to cancer, and to compare their working life paths to those of a sample of workers without SA and with an SA due to other diseases.

Methods: Retrospective dynamic cohort study of social security affiliates in Catalonia from 2012-2018. Cases consisted of workers with an SA due to cancer between 2012-2015 (N=516) and were individually age- and sex-matched with an affiliate with an SA due to other diagnoses and a worker without an SA. All workers (N=1,548, 56% women) were followed up from the entrance to the cohort until the end of 2018 to characterise nine possible weekly labour states. Sequence analysis, optimal matching, and multinomial logistic regression were used to identify and assess the probability of future labour market participation patterns (LMPP). All analyses were stratified by sex.

Results: Compared with workers with an SA due to cancer, male workers with no SA and SA due to other causes showed a lower probability of being in the LMPP of death (aRRR 0.02, 95% CI: 0.00–0.16; aRRR 0.17, 95% CI: 0.06–0.46, respectively), and in women lower probability of increasing permanent disability and death (aRRR 0.24, 95% CI: 0.10–0.57; aRRR 0.39, 95% CI: 0.19–

0.83, respectively). Compared to workers with SA due to cancer, risk of future retirement was lower in workers with no SA (women aRRR 0.60, 95%CI: 0.22–1.65; men aRRR 0.64, 95%CI: 0.27–1.52).

Conclusions Workplaces should be modified to the needs of cancer survivors, many of which are common to all diagnoses, in order to prevent more frequent retirement and permanent disability when possible. Further studies should assess the impact of cancer on premature exit from the labour market among survivors, depending on cancer localisation and type of treatment.

Key words (3 to 10): sickness absence, cancer, return to work, permanent disability, retirement, longitudinal study, sequence analysis.

INTRODUCTION

In 2020, 385 new cases of cancer per 100,000 persons aged 20-64 years were diagnosed in Europe [1]. This figure represents nearly 50% of the total number of new cancer diagnoses [2], and the average 5-year survival of malignant neoplasms considering all ages has reached almost 54% [3]. A recent report predicted an extension of working life, with a 10% increase in the participation rate among workers aged between 64 and 74 years by 2070 in the EU-27 [4]. Therefore, an increase in the number of people diagnosed with cancer while working is expected.

Currently, most cancer survivors take a sickness absence (SA) during their treatment to overcome the acute stage of the disease [5] with the intention of returning to work when treatment ends. These SAs tend to be longer than SA spells due to other diagnoses [6]. After the treatment stage, some cancer survivors face adverse effects that can persist for prolonged periods or become chronic due to the treatment or the severity of the disease itself [7]. When these symptoms impair work performance, cancer survivors may decide to ask for permanent disability (PD) benefits from the social security system. The process of returning to work or not is also affected by other factors. On the one hand, sociodemographic factors such as age, sex, education level and family support influence the ability to continue work after cancer. A recent study showed that female cancer survivors dropped out of work more often than controls of both genders, were less likely to work full-time than males, and that they increased their participation in short part-time work more than male survivors. [8]. On the other

hand, work and employment conditions, job strain, physical job demands, type of job, support at the workplace, type of contract and previous periods of unemployment [9-11]. However, most cancer survivors attempt to return to work (RTW) after the first year or a maximum of 2 years after diagnosis, right after the SA ends [12].

Literature on long-term working life, including all the possible working paths after cancer, is scarce. Most studies look at the probabilities of future labour outcomes individually, which obviates transitions between these states until retirement. Characterising the working paths of cancer survivors may shed light on how surviving the disease and subsequent career decisions may interact in the long term. In a previous study, we showed that cancer survivors are less likely to accumulate days of employment in the long term [13]. On the one hand, these changes in survivors' working life may be driven by personal decisions due to health or financial status or a desire to modify career paths after a reassessment of life priorities [14]. Hence, cancer survivors may decide to work fewer hours than before the SA, take time off from work for prolonged periods, and experience cancer-associated long- or short-term job loss with or without unemployment benefits [15]. In addition, some survivors choose to change their retirement plan by retiring early or before planned [15]. On the other hand, these decisions could also be driven by labour market or workplace demands. For example, some survivors may not be able to carry out a high-strain job due to long-term side effects impairing their ability to work [16], and there may be a lack of appropriate jobs for their new health status. These decisions may take

place at different points after RTW and combine differently depending on opportunities in the labour market and workplace factors. The negative impact of cancer on working life could increase inequalities that could and should be addressed to lessen financial and psychological consequences.

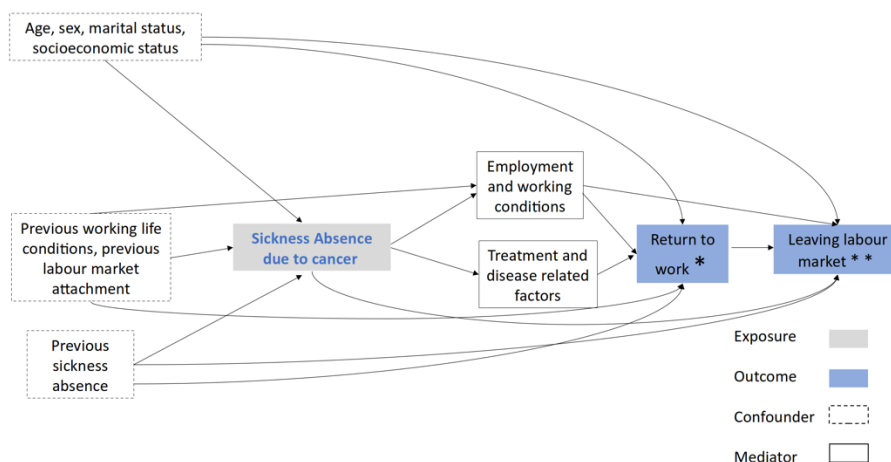


Figure 1 Directed acyclic graph (DAG) of the relationship between having a sickness absence due to cancer and future working life. *categories of the variable “Return to work t1”: temporary employment, unemployment, permanent employment; ** categories of the variable “Return to work t2”: permanent disability, early retirement, retirement, inactivity and premature death.

We hypothesised that cancer survivors would have more unstable career paths after returning to working activity and have a higher probability of prematurely leaving the labour market than people with other diseases or the general working population (Figure 1).

The objective of this study was to analyse future labour participation trajectories, considering nine possible labour market states (temporary and permanent employment, unemployment, inactivity, permanent disability, early retirement, retirement, inactivity and premature death), in a sample of workers affiliated to social security after an SA due to cancer, and to compare their working life paths to those of a sample of workers without SA and to workers with an SA due to other diseases.

METHODS

The study was based on the Spanish WORKing life social security (WORKss) cohort [17]. Briefly, WORKss cohort is based on the Continuous Working Life Sample (CWLS), which has taken an annual random representative sample of 4% (approximately one million of workers) of affiliates of the Spanish social security system since 2004. This database contains a full employment history of each affiliate, including information such as occupational category, the company's economic activity, employment conditions (e.g., type of contract, income, and working time), social benefits (e.g., unemployment, permanent disability [PD], and retirement), other work-related variables (e.g., company ownership and size), and date of death.

In addition, in this study, we linked the database of the Catalan Institute for Medical and Health Evaluations (ICAM by its acronym in Catalan), from which we obtained information on SA records between 2012 to 2015, including the medical diagnosis of the episode

coded according to the 10th edition of the International Classification of Diseases (ICD-10), as well as the start and end date [18] of workers affiliated to the Spanish social security system in Catalonia, who were also part of the Spanish WORKss cohort.

We performed a retrospective dynamic cohort study among 1548 (675 men and 873 women) salaried workers living in Catalonia. For the study population, inclusion criteria were being affiliated with general regime of social security and living in Catalonia between 2012 and 2015 (observational period for SA). For the sample selection, firstly, we identified all salaried workers who had had an SA due to a malignant neoplasm (ICD-10, C00-C97) between 2012 and 2015 from anonymized ICAM records (N=645), and they were linked to the information of WORKss cohort (156,000 salaried workers affiliated to the general regime of social security residents in Catalonia), resulting in 516 workers with information in both databases. Secondly, for each worker with SA due to cancer we individually matched two workers by age- (within a 5-year range), sex- (men and women), and time at risk (entrance to cohort the same week as the SA due to cancer ended). On the one hand, 516 salaried workers with an SA due to a medical diagnosis other than cancer (ending the same week as the SA due to cancer episode) were randomly selected from a pull of 47,663 workers from WORKss cohort among those meeting individual matching criteria. On the other hand, 516 salaried workers without an SA were randomly selected from WORKss cohort, among those meeting individual matching criteria, after excluding workers who had a SA for any

medical diagnosis at beginning of the follow up (N= 139,744) . (Supplementary Table 1 and supplementary Table 2). The selection of two comparison groups with and without SA was made to assess a potential gradient of the possible effect of cancer on working life with general working population and with workers with other health problems recognised by SA.

The average age of the three comparison groups in 2012 was 49.8 years for men (standard deviation: 9.96) and 47.0 years for women (standard deviation: 9.44). Among the comparison group of workers with an SA diagnosis other than cancer, the most frequent cause was diseases of the musculoskeletal system and connective tissue in both men and women (Supplementary table 2)

Each worker's working life was characterised weekly from the time they entered the cohort between 2012 and 2015 until December 31, 2018, according to the possible labour states after an SA due to cancer. The study period ranged from 3 to 7 years, and the time out of the cohort was censored. The possible states were: temporary employment, permanent employment, unemployment with benefits, inactivity (considered as not having contact with social security longer than 15 days), PD (including total, absolute and severe degrees), early retirement, ordinary retirement, and death. If a worker was in two different states in the same week, that worker was assigned the state where he/she spent the longer time.

Potential confounders included in our analysis were occupational category (non-manual skilled, non-manual non-skilled, manual

skilled, or manual non-skilled); working time categorised as a percentage of weekly hours (full-time [$>87.5\%$], part-time [$50\%-87.5\%$], or short and marginal part-time [$\leq 37.5\%-49\%$]); monthly average income in tertiles based on income of study population in 2012 (high [$>€2370$], medium [$€1450 - 2370$], or low [$\leq €1450$]); company size (small/medium [up to 100 employees] and big [>100 employees]); company ownership (private and public); and the company's economic activity (primary sector [agriculture, hunting, forestry, fishing, mining, and quarrying]; manufacturing [including construction and energy], and services). We also considered the previous 5-year employment ratio expressed as a percentage of employed days to the total potential working days, including working or unemployed or not affiliated days, to assess attachment to the labour market before the SA due to cancer. Workers who changed categories over time were assigned the category in which they spent most of the follow-up period.

Patients were not involved in any stage of the study, and confidentiality was maintained in both databases. The authors received data that were previously anonymised.

Statistical analysis

The sample was described according to the above-mentioned response variables, explanatory variables and covariates, and the chi-square test was applied to assess the significance between comparison groups (Supplementary table 1). Sequence analysis was performed to reconstruct individual working lives by generating an

ordered list of weekly labour states after an SA due to cancer. Optimal matching and cluster analyses were applied to identify groups of workers sharing similar working life trajectories. We called the resulting trajectories future labour market participation patterns (LMPP). Average silhouette width (ASW) was used to select the optimal number of clusters (values higher than 0.51 are recommended; Supplementary table 3) [19,20].

To measure the association between having an SA due to cancer and future LMPPs versus the comparison groups, we applied multinomial logistic regression with its relative risk ratio (RRR) and 95% confidence interval (95%CI) using stable employment LMPP as a reference.

All analyses were stratified by sex. Stata v.13 software was used for multinomial regression models, and R v.4.1.0 was used for sequence analysis and optimal matching analysis.

RESULTS

We found five LMPPs in both sexes which were named as a description of labour trajectories found in each sex. Among women, shared LMPPs were stable employment (60.3%), decreasing labour market engagement (18.7%), temporariness (9.1%), increasing PD and death (7.0%), and retirement (4.8%). Men's future LMPP were summarised in stable employment (56.9%), employment instability and early retirement (20.0%), increasing retirement (11.4%), death (7.1%), and PD (4.7%) (Figure 2, Table 1).

Table 1 Future labour market participation patterns (LMPPs) in salaried workers living in Catalonia (2012–2018).

	Employment trajectories											
	Women (N=873)					p value	Men (N=675)					p value
	Stable employment (60.3%)	Decreasing labour market engagement (18.7%)	Temporariness (9.1%)	Increasing PD and death (7%)	Retirement (4.8%)		Stable employment (56.9%)	Employment instability and early retirement (20%)	Increasing retirement (11.4%)	Death (7.1%)	PD (4.7%)	
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)		
Comparison groups												
SA-cancer	170 (32.3)	42 (25.6)	27 (33.8)	38 (62.3)	14 (33.3)	<0.0001***	118 (30.7)	32 (23.7)	25 (32.9)	42 (87.5)	8 (25.0)	<0.0001***
SA-other diagnoses	169 (32.1)	65 (39.6)	29 (36.3)	15 (24.6)	13 (31.0)		120 (31.3)	57 (42.2)	27 (35.5)	5 (10.4)	16 (50.0)	
No-SA any diagnoses	187 (35.6)	57 (34.8)	24 (30.0)	8 (13.1)	15 (35.7)		146 (38.0)	46 (34.1)	24 (31.6)	1 (2.1)	8 (25.0)	
Follow-up period												
Age 2012 (years)												
≤25	3 (0.6)	4 (2.44)	2 (2.5)	*	*	<0.0001***	3 (0.8)	3 (2.2)	*	*	*	<0.0001***
26-35	63 (12.0)	24 (14.6)	9 (11.3)	6 (8.8)	*		49 (12.8)	18 (13.3)	*	3 (6.3)	2 (6.3)	
36-45	186 (35.4)	55 (33.5)	23 (28.8)	18 (29.5)	*		93 (24.2)	18 (13.3)	*	8 (16.7)	1 (3.1)	
46-55	200 (38.0)	57 (34.8)	25 (31.3)	24 (39.4)	*		159 (41.4)	46 (34.1)	*	13 (27.1)	10 (31.3)	
>55	74 (14.1)	24 (14.6)	21 (26.3)	13 (21.3)	42 (100)		20 (20.8)	50 (37.0)	76 (100)	24 (50.0)	19 (59.4)	
Monthly income average (tertiles)												
High (>€2370.0)	167 (31.8)	27 (16.5)	14 (17.5)	12 (19.7)	3 (7.1)	<0.0001***	196 (51.0)	46 (34.1)	24 (31.6)	15 (31.3)	5 (15.6)	<0.0001***
Medium (€1451.0 - 2370.0)	197 (37.5)	42 (25.6)	34 (42.5)	13 (19.7)	6 (14.3)		137 (35.7)	44 (32.6)	16 (21.1)	10 (20.8)	11 (34.4)	
Low (≤€1450.0)	162 (30.8)	91 (55.5)	32 (40.0)	31 (50.8)	33 (78.6)		51 (13.3)	43 (31.9)	35 (46.1)	19 (39.6)	13 (40.6)	
Occupational category												
Non-manual skilled	136 (25.9)	31 (18.9)	22 (27.5)	10 (16.4)	16 (38.1)	0.003**	89 (23.2)	29 (21.5)	26 (34.2)	9 (18.75)	3 (9.4)	0.039*
Non-manual non-skilled	246 (46.8)	59 (36.0)	35 (43.8)	27 (44.3)	12 (28.6)		123 (32.0)	44 (32.6)	15 (19.7)	18 (37.5)	12 (37.5)	
Manual skilled	76 (14.5)	28 (17.1)	9 (11.3)	14 (23.0)	3 (7.1)		139 (36.2)	45 (33.3)	26 (34.2)	11 (22.9)	11 (34.4)	
Manual non-skilled	51 (9.7)	29 (17.7)	8 (10.0)	8 (13.1)	10 (23.8)		22 (5.7)	12 (8.9)	8 (10.5)	2 (4.2)	6 (18.8)	
Company economic activity												
Manufacturing, energy construction	84 (16.0)	16 (9.8)	6 (7.5)	6 (9.8)	1 (1.4)	0.016*	123 (32.0)	38 (28.2)	24 (31.6)	11 (22.9)	12 (37.5)	0.717
Services	432 (82.1)	140 (85.4)	73 (91.3)	51 (83.6)	41 (97.6)		253 (65.9)	91 (67.4)	47 (61.8)	31 (64.6)	18 (56.3)	
Working time (% weekly hours)												
Full-time (>87.5%)	423 (80.4)	111 (67.7)	52 (65.0)	40 (66.7)	11 (26.2)	<0.0001***	363 (94.5)	117 (86.7)	31 (40.8)	33 (68.8)	25 (78.1)	<0.0001***
Part-time (50%-87.5%)	89 (16.9)	33 (20.1)	11 (13.8)	15 (25.0)	4 (9.5)		14 (3.7)	8 (5.9)	5 (6.6)	4 (8.3)	5 (15.6)	

Short and marginal part-time ($\leq 37.5\%$ -49%)	14 (2.7)	19 (11.6)	17 (21.3)	5 (8.3)	27 (64.3)		7 (1.8)	10 (7.4)	39 (51.3)	5 (10.4)	2 (6.3)	
Company size												
Small-medium (≤ 100 workers)	269 (51.1)	112 (68.7)	36 (45.0)	29 (48.3)	25 (59.5)	0.001**	229 (59.6)	92 (68.2)	49 (64.5)	23 (47.9)	24 (75.0)	0.156
Big (>100 workers)	257 (48.9)	51 (31.3)	44 (55.0)	31 (51.7)	17 (40.5)		155 (40.4)	43 (31.9)	26 (34.2)	19 (39.6)	8 (25.0)	
Company ownership												
Private	373 (70.9)	108 (65.9)	37 (46.3)	42 (68.9)	33 (78.6)	<0.0001***	303 (78.9)	98 (72.6)	55 (72.4)	32 (66.7)	27 (84.4)	0.956
Public	102 (19.4)	22 (13.4)	32 (40.0)	11 (18.0)	7 (16.7)		59 (15.4)	19 (14.1)	13 (17.1)	6 (12.5)	4 (12.5)	
5 years previous to follow-up												
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Employment time (ratio)	95.1 (12.9)	87.0 (22.7)	86.3 (23.6)	89.6 (18.6)	97.4 (9.3)	<0.0001***	95.0 (13.6)	86.1 (23.4)	97.3 (10.1)	84.3 (29.1)	88.3 (21.1)	<0.0001***
Total	526	164	80	61	42		384	135	76	48	32	

SA, sickness absence; follow-up period ranges from 3 to 6 years, from entrance to the cohort until the end of 2018; previous 5 years, calculated from to each individual's entrance; SD, standard deviation. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

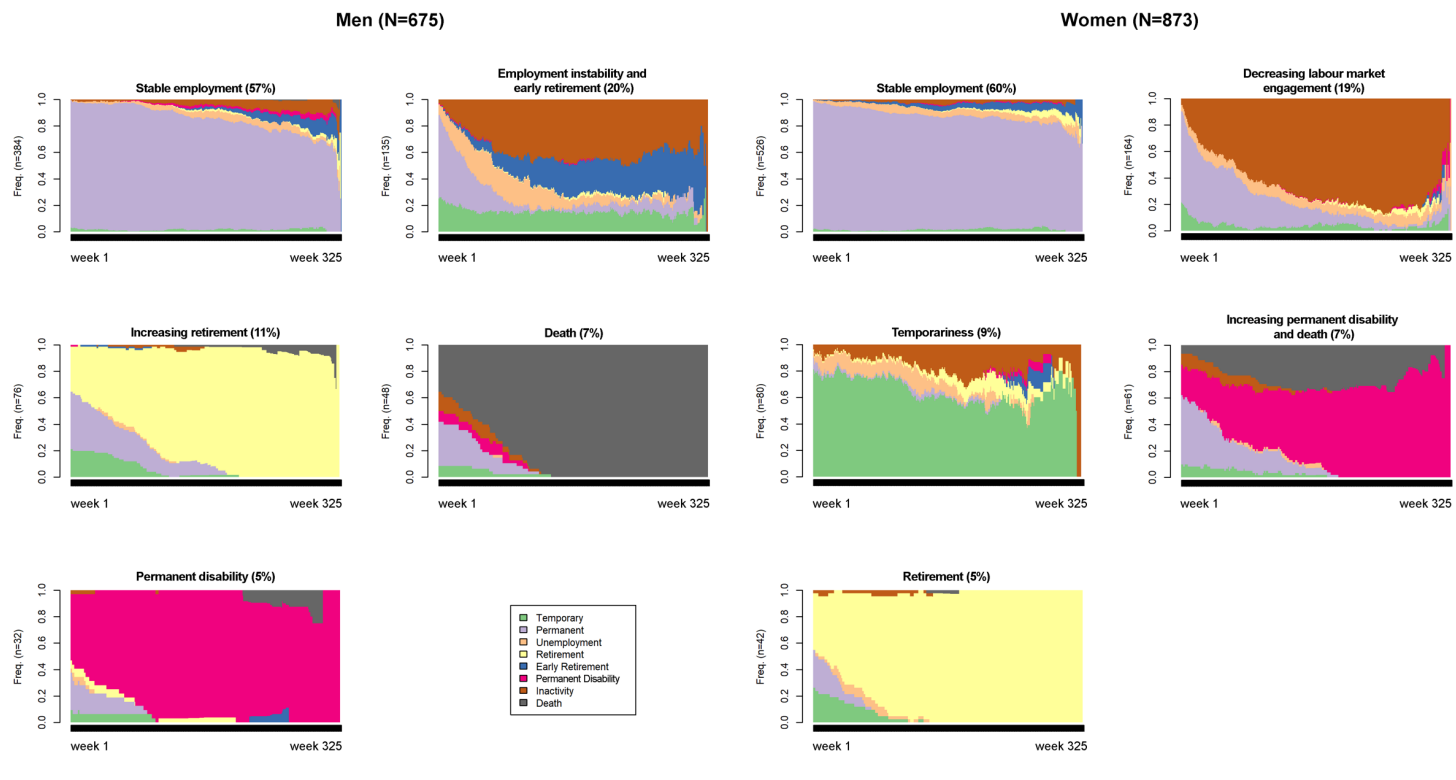


Figure 2 Future labour market participation patterns (LMPPs) in a sample of salaried men (top) and women (bottom) in Catalonia (2012–2018).

In both sexes, the most frequent LMPP was stable employment. Among workers with an SA due to cancer, 32.3% of women and 30.7% of men were in this pattern (Table 1). In this LMPP, 80% of workers were employed on a permanent contract throughout the follow-up period (Figure 2), and monthly income tended to be high (31.8% of women and 51.0% of men). In women, it also showed the lowest proportion of manual non-skilled occupations (9.7%) (Table 1).

Taking this stable employment LMPP as the reference category in both sexes, and compared with workers with an SA due to cancer, we examined the probability of belonging to each LMPP among workers with an SA due to other causes and workers without an SA (Tables 2 and 3).

Table 2 shows that, taking workers with the SA due to cancer reference group, women with an SA due to other causes had a higher probability of being in a decreasing labour market engagement LMPP rather than in a stable employment LMPP (aRRR 1.72, 95% CI: 1.02–2.90). In men (Table 3), a similar pattern was found, employment instability and early retirement LMPP, with same differences between workers with a SA due to other causes and those with SA due to cancer (aRRR 1.76, 95% CI: 1.00–3.11). These LMPPs represented the second most frequent LMPP in men and women, showing a group of workers mostly employed on permanent contracts (60.0%), but very soon they started switching to inactivity

in women, whereas in men the switch was towards unemployment benefits and inactivity, or to early retirement (Figure 2).

Table 2 Association between future labour market participation patterns (LMPPs), company characteristics, and employment conditions among female salaried workers with a SA due to cancer (reference) and comparison groups.

	Women											
	Decreasing labour market engagement vs stable employment			Temporariness vs stable employment			Retirement vs stable employment			Increasing PD and death vs stable employment		
	RRR	95% CI	p value	RRR	95% CI	p value	RRR	95% CI	p value	RRR	95% CI	p value
Crude												
SA-cancer	1			1			1			1		
SA-other diagnoses	1.56	(1.00–2.42)	0.050	1.08	(0.61–1.90)	0.789	0.93	(0.43–2.05)	0.865	0.40	(0.21–0.75)	0.004**
No-SA any diagnoses	1.23	(0.78–1.93)	0.360	0.81	(0.45–1.45)	0.477	0.97	(0.46–2.08)	0.946	0.19	(0.09–0.42)	<0.0001***
Individually adjusted by:												
Income (tertiles)												
SA-other diagnoses	1.55	(0.98–2.45)	0.059	1.06	(0.60–1.87)	0.850	0.92	(0.41–2.05)	0.831	0.42	(0.22–0.83)	0.012*
No-SA any diagnoses	1.12	(0.70–1.78)	0.630	0.79	(0.43–1.42)	0.425	0.84	(0.38–1.82)	0.650	0.20	(0.09–0.45)	<0.0001***
Occupational category												
SA-other diagnoses	1.47	(0.92–2.36)	0.111	1.08	(0.60–1.94)	0.808	1.01	(0.45–2.25)	0.983	0.32	(0.16–0.62)	0.001**
No-SA any diagnoses	1.21	(0.75–1.95)	0.435	0.77	(0.42–1.43)	0.414	0.96	(0.44–2.11)	0.926	0.18	(0.08–0.40)	<0.0001***
Company economic activity												
SA-other diagnoses	1.67	(1.06–2.64)	0.027*	1.11	(0.62–1.96)	0.725	1.03	(0.47–2.26)	0.944	0.41	(0.21–0.80)	0.009**
No-SA any diagnoses	1.37	(0.86–2.17)	0.185	0.87	(0.48–1.57)	0.643	1.07	(0.50–2.29)	0.862	0.22	(0.10–0.49)	<0.0001***
Working time (% weekly hours)												
SA-other diagnoses	1.58	(1.01–2.47)	0.047*	1.03	(0.58–1.83)	0.923	0.80	(0.33–1.92)	0.610	0.41	(0.22–0.77)	0.006**
No-SA any diagnoses	1.26	(0.80–1.99)	0.321	0.78	(0.43–1.42)	0.410	0.86	(0.37–2.03)	0.732	0.20	(0.09–0.44)	<0.0001***
Company size												
SA-other diagnoses	1.68	(1.07–2.64)	0.023*	1.06	(0.60–1.87)	0.834	0.96	(0.44–2.10)	0.914	0.40	(0.21–0.77)	0.005*
No-SA any diagnoses	1.24	(0.79–1.96)	0.352	0.81	(0.45–1.46)	0.490	0.97	(0.45–2.06)	0.929	0.20	(0.09–0.44)	<0.0001***
Company ownership												
SA-other diagnoses	1.65	(1.01–2.71)	0.045*	1.14	(0.62–2.12)	0.675	1.00	(0.45–2.23)	0.999	0.41	(0.21–0.81)	0.010*
No-SA any diagnoses	1.35	(0.82–2.24)	0.242	0.93	(0.49–1.77)	0.826	1.04	(0.47–2.27)	0.931	0.24	(0.11–0.54)	0.001**
Previous 5-year employment time (ratio)												
SA-other diagnoses	1.62	(1.03–2.54)	0.036*	1.13	(0.64–2.00)	0.683	0.92	(0.42–2.02)	0.833	0.41	(0.22–0.77)	0.006*
No-SA any diagnoses	1.26	(0.80–2.00)	0.320	0.81	(0.44–1.47)	0.488	0.97	(0.45–2.07)	0.937	0.20	(0.09–0.43)	<0.0001***
Adjustment by all variables:												
SA-other diagnoses	1.72	(1.02–2.90)	0.043*	1.09	(0.56–2.13)	0.801	0.72	(0.26–1.95)	0.515	0.39	(0.19–0.83)	0.014*
No-SA any diagnoses	1.23	(0.72–2.11)	0.442	0.90	(0.45–1.80)	0.762	0.60	(0.22–1.65)	0.324	0.24	(0.10–0.57)	0.001**

SA, sickness absence; PD, permanent disability; RRR, relative risk ratio; 95% CI, 95% confidence intervals. *p<0.05; **p<0.01; ***p<0.001.

Compared with workers with an SA due to cancer, both comparison groups showed a lower probability of death in men (no SA aRRR 0.02, 95% CI: 0.00–0.16; SA due to other causes aRRR 0.17, 95% CI: 0.06–0.46) (Table 3). This pattern depicting workers who died during follow-up consisted mainly of men with an SA due to cancer (Table 1). In women, LMPP depicting workers who died was increasing PD and death LMPP, and same as in men comparison groups showed a lower probability of exhibiting them (no SA aRRR 0.24, 95% CI: 0.10–0.57; SA due to other causes aRRR 0.39, 95% CI: 0.19–0.83) (Table 2). The pattern showing workers on PD was more frequent among men with an SA due to other causes (50.0%), and those aged over 55 years (55.6%) (Table 1).

In women, unlike in men, an LMPP of temporariness represented 9% of the sample (Figure 2). Women without an SA showed trends towards a lower likelihood of being in a temporariness pattern (aRRR 0.90, 95% CI: 0.45–1.80) (Table 2). This LMPP showed the lowest percentage of employment in the 5 years before entering the cohort (86.3%) (Table 1).

Table 3 Association between future labour market participation patterns (LMPPs), company characteristics, and employment conditions among male salaried workers with a SA due to cancer (reference) and comparison groups.

	Men											
	Employment instability and early retirement vs stable employment			Increasing retirement vs stable employment			PD vs stable employment			Death vs stable employment		
	RRR	95% CI	p value	RRR	95% CI	p value	RRR	95% CI	p value	RRR	95% CI	p value
Crude												
SA-cancer	1			1			1			1		
SA-other diagnoses	1.75	(1.06–2.89)	0.029*	1.06	(0.58–1.94)	0.844	1.97	(0.81–4.77)	0.135	0.12	(0.04–0.31)	<0.0001***
No-SA any diagnoses	1.16	(0.70–1.94)	0.566	0.78	(0.42–1.43)	0.415	0.81	(0.29–2.22)	0.679	0.02	(0.00–0.14)	<0.0001***
Individually adjusted by:												
Income (tertiles)												
SA-other diagnoses	1.68	(1.00–2.79)	0.048*	1.06	(0.57–1.98)	0.857	2.22	(0.82–6.02)	0.116	0.12	(0.05–0.33)	<0.0001***
No-SA any diagnoses	1.03	(0.61–1.74)	0.920	0.73	(0.38–1.38)	0.334	0.92	(0.31–2.77)	0.881	0.02	(0.00–0.14)	<0.0001***
Occupational category												
SA-other diagnoses	1.63	(0.98–2.73)	0.062	1.17	(0.63–2.18)	0.611	1.77	(0.72–4.36)	0.212	0.14	(0.05–0.38)	<0.0001***
No-SA any diagnoses	1.18	(0.70–1.99)	0.526	0.87	(0.47–1.63)	0.667	0.80	(0.29–2.21)	0.666	0.02	(0.00–0.18)	<0.0001***
Company economic activity												
SA-other diagnoses	1.92	(1.14–3.22)	0.013*	1.07	(0.58–1.98)	0.836	2.19	(0.86–5.57)	0.100	0.14	(0.05–0.37)	<0.0001***
No-SA any diagnoses	1.21	(0.71–2.05)	0.481	0.72	(0.38–1.37)	0.320	0.82	(0.28–2.40)	0.713	0.02	(0.00–0.17)	<0.0001***
Working time (% weekly hours)												
SA-other diagnoses	1.78	(1.08–2.95)	0.025*	1.33	(0.65–2.72)	0.440	1.99	(0.81–4.86)	0.132	0.14	(0.05–0.37)	<0.0001***
No-SA any diagnoses	1.13	(0.68–1.89)	0.641	0.66	(0.31–1.40)	0.278	0.78	(0.28–2.16)	0.635	0.02	(0.00–0.16)	<0.0001***
Company size												
SA-other diagnoses	1.76	(0.06–2.91)	0.028*	1.11	(0.61–2.03)	0.737	1.98	(0.82–4.82)	0.131	0.14	(0.05–0.36)	<0.0001***
No-SA any diagnoses	1.13	(0.67–1.88)	0.650	0.79	(0.43–1.47)	0.457	0.76	(0.28–2.10)	0.602	0.02	(0.00–0.17)	<0.0001***
Company ownership												
SA-other diagnoses	1.53	(0.90–2.59)	0.115	1.03	(0.55–1.94)	0.922	2.19	(0.87–5.54)	0.098	0.15	(0.06–0.40)	<0.0001***
No-SA any diagnoses	1.14	(0.66–1.94)	0.643	0.79	(0.41–1.50)	0.470	0.95	(0.33–2.72)	0.930	0.03	(0.00–0.19)	<0.0001***
Previous 5-year employment time (ratio)												
SA-other diagnoses	1.86	(1.11–3.11)	0.018*	1.05	(0.58–1.91)	0.876	2.06	(0.84–5.01)	0.113	0.12	(0.05–0.33)	<0.0001***
No-SA any diagnoses	1.24	(0.73–2.09)	0.431	0.79	(0.43–1.45)	0.448	0.85	(0.31–2.34)	0.750	0.02	(0.00–0.15)	<0.0001***
Adjustment by all variables:												
SA-other diagnoses	1.76	(1.00–3.11)	0.052	1.38	(0.61–3.14)	0.443	2.24	(0.79–6.34)	0.128	0.17	(0.06–0.46)	0.001**
No-SA any diagnoses	1.09	(0.61–1.96)	0.761	0.64	(0.27–1.52)	0.314	0.86	(0.27–2.75)	0.793	0.02	(0.00–0.16)	<0.0001***

SA, sickness absence; PD, permanent disability; RRR, relative risk ratio; 95% CI, 95% confidence intervals. *p<0.05; **p<0.01; ***p<0.001.

When we assessed the probability of having an LMPP of exit from the labour market due to retirement, workers without an SA showed trends of a lower likelihood of being in this pattern, especially when adjusted by all employment and working conditions (women aRRR 0.60, 95% CI: 0.22–1.65; men aRRR 0.64, 95% CI: 0.27–1.52) than those with an SA due to cancer (Table 2 and 3). In men, this LMPP was the third most prevalent (11.4%), with almost 100% of men being retired by the end of follow-up. Women showed a similar LMPP, but in contrast, it was the least frequent pattern (Figure 2). Both men and women in these patterns were over 55 years and worked in a private company (Table 1).

DISCUSSION

This study's results go in favour of our hypothesis that workers with an SA due to cancer were more likely to retire, receive PD benefits or die than their counterparts. However, patterns depicting these outcomes represented a small proportion of the sample, the results should be interpreted with caution. Our findings are consistent after adjustment by several employment and working conditions.

Our results on retirement in workers with an SA due to cancer are in line with those of previous literature. We found retirement patterns in women and men. These negative results in workers with an SA due to cancer showed small estimates and were not statistically significant, especially in women. In men this difference was only found compared to those without SA. However, although they should be interpreted with scepticism, these tendencies are important in

terms of the population they represent. As previous studies show, workers very close to retirement age who are diagnosed with cancer may choose to retire [21]. Cancer treatments are still, in general, highly aggressive and leave some survivors with long-term health problems that may make them unable to carry out their prior employment, requiring them to live on PD. For example, a systematic review found that long-term survivors were less likely to be working than people without cancer [22]. Some workers experience less severe side effects from treatments, but require longer SA spells for recovery and readaptation to be able to work. In this regard, the social security system plays a major role by setting a maximum amount of time on SA that does not always suit cancer survivors' needs. These results question the effectiveness of the Spanish social security system in maintaining workers in the labour market during their working life and, when they are ill, to guarantee their income through benefits. In this case, after cancer treatment, some workers could continue working, but require more flexible SA schemes to recover from the range of effects produced by the cancer. Another explanation could be that workers who have had a serious health problem may find it more difficult to maintain the pace of a normal full-time job in the long term. However, they might also encounter discrimination – including hiring discrimination, harassment, job reassignment, job loss, and limited career advancement– due to their health problem [23]. These results are also coherent with the well-known healthy worker effect [24].

When we compared the probability of having a stable future working life to other patterns, we found unexpected results in workers with a

SA due to cancer. In men, in general, they were less likely to be in unstable and early retirement, or in PD trajectories than those with SA due to other causes. And although not statistically significant and with lower estimates, the same result was found compared to workers without a SA. In women, we observed similar statistically non-significant tendencies of unstable future working life among those with an SA due to other causes that became significant after adjustment by employment-related conditions. In both sexes, individual adjustment by the previous five-year attachment to labour market increased the estimations, as well as the economic activity of the company and the working time. In light of these results, we hypothesised that future instability could lie in the fact that SA due to other causes were highly represented by diseases of the musculoskeletal system and connective tissue, and these types of diagnoses are more prevalent among manual workers [25,26], who normally have more precarious jobs characterised by temporality and insecurity in Catalonia [27] and in the whole of Spain [28]. Few studies have assessed RTW and long-term working trajectories regarding PD or early retirement after all-cause SA comparing them with those with an SA due to cancer. A study carried out in Norway with a 10-year follow-up that examined long-term SA due to all diagnoses found that 32% of workers with SA due to any diagnoses had low attachment labour market trajectories, consisting of part-time work, recurrence of SA, unemployment or PD [29]. Having a comparison group with workers who have other health conditions, also recognised by a SA, allows us to see future differences in working life between overcoming cancer and other health problems,

and how after ending SA due to cancer adverse effects may still be affecting the ability to work of survivors, even more than other health problems. Moreover, it allows us to control for the potential effect of SA in itself, as SA is a determinant of low labour engagement and future SA [30].

This study identified differences in employment patterns by sex. Only in women, we found an LMPP of temporary employment. This LMPP was more probable among workers with an SA due to cancer than among workers with no SA. In Spain, temporary and part-time employment is more prevalent among women due to huge gender inequities in the Spanish labour market [31]. A similar study carried out in northern countries using the same methodology, but examining all-cause SA, found no differences by sex [32], whereas another study found that women were more prone to be in less stable trajectories with part-time work and SA recurrence than men [29]. It is likely that this gender-based temporariness is exacerbated by cancer. However, differences were not statistically significant so future studies should look at future precarity in cancer survivor women.

We also found differences by sex in retirement. In men, the difference in the likelihood of retirement among workers with an SA due to cancer compared with those without an SA was larger than that in women. We found a percentage of male workers that started to retire early, and this percentage increased steadily during the follow-up period. Also, retirement pattern was twice as prevalent as that found

in women. This might be due to differences in ease of access to retirement for several reasons. Firstly, as in all countries, a minimum period of pension contributions is a prior condition for retirement or early retirement. Due to reproductive work and motherhood, women have often contributed fewer years to the social security system, and for early retirement, workers must have contributed for at least 35 years [33,34]. Secondly, men are generally in better paid jobs, and since the amount of the early retirement pension depends on the workers' previous regulatory basis, men have better early retirement pensions, making retirement more appealing [31]. In addition, some companies have early retirement policies if the worker voluntarily wants to retire and does not meet social security requirements, and these policies are more accessible to men than to women [35], probably because they exist in male dominated sectors. Lastly, in our study, the sample of men was older than that of women and, throughout Spain, to retire before the retirement age, the worker must be a maximum of 2 years below this age to get full pension benefits.

The main limitation of the present study is the lack of information on cancer other than the SA diagnosis for the period 2012-2015. Hence, we were unable to take into consideration the effect of clinical features (i.e., type of treatment, stage of cancer, effects of health status before 2012). In addition, we managed time-varying covariates by assigning workers to the category in which they spent most of their time during the follow-up. Also, self-employed were not included in the study, because they did not have access to SA benefits during the study period. Furthermore, the methodology applied to employment

trajectories involved an algorithmic data-driven approach that classified individuals according to similar characteristics. Consequently, some resulting groups had a small number of observations which should be interpreted cautiously.

The primary strength of this study, in terms of occupational health relevance, as well as from a clinical perspective, is the use of administrative data with information on social security benefits and an extensive time window of follow-up with information on labour market states, which is needed to obtain a sufficient overview of the RTW process. The size of the database allowed us to match our workers with SA due to cancer to two comparison groups by age, sex, and follow-up time. This matching allowed us to compare the working life of cancer survivors with that of the general working population with or without SAs, enabling us to account not only for the disease, but also for the effect of SA. The diagnoses causing SAs were medically certified by primary care doctors rather than self-reported, enhancing the validity of our results [36].

CONCLUSIONS

Most workers with an SA due to cancer have a future working trajectory in employment. However, our results show that they could be more likely to retire, receive a PD benefit or die than their counterparts of the same age and sex. Nevertheless, further studies with higher sample sizes would be necessary to confirm our trends. This study represents a step towards a deeper understanding of the consequences of cancer on working life as it captures all possible

labour outcomes and their chronological onset on workers' life. However, more studies are needed to address questions that remain unanswered in the light of our results such as the whether there any differences between cancer diagnoses, stages, or treatments regarding future working trajectories.

Nevertheless, for the time being, action should be taken to regulate programmes in the workplaces that consider the needs of workers who have survived cancer, many of which are common to all diagnoses, so that these workers may remain working when possible and desired.

LIST OF ABBREVIATIONS

- SA: Sickness Absence
- LMPP: Labour market participation patterns
- RRR: Relative risk ratio
- aRRR: Adjusted relative risk ratio
- 95%CI: 95% confidence interval
- EU: European Union
- RTW: Return to work
- PD: Permanent disability
- ICD-10: 10th Edition of the International Classification of Diseases
- ASW: Average silhouette width

DECLARATIONS

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was performed in accordance with the standards of Good Clinical Practice and the principles of the Declaration of Helsinki. The study protocol guaranteed the fulfilment of Regulation (EU) 2016/679 of the European Parliament and the Council of 27 April 2016 on the protection of natural persons regarding the processing of personal data and the free movement of such data. It also fulfilled Spanish Organic Law 3/2018 of 5 December on the Protection of Personal Data and the Guarantee of Digital Rights. This study was approved by the Parc de Salut Mar Clinical Research Ethics Committee (CEIm-PSMAR) (Research Protocol no. 2020/9119) and was exempted from informed consent requirements owing to its registry-based design. The research team committed itself to the strict use of data for the present study. In addition, a linkage protocol agreement between the Centre for Research in Occupational Health at Pompeu Fabra University, the National Social Security Institute, and the Catalanian Institute for Medical Evaluations guaranteed the maintenance of confidentiality in providing the identified datasets to the authors.

CONSENT FOR PUBLICATION

Consent for publication is not applicable for this study.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from General Directorate of Social Security (DGOSS by its acronym in Spanish) and the Catalan Institute for Medical and Health Evaluations (ICAM by its acronym in Catalan), but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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AUTHORS' CONTRIBUTIONS

All listed authors fulfil authorship criteria. A.A.G., L.S. and F.G.B. participated in the study conception and design. A.A.G. and L.S. performed the main data management and analysis and interpreted the data. A.A.G. drafted the first version of the manuscript with close help from L.S. F.G.B. and L.S. made subsequent revisions to the manuscript. All authors revised the final version, agreed with the text

and findings, and approved this final version. The corresponding author certifies that all listed authors meet authorship criteria. A.A.G. is the guarantor.

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4.4. Study IV: Understanding return to work after a cancer-related sickness absence. Perceptions of barriers and facilitators among all relevant stakeholders.

STUDY IV

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Understanding return to work after a cancer-related sickness absence. Perceptions of barriers and facilitators among all relevant stakeholders

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ABSTRACT:

Purpose: The literature on cancer and its effect on work, both qualitative and quantitative, has mainly focused on the moment of return to work (RTW), and from a single stakeholder perspective. The aim of this study was to examine the factors acting as barriers or facilitators, from diagnosis and sickness absence (SA) to RTW and work retention, after a cancer-related SA from the perspectives of all stakeholders in the Spanish setting.

Methods: Descriptive qualitative approach with a socio-constructivist perspective. Theoretical sampling was carried out until saturation. Six discussion groups (4-8 people/group) were conducted: three groups of people with a cancer-related SA in Catalonia (Spain), one with oncology care professionals, and two with company representatives. An additional individual interview was conducted with a primary care physician. The sessions were held virtually and were recorded, transcribed verbatim, and analyzed using thematic analysis and mixed coding.

Results: Barriers to RTW and work retention detected by stakeholders included insufficient information and guidance on the impact of cancer on work and SA management, lack of general knowledge and recognition of side effects, lack of consideration of job tasks by medical tribunals, and working in precarious employment. Facilitators included workplace support, psycho-oncologists, patient associations, and working for a public company.

Conclusions: Both work interruption due to an SA and RTW, are key moments for determining cancer survivors' work retention. We

found a general perception of lack of involvement of the social security system, companies, and health professionals in Spain in the impact of cancer on work.

Implications for Cancer Survivors: Integrating the work sphere in cancer care from the beginning of cancer treatment, and by all stakeholders, could facilitate successful future RTW.

Keywords: Sickness absence, Return to work, Cancer survivors, Healthcare professionals, Employers, Qualitative

BACKGROUND:

Cancer has a significant impact on individuals in Europe, with approximately 385 new cases per 100,000 persons [1]. In half of these individuals, the disease is diagnosed during their working life and usually requires an interruption of daily routines shaped by work. This interruption is usually temporary [2], and is subsidized by sickness absence (SA) benefits in countries with a robust social security system. As survival rates among people with a cancer diagnosis continue to increase [3], it is crucial to consider cancer survivors' labor participation and its role in quality of life, as work provides not only economic stability but also structure, a sense of normalcy, and social interaction [4]. Effective cancer care should encompass more than just medical treatment and should also address the working sphere [5]. From a societal perspective, survivors' participation in the labor market is vital for the sustainability of social security systems [6].

Interruptions of working life due to a cancer-related SA normally end shortly after treatment completion, when most survivors endeavor to RTW [7]. In Spain, as in other European countries, the SA benefit period is limited to a maximum of 1 year. After that period, persons on SA undergo a review by a medical tribunal, which determines whether the benefit period can be extended for a maximum of an additional 6 months or whether they must RTW [8]. Persons who are permanently impaired may receive a permanent disability allowance[9].

The RTW process in cancer survivors is highly complex and can be affected by numerous factors that can act as barriers or facilitators. The literature identifies various factors that influence successful RTW and sustainable work participation, including clinical factors (eg, cancer stage and chemotherapy), sociodemographic factors (eg, age, gender, and family support), and working and employment conditions (job strain, physical demands, type of job, workplace support, and employment type) [10–12]. Survivors also experience multiple long-term work limitations and are less productive than the general population due to chronic side effects caused by treatments and the disease itself [13]. Because there is no comprehensive guidance on the RTW or adaptations to survivors' health status on reinsertion in the labor force [14], a significant proportion of these individuals are unemployed, retire early, or change jobs more often than their counterparts without cancer [15]. Barriers can also include bureaucracy, emotional needs, and uncertainty. To achieve the beneficial effect of work on cancer survivors, interventions targeting RTW should encompass clinical, work-related, and social-individual factors [16].

To date, the literature on cancer and working life has been predominantly quantitative, which leaves unanswered questions on the factors influencing outcomes in survivors. Recent studies have explored the perceptions of survivors [6,17,18], physicians and nurses [19,20], and employers [21], but have focused separately on the needs and viewpoints of different stakeholders. These studies reveal that survivors can find managing the impact of cancer on working life both difficult and lonely [17] and can even encounter

discrimination and hostility at work [21]. Survivors report a lack of understanding and support from employers, managers, and occupational health services, as well as a lack of information on side effects, especially those involving cognitive difficulties. In addition, care planning has been shown to have a negative impact on RTW [18]. These perceptions are shared by other stakeholders, including insurance companies, physicians, and individuals close to survivors [22]. However, each RTW experience is unique and is shaped by personality and coping skills, contextual support, and the working environment. To improve understanding and support, it is essential to consider individual preferences regarding information-seeking and effective communicating [18]. Despite the available evidence, there is a lack of research on the factors influencing work outcomes at various stages, including diagnosis, SA and RTW, and encompassing the perceptions of distinct stakeholders on survivors' needs when navigating the impact of cancer on work across these various stages. The aim of this study was to identify the barriers and facilitators affecting the RTW process and sustained work participation among salaried workers, as perceived by various stakeholders, including cancer survivors. A particular aim was to identify work-related factors, starting from diagnosis and SA, up to the reintegration process and long-term occupational stability, with the goal of enhancing RTW after a cancer-related SA.

MATERIAL AND METHODS

Design and participants

A descriptive qualitative study was conducted from a socio-constructivist perspective [23]. In accordance with the theoretical perspective used, data were collected using the discussion group technique for different profiles (survivors, oncology professionals, and company representatives). To supplement the group discussions, an individual interview was held with a primary care physician.

Participants consisted of individuals diagnosed with cancer who were employed at the time of diagnosis and who subsequently took a period of SA due to cancer, health care professionals involved in cancer treatment and follow-up (oncologists, a primary care physician and psycho-oncologists) and company representatives (human resources and health and safety at work prevention staff). All participants were fluent in Spanish or Catalan and were residents in Catalonia (Spain).

Additional inclusion criteria for cancer survivors were being employed at the time of diagnosis and to be taking an episode of SA due to cancer. To select the sample of survivors, we first conducted theoretical sampling until saturation [24]. This theoretical approach was performed considering the following characteristics to achieve the greatest representativeness possible: sex (female/male), age range (35-50/51-65 years), type of employment contract (permanent/temporary), cancer stage (I-IV), occupational category (manual/non-manual), having dependent children, and marital status (married/registered or unregistered partner/single). Survivors were recruited through the Catalan Federation of Organizations Against Cancer (FECEC), an entity that collaborates with the main

organizations dedicated to improving the quality of life of patients with cancer and their families in Catalonia. Most participants were women aged between 40 and 60 years with a diagnosis of breast cancer (Supplementary table 1).

For the inclusion of oncology professionals and company representatives, we used snowball sampling. Oncology professionals were recruited through Hospital del Mar in Barcelona, a tertiary public hospital with which the research group collaborates. Most of these professionals were women, predominantly oncologists, with one psycho-oncologist (Supplementary table 3). Company representatives were recruited through the investigators' professional network. Most of them worked at the health and safety prevention departments of companies in the services sector (Supplementary table 2).

Data collection

Six discussion groups were formed with four to eight participants per group: three groups of survivors, one group of oncology professionals, and two groups of company representatives. To complement the information obtained from the healthcare point of view, we conducted an individual interview with a primary care physician.

The discussion group and interview guide were structured around questions corresponding to the stage of the process. and the factors involved in each stage (diagnosis, approval of SA, treatment time

absent from work, end of SA and RTW) were listed based on investigators' knowledge and on previous literature on the factors affecting RTW, policies and guidelines (Supplementary table 4).

The discussion groups, led by two co-authors, one as the interviewer and the other as the observer, were performed online and lasted an average of 90 minutes. The groups were video-recorded and transcribed verbatim by the same researchers who attended the interviews.

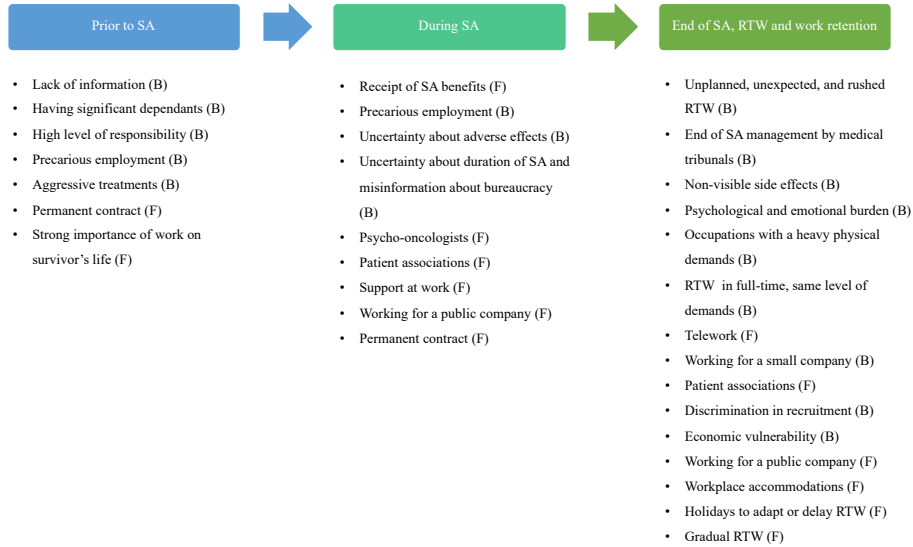
Analysis

To capture salient concepts and themes, the discourse from each discussion group was analyzed separately and summarized in a report [25]. After agreement between the two analysts, the results of each interview were triangulated by all co-authors of the study. Thematic analysis and mixed coding of the data were performed. The codes were generated inductively, guided by the analysis of the texts. These codes were shared and agreed upon by the research analysts. Subsequently, the findings were organized into an overarching scheme encompassing the themes common to all the interviews. The codes and themes emerging from the data were grouped into categories using a mixed procedure. Initially, broad categories derived from the literature served as a starting point. These categories were then refined by the patterns emerging during the analysis process. Several techniques were used to strengthen the quality of the qualitative analysis, such as triangulation by four of the co-authors of the study at all steps of the study [26] and individual and team reflexivity.

RESULTS

A total of 40 participants took part in the discussion groups, providing insights into the factors influencing the effect of cancer on work from the perspectives of all the stakeholders involved, as well as their perceptions of the entire process. All interview statements related to these topics were included in the analyses. Although some factors were common to all stages, their impact differed depending on the medical stage (diagnosis, treatment, and end of treatment), which coincided, respectively, with the beginning of SA, the SA, and end of SA and RTW. The main factors acting as barriers or facilitators to RTW are summarized in Figure 1 by stage, and the characteristics of the categories are presented below.

Figure 1. Barriers (B) and facilitators (F) impacting management of work at different stages of the process from diagnosis to RTW and work retention in cancer survivors.



SA: Sickness absence; RTW: Return to work.

1. Early stages. Diagnosis, treatment initiation and sickness absence.

According to the participants' accounts, receiving a cancer diagnosis was an exceptionally delicate moment for survivors. From the outset, they had to digest a large amount of medical information and adjust their daily routines.

One of the most important adjustments was related to work and the need to take SA. The participants identified several barriers and facilitators. The lack of guidance on the impact of cancer on their

work, use of health services and access to social security entitlements emerged as a significant barrier among survivors to decision-making on the duration and management of SA, leading to uncertainty and confusion. For their part, both oncology professionals and the primary care physician interviewed acknowledged they had insufficient training or time to discuss work-related issues, although they agreed that it would be highly beneficial to patients. The primary care physician perceived that survivors were not worried about their working life at this first stage.

Employment and working conditions were mentioned as both barriers and facilitators to an SA. The participants noted that higher levels of responsibility at work made it challenging to deal with absence from work. Another barrier to SA was having a precarious contract (temporary, unstable, and others), which increased employment vulnerability and the probability of experiencing the need for an SA as a stressor. When combined with older age, a precarious contract led to a much more negative experience. In contrast, having a permanent contract was identified by participants as a facilitator when dealing with work interruption. The importance of work in survivors' lives also played a role in the decision to take an SA sooner or later. Finally, having caregiving responsibilities (such as significant dependents) increased the difficulty of combining work, treatment, and care. Oncologists also perceived aggressive treatments as being an important determinant in whether patients took an SA or not.

2. Being on sickness absence. Receiving treatment, and management of the SA benefits

The benefits of SA allowed some participants to focus on self-care and overcoming the cancer. For others, however, the SA was also a source of stress because they could no longer work. Within this group, two distinct experiences emerged. On the one hand, there were individuals whose work played a central role in their lives. For them, SA had a negative psychological impact. On the other hand, survivors with precarious working situations faced additional challenges, with some even losing their jobs as a result of taking an SA.

Survivors with a permanent employment contract generally had a more positive experience of SA, its management, and the entire treatment process than those who were precariously employed, as work was not an additional concern for them. The security of their job and continued income during SA provided them with a sense of stability. Experiences, however, differed by type of company. Survivors working in the public sector felt their job was guaranteed, while working in privately-owned companies reported that their experience depended on the company's values and policies.

Survivors reported that, during the treatment phase of an SA, concerns about adverse effects led to uncertainty about how and when RTW would occur. Survivors missed guidance from oncology care professionals on this matter, feeling that oncologists focused exclusively on curing the disease. The survivors identified psycho-oncologists and patient associations as crucial facilitators in navigating the effects of cancer treatment on their ability to work.

Among all the institutions involved in overcoming cancer, the latter were praised for their role in addressing misinformation about the employment implications of cancer, collecting, and disseminating information related to work and making it accessible to people with cancer at no cost.

The presence or absence of support at work was a determining factor shaping a positive or negative experience of SA. Survivors who received considerable support from their company and colleagues, which translated into respect for their needs throughout the treatment process, reported a more positive experience. Other survivors, however, highlighted a notable lack of support; sometimes companies failed to hire temporary replacements, placing additional stress on survivors who felt pressured to shorten their SA, as there was an expectation that they would return to work as soon as possible. Some survivors also mentioned that they received recurrent calls from their company inquiring about their RTW. This pressure was substantially lower in public companies. Some company representatives explained that they have protocols in place to manage the SA process and minimize its impact on both the worker and the company. Overall, however, companies tended to have a passive approach, lacking consistent follow-up with the survivor.

Gender emerged as a significant factor influencing how survivors coped with the implications of cancer on their personal and professional lives. Survivors reported that was a belief that they should be able to manage both productive and reproductive work. However, the experience of cancer reversed their prior role of being

a caregiver to one in which they required care, completely altering their lives and family dynamics. The primary care physician noted a difference in partner support depending on the survivor's gender, with women tending to play a more pivotal role and maintaining emotional stability throughout the process than men.

Age emerged as another significant factor, with healthcare professionals differentiating between two distinct groups. Younger patients and those nearing retirement expressed keen interest in the prognosis of SA and their prospects for returning to work. In contrast, older patients, especially women in their fifties, placed less emphasis on returning to work.

Other barriers at this stage were misinformation and insufficient support when dealing with bureaucracy. Survivors reported that the absence of a standardized pathway or clear guidelines left them unaware of the necessary steps to follow, whom to approach, and where to seek guidance. This lack of clarity intensified the already stressful experience of navigating the absence from work.

3. End of sickness absence and return to work

Participants reported that the process of returning to work was often unplanned, unexpected, and rushed. The evaluation by the medical tribunal, which determines whether survivor's SA benefit period should be extended or the survivor must RTW, was perceived as a barrier. Survivors also mentioned that it was extremely difficult to obtain recognition of permanent disability, often believing it to be

only possible for certain adverse effects, such as having a colostomy. This process further exacerbates survivors' anxiety. Appearing before a tribunal often indicated that they did not feel ready to RTW. Unfortunately, this process can be traumatic, often resulting in a rejection of the request to extend the SA, even when the individual felt unprepared to RTW.

The main challenge for survivors was the invisible adverse effects of cancer and its treatment, and a lack of instruments to measure and justify their impact on work ability. Moreover, survivors noted that the medical evaluators lacked a holistic view as their assessment criteria failed to include the psychological and emotional burden of the disease, or individuals' job description, such as workload, type of task, working conditions, working hours, physical and mental demands, etc. Survivors mentioned that occupations with high physical burden were particularly challenging, as they had no way of avoiding the strenuous tasks inherent to their work. This opinion was shared by oncologists, who also perceived that medical tribunal professionals did not adequately review survivors' medical and employment records.

Furthermore, the decision of the medical tribunal was communicated via letter, leading to uncertainty about whether it would arrive and the timing of its arrival. Several survivors mentioned that notification of the end of the SA was sent to the workplace before reaching the survivor.

The RTW process was also influenced by the willingness of the company to adapt previous working and employment conditions. On the one hand, such conditions often acted as a barrier when survivors felt unwell and too fatigued to return on a full-time basis yet were expected to work at the same level as that required of them before their cancer diagnosis. Because they were not fully recovered, if the company did not offer either a change of position or make job adaptations, such as adjusting tasks or working hours, survivors were compelled to search for another job. In this regard, small companies in particular struggled to bear the costs of adjusting survivors' RTW. On the other hand, a company's willingness to adapt was mentioned as a facilitator when there was the possibility of a gradual RTW. However, the availability of this option often depended on the company ownership, which again emerged as a determining factor in safeguarding survivors' rights. Some survivors were able to reach an agreement with their employers to make an adjustment using accrued holiday time to extend their leave or to modify their RTW arrangements. Company representatives perceived that, since there were no regulations on RTW policies, including adaptations, a change of position, or gradual RTW, making these adjustments depended entirely on the company's willingness and ability to do so. Large companies generally provided more flexibility and resources for an adapted and individualized RTW previously specified in collective agreements.

All stakeholders, including survivors, felt that a significant problem arose when a medical tribunal deemed a survivor who did not feel

ready to RTW as being *fit*. This decision often led to an extension to the SA period being denied, either after a year or 18 months (the maximum time allowed). The possibility of granting a permanent disability was often not considered. Either of these outcomes would entitle survivors to financial support while unable to work because of poor health.

When RTW was not possible and no financial support was granted, patient associations also acted as facilitators to survivors' continued inclusion in the labor market. These associations assist people with cancer who are unemployed to seek work and find training opportunities and advice. However, survivors who have lost their jobs often faced discrimination in recruitment processes due to their health limitations when seeking new employment.

As noted by oncologists, economic vulnerability was an additional barrier affecting both survivors' emotional state during SA and the motivation - not necessarily healthy - to stay in a job at all costs after the RTW. This circumstance was directly related to the individual's personal situation and the availability of economic and emotional support.

DISCUSSION

There was a broad consensus among all stakeholders regarding most of the barriers and facilitators encountered by survivors when grappling with the impact of cancer on their work. Of note, many of these barriers are potentially modifiable. Some, such as the lack of

information and guidance on the impact of cancer and SA management, could be addressed relatively easily. Other structural barriers are more difficult to modify and include precarious employment conditions, inflexible working arrangements, lack of recognition by official medical tribunals of the limiting effects of cancer and its treatment on the ability to work, and the absence of regulations that ensure a sustainable RTW. Further barriers mentioned by participants were economic vulnerability, and type of occupation, which are often intertwined with above factors and may be further exacerbated by older age.

Facilitators impacting favorably on cancer and work management included company support, working for a public company or a large company with collective bargaining agreements, and having access to a gradual RTW. Many of the barriers and facilitators found were common to all stages but their effect differed, depending on the timeline from diagnosis to the end of the SA and RTW.

Survivors expressed dissatisfaction with the inadequate support and guidance received from primary care physicians and oncologists on managing the impact of cancer on work. They reported a lack of guidance on when and whether to take the SA, the implications of treatment, long-term side effects, and the overall process of taking an SA and their rights as an employee. For their part, the primary care physician and oncologists reported that, although they would like to provide this support, they felt they lack the requisite training and time to do so.

These findings concur with those of previous studies reporting a lack of medical advice on ongoing cancer symptoms and treatment, the side effects of treatment, and the timing of RTW in relation to an individual's ability to work [27]. In agreement with our results, other studies have identified a need for early education on workplace accommodations, improved communication, and understanding among employers, insurers, the medical team, and patients of their respective roles [22,28,29]. Moreover, uncertainty about survivors' ability to work and the possibility of job loss have been identified as key factors influencing RTW [29]. These deficiencies are partly addressed by patient associations and psycho-oncologists who guide patients in dealing with the uncertainty about their future life, including their occupational life.

Many cancer survivors believed that the length of the period of receiving SA benefits was inadequate to ameliorate the impact on work of their health. Some survivors believed they were denied permanent disability benefits when they felt they truly needed them. Other survivors believed that a longer SA would have given them time to fully recover before returning to work. The future trend in SA expenditure in Europe is predicted to decrease overall except for SA due to cancer [30], which is expected to be the main driver of disability in OECD countries. It would be beneficial to allocate funds to ameliorate the effect of cancer-related disabilities on work by adapting SA duration and modalities (part-time SA, the option to extend the SA for more than 1.5 years if required, etc.). Some countries, especially those in northern Europe, have attempted to

address the issue of a transitional phase between SA and full-time work by creating new categories of benefits focused on rehabilitation and flexible work, such as retraining, rehabilitation and labor market integration benefits [31].

We found that the lack of viable alternatives within the social security system led to situations such as company representatives being unable to comply with the verdicts of medical tribunals due to concerns for the wellbeing of the survivor and third parties (eg, machine operators or drivers), and the absence of options to adapt jobs due to the company's sector or available resources. In this regard, RTW was generally more likely when workplace accommodations, such as reduced hours, were available. A previous study reported that modifying workspaces to facilitate the transition back to work were highly beneficial for a successful RTW [32]. Other studies have also identified manual work and employment in the private sector as factors negatively affecting the RTW of cancer survivors [6]. These conditions are directly associated with economic vulnerability, one of the main factors affecting RTW [33].

In this study, precarious employment and poor working conditions were significant barriers to managing work while under treatment and returning to work. These challenges also affected the decision-making process regarding when and how to stop working. Precarious working conditions and job insecurity, particularly associated with temporary contracts, were also highlighted as a factor rendering survivors highly vulnerable to various forms of discrimination, as

reported by previous research [34]. In contrast, public companies where job security is generally presumed, and workers' rights and wellbeing are prioritized beyond productivity concerns emerged as an important facilitator.

Similarly, support at work, which was directly linked to stable employment conditions [35], significantly influenced the approach to RTW. There is a consensus in the literature on the importance of the role played by employers and co-workers in facilitating survivors' successful RTW [14]. Open and regular communication between the workplace and the person with cancer, both before and during their RTW, allowed shared understanding of ongoing challenges, including functional, cognitive and psychological implications, as well as recovery timeframes [29].

Strengths And Limitations

This study has several limitations. One limitation is the limited sample size (survivors N=22; company representatives N=11 and healthcare professionals N=7). Consequently, caution should be exercised when generalizing the findings to larger populations. In addition, most of the sample of survivors were middle-aged women, and there was a predominance of breast cancer. However, breast cancer is the most prevalent form of cancer and understanding of the consequences of its adverse effects is crucial. Likewise, most of the company representatives worked in large companies, which may have provided them with greater resources to address the challenges faced by survivors. All the healthcare professionals, except for one,

worked in the same hospital setting. However, the hospital is a tertiary facility, covering a representative sample of the population in Barcelona receiving cancer care.

This study contributes valuable insights to our understanding of the relationship between work and cancer by integrating the perspectives of all stakeholders involved. Through a qualitative approach, the study identifies both the barriers and facilitators experienced by the parties involved. The results highlight the importance of paid work to cancer survivors of working age and the need to improve the circuits that must be navigated by these survivors when they are diagnosed with cancer, as well as implementing reintegration policies. Making reintegration a primary goal of the social security system is crucial to ensure that inequalities are not created, and that this vulnerable population is not left unprotected and excluded from the dynamics of the labor market.

CONCLUSIONS AND PRACTICAL IMPLICATIONS

In light of the results obtained, it is crucial to develop comprehensive information systems and guidelines starting from the early stages of cancer. From the moment of diagnosis, paid work should be recognized as a factor affected by the treatment plan so that cancer survivors and their employers are provided with timely and appropriate advice on the timing and manner of RTW. Special attention should be paid to survivors in precarious employment as they are more vulnerable to workplace discrimination and marginalization from the labor market.

Research efforts should be directed toward describing and delimiting the adverse effects of different treatment types in order to fully comprehend the implications of the disease and the limitations it imposes on survivors. There is a need to develop suitable tools to measure work ability that take into account the type of occupation and its associated demands.

Finally, revised employment policies are also needed to support the continued employment and hiring of cancer survivors while considering their new health needs and the non-linear nature of reincorporation. This calls for the establishment of protocols and practices for a gradual RTW.

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STATEMENTS & DECLARATIONS

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Competing Interests

There are no competing interests to declare.

Author Contributions

All listed authors fulfill authorship criteria. A.A.G. and F.G.B. participated in the study conception and design. A.A.G. and D.R.A. performed the main data collection and analysis with support from M.U. and L.S.. A.A.G., D.R.A., L.S., M.U., and F.G.B. interpreted the data. A.A.G. drafted the first version of the manuscript with close help from D.R.A., L.S., and M.U.. D.R.A., L.S., M.U., and F.G.B. made subsequent revisions to the manuscript and all authors revised

the final version, agreed with the text and findings, and approved this final version. The corresponding author certifies that all listed authors meet authorship criteria. A.A.G. is the guarantor.

Data Availability

Interview transcripts are confidential and can only be accessed by the research team.

Ethics Approval

This study was approved by the Parc de Salut Mar Ethics Committee in Barcelona (Research Protocol no. 2021/10036). The confidential transcripts were handled with care (not distributed outside the team). In the results section, the anonymity of the participants is preserved.

Consent To Participate

All participants signed an informed consent form. This informed consent described the context and objectives of the study, how it would be conducted, their rights as participants, how anonymity is preserved, and contact information for any questions or requests.

Consent To Publish

All authors have given full consent for publication of the manuscript.

DISCUSSION

5. DISCUSSION

5.1. Main findings

The thesis aimed to analyse the consequences of having cancer, recognized by an SA, in working life trajectories, comparing them to those experienced by workers with an SA due to other medical diagnoses, and to workers without any SA. It also aimed to explore barriers and facilitators that survivors find on their process from cancer diagnosis to future working life. Finally, it aimed to describe these consequences in terms of usage of social protection benefits. Among benefits to protect working salaried cancer survivors from health consequences and economic vulnerability assessed sickness absence, permanent disability, unemployment and to early retirement benefits.

The main findings of the thesis are:

- Most cancer survivors returned to work and stayed in employment through the follow-up period. However, salaried workers who suffered an SA due to cancer are at higher risk of not being employed, especially compared to workers without an SA. This result was also observed in women who suffered an SA due to breast cancer.
- Cancer survivors were more likely to have future labour trajectories ending on retirement, permanent disability, and death than those without an SA. We found differences by sex, only in women SA due to cancer was related to having a trajectory of temporary employment.

- Lack of information, knowledge, and education on the impact of side effects on working life; lack of understanding and help from institutions such as social security, and medical tribunals; limited workplace adaptations; and the uncertainty of the effect of cancer on work ability were identified as barriers to RTW. Conversely, graded RTW, flexible working conditions, company support, working for a public company, associations and psycho-oncologists were found as helpful factors to RTW.

5.2. Staying in the labour market: future employability

In cancer, as in other life-threatening illnesses, the importance of work has historically stayed out of the medical care concerns (134), but in recent years it has started to draw attention from an occupational health perspective. With the increase in the survival rates worldwide (12), especially in high-income countries, greater attention has been put to issues affecting the quality of life of the survivors, as cancer treatments have been consistently shown to provoke adverse effects that can prolong for a long time after ending treatment (20). In this sense, the proportion of cancer survivors in the work force is expected to increase (56), especially with the rise in retirement age and development in the efficacy of cancer therapies. Being able to work after cancer is considered, not only by cancer survivors but also by other chronically ill patients, as a major contributor to their quality of life (135). Moreover, being employed has been shown to improve general health (136), when carried out in

good working conditions. However, while returning to work would seem to indicate that a cancer survivor has acceptably recovered from the disease and from the adverse effects of treatment, it only demonstrates that their ability to work has recovered to a level where they can be reinstated (137).

In the first **two studies** of the thesis, the focus was put on the future working life of cancer survivors while they remained part of the work force. This is, considering remaining in the work force as being employed (**Study I, Study II, Study III**) and unemployed (**Study II, Study III**). While the **third** also integrated possible exits from labour market, considering as such to retire early or permanent disability.

In the **first study**, the accumulation of days in employment of workers who have had a SA due to any type of cancer was measured and compared to workers who have had a SA due to other medical diagnoses and to workers without any SA. Cancer survivors accumulated both men and women the fewest number of days among the three groups, showing the least probability of being employed compared to other groups. Regarding employment trajectories, three main trajectories were found in men and women. The trajectory representing a stable working life in terms of accumulation of days in employment had the highest proportion of cancer survivors compared with the other less desirable trajectories (71% women and 52% men).

Literature about maintenance in the workforce of cancer survivors has mainly focused on whether cancer survivors RTW or not. Hence, RTW has been measured as a single point measure, and even as a success itself. However, returning to work only determines the impact of cancer treatment in the short-term (58,138). These cited reviews show RTW rates in the first two years after diagnosis was very wide ranging between 39% and 93%. The distribution of cancer survivors in employment trajectories that we found in the **Study I** is in line with the literature. We found that the overwhelming majority of cancer survivors RTW. In fact, we did not find trajectories with zero accumulation of days. All trajectories start accumulating at least 200 days (almost 7 months) in the less desirable trajectory to 365 days in the most stable employment trajectory the year after ending the SA. In Spain, SA has a maximum duration of one year, which can be extended to another six months (116). Considering most cancer patients start treatment and their corresponding SA soon after diagnosis, these results from the **Study I** show how, with variations among cancer survivors, RTW is mostly produced in the same interval of time (1-2 years) as shown in the literature. These timelines, hence, could be influenced not only by the end of the acute stage of the disease, but also by the duration of benefit entitlement. In the **Study II**, women without a SA were 18% more likely to be employed than workers who had a SA due to breast cancer. The first two studies show similar results to the **Study III**, with more than half of cancer survivors being in a stable employment pattern (58% women and 52% men) after ending SA.

However, as the **Study I** results show in the employment trajectories, the employment pathways of cancer survivors could change after this RTW showing fluctuations in employment. Trajectories show how the yearly accumulation of days is not stable in two of the trajectories found, which fluctuate not necessarily towards decreasing over the follow-up period. In men, workers without a SA were three times more likely of showing a stable accumulation of employment during the six-year follow-up period. Results in women were more inconclusive.

There could be several reasons for cancer survivors to show these fluctuation patterns. Firstly, although most treatments end before the year, cancer treatment can be a long process that elongates beyond this duration. Even if after initial treatment there is a remission, maintenance treatment might be prescribed in some types of cancers to prevent recurrence. Maintenance treatment could have a duration of two years or more (139–141). Secondly, persistent long-term effects may last well beyond 2-year post-diagnosis, in some cases even over 10 years after diagnosis (20). Thirdly, it has increasingly been documented how some side effects named late side effects may appear years after ending treatment (18). In fact, there is increasing literature showing that employment decreases years after returning to work (68,91). A longitudinal study on employment and income losses in cancer survivors, showed the probability of being employed fell by almost 10% in the 5 years after diagnosis. Thus, annual labor market earnings dropped almost 40% within two years after diagnosis (142).

For these reasons, it could be expected that, even if survivors RTW and remain part of the workforce for a long time, due to changes in their health state, their working life is characterized by discontinued periods of employment. Most studies hypothesize about their lower employment results on the fact that cancer survivors exit the labour market because they may decide to retire earlier or even receive permanent disability benefits (68). However, this might not be the case for all cancer survivors, especially not for younger ones. Younger cancer survivors who are not entitled to a retirement, early retirement, or permanent disability pension, and/or wish to continue in the workforce even if their work ability is diminished. A complex situation where cancer clinical state, occupation and sociodemographic characteristics, and personal life interaction are key to understand each particular employment trajectories after a cancer.

Hence, they may show a decrease/fluctuations in employment over time due to unstable working lives caused by: unemployment periods, SA periods, change of job, reduced working hours or even changes between part-time and full-time working hours. A systematic review and meta-analysis reported 12–52% of survivors who had returned to work showed reductions in working hours; increasingly switched to working part-time; and 15–55% showed reductions in workload, or work adaptations due to cancer (56). Thus, even if their working trajectories show a decreasing employment

pathway, they may remain part of the work force as further explained below.

Previous studies are consistent on the risk of unemployment among cancer survivors (68,92,143). Recent studies show an increased risk of loss of paid employment up to seven years after diagnosis (93), an increased risk of obtaining unemployment benefits up to five years after diagnosis (93), and even 30% increased risk ten years following cancer diagnosis relative to individuals without a history of cancer (144). Most studies don't differentiate unemployment with or without benefits, generally studies address unemployment as not being employed. This difference is very important because, as it has been estimated, workers with unemployment with benefits has similar good health perception than workers with employment (145).

In **Study III**, unemployment was measured as receiving benefits, and those not employed who didn't receive unemployment benefits neither other benefits were considered as a separate outcome: inactivity/not being in contact with social security. In this study, both in men and women, labor market participation patterns were found that showed transitions between inactivity/not contact with social security and unemployment, depicting patterns with the weakest engagement to the labour market. Similarly, **Study II** results showed a lower probability of unemployment trends in workers without a SA compared to those with SA due to breast cancer. A population-based longitudinal study saw a 20% higher probability of unemployment among breast cancer survivors 2-5 years after diagnosis than cancer-

free controls (93). Another study in Canada showed 30% higher probability of unemployment up to three years after diagnosis in breast cancer survivors compared to a cancer-free control group (146). Although our results are to be carefully interpreted due to lack of statistical significance, they do show as other studies do, that a high proportion of cancer survivors remain in the workforce and their working life trajectories are more likely to be shaped by precarity in terms of instability.

Work ability and future unstable working pathways in cancer survivors have also been evidenced by rates of job changes (147) and job resignation (66). A British study found a strong association between the duration of SA and return by survivors to the same employer. Of those with less than six months SA 95% returned to the same employer while of those with more than 18 months SA only 71% returned to the same employer (148). Though other studies found no differences in job change between breast cancer survivors and cancer-free comparison groups (146). This may be a difficult decision (if it is voluntary) among survivors as discrimination and difficulty obtaining a new job have been previously reported (146,149). Moreover, perceived workplace discrimination has been recognized as one of the major causes of unemployment (149). And these situations are probably aggravated by workers in precarious employment conditions.

Recurrent SA has also been described after returning to work, especially among breast cancer survivors. A Swedish study on breast

cancer survivors found that chemotherapy was associated with an increased risk of SA up to 5 years after diagnosis (150). Similar results have been found on the effect of SA 1-5 years from diagnosis (137,151,152).

In both **Study I** and **Study III** we found sex differences in the probability of being employed after cancer. We found higher levels of stable employment among women compared to men with SAs due to cancer. Also, differences by sex with comparison groups, especially with workers without a SA who showed a higher probability of being employed and exhibiting a more desirable working trajectory were found higher among men.

These results are unexpected since previous studies have found that the female gender is a barrier to employment after cancer (58,153). As there has been historical gender discrimination against women in the labour market that still today is reflected in salaries and employment rates, it could be expected some women may discontinue work after cancer because their partner is the main wage earner, as observed by other authors (154). However, there are other studies that found similar results to this thesis. A study in the US found that men suffered a steeper decline in employment and income losses than women after cancer. In women, practically no differences were found in employment before and after cancer. As they argue, the difference could be due to lower overall labour-market participation of women, that would lessen the average effects of cancer (142). Similarly, another study found larger differences for

men compared to women survivors, especially for being employed (−28 to −30 percentage points for men and −19 to −21 for women) and weekly hours (−16 to −17 h for men and −8 to −10 h for women) (154). A higher risk of unemployment in the long term has also been shown among men compared to women (144). Some of these studies argue that types of cancer and treatments associated with males may be partly explaining the results, as they could have a greater impact on their ability to work and masculinized occupations are more physically demanding. Another possible explanation would be that as are less likely to take a SA when they have cancer, when they go on SA it is for longer periods (148). It is plausible that men who take the SA are the ones that suffer the most severe stages and/or go through more aggressive treatment. For this reason, it would be expectable that their work ability is more affected than women's.

In **Study III**, we found that those with SA due to other causes, especially in men, were more likely to be in unstable and early retirement, or in permanent disability trajectories than those with SA due to cancer. This comparison group was highly represented by diseases of the musculoskeletal system and connective tissue.

These results could be because these diagnoses are among the most difficult to manage in terms of workability as they suppose one of the longest episodes of SA in Spain (63). Also, they are associated with work with a higher physical burden, more prevalent among manual workers (156) who normally have more precarious working trajectories in Spain (157).

5.3. Early exit from the labour market

Any disruption in a worker's employment trajectory related to cancer and its side effects on work ability could be considered undesirable. While some may choose to retire early after a reassessment of priorities, for most survivors, the negative impact of cancer on work is unwanted and problematic. Anyhow, among negative work outcomes, this chapter will focus on the ones that suppose a permanent impact on working life, which are early retirement and permanent disability. These two outcomes represent an early exit from the labour market, with profound consequences for the survivor, family, workplace, and society as a whole.

In **Study III**, the aim was to characterize working trajectories of cancer survivors in the long-term and evaluate differences in these trajectories compared to the general working population with and without SA due to other diagnoses. For this purpose, all possible work outcomes were considered (except from SA, because data wasn't available). In both men and women, we found trajectories of retirement and permanent disability.

Trajectories depicting working lives shaped by ordinary retirement in **Study III** showed trends of a higher likelihood of being presented by cancer survivors, though these trends were not statistically significant. These differences were observed especially when compared with workers without a SA in men. In women trends showed lower estimates with almost no differences with comparison groups. These results show ordinary retirement pension results, which in Spain is different from early retirement pension. This is, cancer survivors show a higher probability of ordinary retiring before comparison groups.

Legislation on retirement in Spain changed in 2013 towards stricter requisites to access the pension. On the one hand, in terms of higher number of minimum years contributing to social security (from a minimum of 30 to 37 years), and in the other hand, a higher minimum retirement age (from 61 to 65). To retire a worker must be 65 nowadays to get all the pension benefits he/she is entitled for. However, working for longer supposes a higher retirement pension as there are monthly percentage increases to incentive longer contribution working lives (158). So, choosing to retire earlier in the group of cancer survivors could be a choice based on the health state with financial consequences for the worker. A study looking at cancer survivors compared to cancer free siblings in 2013 observed a higher likelihood of retirement (36%) in survivors after adjusting for age, sex and education (159). However, literature looking at retirement in cancer survivors is focused generally on early retirement rather than ordinary retirement.

In **Study II**, only in men, we found a pattern depicting trajectories of early retirement. In this pattern, workers start in permanent contracts that decrease rapidly to turn into unemployment, not having contact with social security and early retiring. Also, they transition between these states and temporary contracts, as there is a constant 20% of temporary workers throughout the whole follow-up period. This pattern is the second most prevalent among men. Early retirement prevalence starts to increase in the first year of the follow-up and continues steadily until the end of the follow-up when it represents almost 60% of the workers. Both in men and women stable pattern also depicted a small proportion of workers that early retire from the fourth year onwards. When the probability of cancer survivors showing this trajectory was compared, survivors showed less probability than comparison groups of having a trajectory of employment instability and early retirement.

These results contrast with results found in previous research. Literature shows how cancer patients have an excess risk of early retiring compared to cancer-free controls up to eight years after diagnosis, and higher among females (60% in women, and 55% in men). Cancer types with higher risks were leukaemia, prostate cancer, and ovary cancer (98). The observed risk factors for taking early retirement pension are older age, being on SA, desiring early retirement, prolonged SA, advanced stage of cancer, high level of pain, physical and psychological comorbidity, being on a permanent contract, and having a lower socioeconomic status (99,101,160). Also, among survivors who early retire, workplace-related factors

have been found to be perceived more negatively (98). Hence, early retirement depends not only on the survivor's health status but also on nonmedical factors, such as working and employment conditions, socioeconomic status, and sex (161).

Considering the evidence, any probability of retirement of any kind may partly reflect the older age of cancer survivors. However, the extent to which factors such as precarious employment, poor socioeconomic conditions, or even sex determine the likelihood of cancer survivors and interact with side-effects of the disease should be considered as they could be enlarging social inequities faced by most vulnerable survivors.

Pathways of an early exit from labor market by permanent disability were also found in **Study III**. Permanent disability in Spain doesn't necessarily suppose an exit from labour market. Among four permanent disability degrees, partial and total permanent disabilities are a complement to the salary and, in total permanent disability, also a recognition of the impossibility of continuing in the same occupation but still being able to work in a different one. Most severe degrees are absolute and great permanent disability, which recognizes the impossibility to continue working due to health limitations (118). However, even if not supposing a complete disengagement from labor force in all cases, and their revisable character, they do have long-lasting consequences that permanently affect labour participation.

According to the results of **Study III**, female cancer survivors had a higher probability of having a permanent disability, compared with both workers with and without SA due to other medical diagnoses. Differences were higher compared to workers without SA. Moreover, in women this pattern was related to working trajectories of workers who died during the follow-up period, probably depicting a group of women whose health was severely affected by cancer. In men, cancer survivors showed trends of higher likelihood of being in patterns of permanent disability only compared to workers without a SA, but estimates were much lower and statistically weak.

In Spain, it has been estimated that 10% of the recognized permanent disabilities are due to a malignant neoplasm. Moreover, 50% of cancer survivors are recognized a permanent disability (63). Most recent literature has focused on specific cancer types due to differences in side-effects among different cancer types, stages and their associated treatments. Among breast cancer survivors, studies looking at the risk of permanent disability in a nationwide population-based study in the Netherlands showed that survivors experienced an twice the risk of obtaining disability benefits during the ten years after diagnosis compared to the general working population. This study also showed that younger women suffered more severe side effects and aggressive treatments (axillary lymph node dissection, mastectomy, radiotherapy and chemotherapy) experiencing higher risks (93). Similarly, a study on breast cancer patients, without cancer-free comparison group, saw that permanent disability increased over the duration of the study from 16% in year

one to 29% in year five (162). A higher likelihood of accumulating days on a disability pension was also observed in colorectal cancer survivors, especially among women, lower-educated, foreign-born, with previous comorbidities or previous mental disorders compared to cancer-free controls (163). Similar results were obtained in cervical (164), other gynaecological cancers (165), and all cancers (97). There is a big variability in study settings and designs; some are longitudinal while others are cross-sectional; some include a cancer-free comparison group while others don't; and among the longitudinal designs, there are different follow-up times which make comparisons of results challenging. More evidence is needed, with better medical and administrative record linkage.

5.4. Barriers and facilitators in work after cancer pathway

Social protection system through Social Security protects workers from financial hardship while they are being treated from a disease through its SA and permanent disability benefits. However, as discussed in the sections above the consequences of cancer are challenging Social Security mechanisms and evidencing its deficiencies. As cancer survival rates are increasing, its consequences on working life and the impact of these consequences on survivors' life and finances, family income, companies' revenues, and also its economic impact in society through social security are becoming more studied. The reason for this is multicausal and goes from individual, disease, and workplace-related factors to macro

determinants that interplay resulting in survivors facing difficulties to resume work and having a sustainable working life.

After looking at consequences on future working life from a quantitative perspective, impact of cancer on work was studied qualitatively through all its stages, from work interruption by SA to RTW and permanence. In **Study IV** the aim was to explore perceptions of stakeholders involved in the process of cancer care and RTW including perspectives from: cancer survivors, general practitioners (GPs), oncologists, psycho-oncologists, health and safety professionals, and human resources professionals. Uncertainty derived from lack of timely information and guidance on diverse aspects related to work were one of the main barriers found when dealing with work dimension. Lack of information was related to impact of side effects on work ability and their official recognition by medical tribunals, management of SA and RTW and expectations related to it. Also, absence of understanding and help from institutions (social security and workplaces) was perceived as a barrier.

In this same line, a British study on barriers of RTW identified by experts draw two main conclusions on measures to facilitate RTW process. On the one hand, they pointed at the importance of an active role of health professionals in the screening of cancer survivors at risk, and in early provision of information. This information would consider the existing options for RTW and advise on the involvement of other stakeholders like GPs, social security physicians and

occupational physicians on RTW decisions. On the other hand, they pointed at the need of a thorough and systematic evaluation of the work capacities to facilitate RTW process (166). Guidance by healthcare professionals has also been found before as determining in work management in cancer survivors (167). In the evaluation of side effects limiting work capacity, as shown by the literature, fatigue has been shown as one of the most frequent adverse effects of cancer treatment. However, it's most likely not recognized with its consequent poor medical management, insufficient counselling, and referral to existing therapeutic offers, which severely affects quality of life of survivors and workability (168). Also, treatment-caused cognitive impairment prevalence in cancer survivors, and extent of disability caused by it remains largely unknown. Consideration of cognitive impairment has been claimed to be a necessary part of a comprehensive oncological care plan (169). Moreover, the invisibility of these side-effects has been reported to be mistakenly interpreted as burnout symptoms (170).

Another barrier detected by participants in **Study IV** are structural barriers such as precarious employment conditions, or rigidity of working conditions. Lack of regulation or collective agreements that ensures a sustainable RTW was also found as a barrier in **Study IV**, participants who experienced the opposite, a good experience going back to their workplace, were more likely to be working on a company that implemented RTW protocols, like gradual RTW, were generally public companies, or big companies with collective bargains and more likely to provide support.

Previous literature has reported, as it was found in **Study IV**, temporary employment contracts as one of the main causes for job loss because survivors don't get extended due to their health state, even if the contract ends during SA (167). Also lack of flexibility in working conditions have been found as barriers to RTW after cancer (79). As found by other researchers, RTW was generally reported to be easier and less stigmatizing if there were clear workplace policies and protocols for insurance and employer support during RTW, guided by legal understanding but also flexible to individual needs (171).

Among other factors negatively affecting RTW and future employability, **Study IV** showed economic vulnerability and type of occupation.

Cancer it's related to economic losses faced by survivors. In fact, socioeconomic inequities are aggravated by the disease, increasing

poverty of those who already suffer from it. Among the reasons, salaried workers will see their economies diminished by the loss of economic remuneration while they are on a situation of SA, due to the difference between their salary and the economic benefit of the SA or permanent disability pensions. In the case of the self-employed, this is increased by the economic loss resulting from the loss of earning capacity and the low pay for SA, which does not compensate for the loss of earnings. Moreover, there are expenses not covered by the public health system, such as expenses for drugs not covered by the public health system, "parasaniitary" product expenses, and in some cases expenses for travelling to receive treatment or support staff for their care, if required. So, we can say that workers with cancer may get into debt or are forced to spend more to cover the costs of the disease, leading in many cases to financial toxicity (63). In Spain, according to a report by Spanish Agency Against Cancer, cancer has an economic impact that puts 25,000 people at risk of social exclusion every year (around 28% of cancer survivors every year). The groups at greatest risk are the self-employed, the workers who over the process become unemployed or are affected by cancer in this situation, low-income workers and women (172).

Cross-country comparisons are difficult due to differences in social protection systems, especially between different income countries (high vs middle- and low-income countries), but also among high income countries. Despite this difficulty, all studies, even those carried out in European countries with generous social protection

policies, coincide (at different levels) in the great impact that cancer has on work, and that cancer survivors are at higher risk of social exclusion due to this impact. However, literature also agrees in factors that predict a successful RTW and a higher likelihood of remaining longer in the labour market. Therefore, all international evidence should be harmonized, and countries should implement cancer policies that integrate prevention of adverse work outcomes on cancer care plan when possible, and in accordance with each countries' possibilities. And when returning is not possible, social security should ensure survivors with a disability can enjoy a decent life after the disease.

5.5. Strengths and limitations

This is a mixed method thesis composed by four scientific papers, three of which are quantitative and based on secondary data, and one qualitative based on primary data from discussion groups and an individual interview. Having a mixed method approach to the study problem is one of its strongest strengths, for it enables us to contrast and complement our quantitative results and scientific literature results, with testimonies of survivors and the main stakeholders involved in cancer care and work. The main limitations and strengths of each specific study are described in each paper. This chapter is rather a reflection on strengths and limitations of the thesis results, with a more general overview.

Regarding the **quantitative results**, the main limitation is the lack of health information on cancer other than the SA diagnosis for the period 2012-2015. Cancer information was only available through SA information. Hence, the effect of clinical information related to cancer (i.e., type of treatment, stage of cancer, effects of health status before 2012) was not taken into consideration. Most importantly, there was no information available on adverse effects of the survivors or impact of the disease on work ability. Furthermore, information on SA was only available for salaried workers during a limited time period (2012-2015). This is, any worker having cancer during their working life recognized by a SA out of this period, or not recognized by a SA, would not be part of our study sample. Nor would be part self-employees or informal workers. However, a strength of SA diagnoses is that they were medically certified by primary care physicians rather than being self-reported, enhancing the validity of our results.

As the thesis uses secondary data from the Spanish WORKing life Social Security system cohort (WORKss cohort) and the Catalonia SA records, some of the main limitations of the thesis are due to using administrative data, although these databases also have big strengths. The WORKss cohort, which is constructed from CWLS (Continuous Working Life Sample), as a database created by Social Security for research purposes contains high rigor and accurate data. This database has been constructed to include necessary information about working lives longitudinally. This allowed us to integrate a life course perspective in the analyses of working trajectories with an

extensive time window of follow-up. In terms of occupational health relevance, as well as from a clinical perspective, a big strength is that it contains information on social security benefits. However, as this database is not meant to relate working lives to health, it has information about reception of permanent disability benefits, but no the diagnosis behind its recognition. Moreover, partial disability benefit recognition is not included. Furthermore, it's the only available population-based information in Spain, and representativeness is guaranteed in affiliate population as data follows a systematic recollection throughout the years, which decreases information biases and increases temporal consistency of the longitudinal study. Besides, among the strengths it should be noted the availability of data, which decreases the cost of the project.

Another strength of the thesis resides in the detailed information in the database which allowed us to have a good picture of each worker's labour market situation. This information is needed to obtain a sufficient overview of the RTW process. Anyhow, when it comes to specific characteristics of the RTW process, information such as workplace adaptations, support, flexibility on working conditions, or RTW protocols was lacking. Moreover, there was information on the reasons for the end of SA. Another important variable lacking was the occupation of the worker, which can be determining for a cancer survivor.

In addition, and even though each method for managing time varying covariates has its limitations, one of the main methodological

challenges was management of time-varying covariates by assigning workers to the category in which they spent most of their time during the follow-up could be under or overestimating the effect of some categories. Also, LCGM and Sequence Analysis statistical techniques for classification of life course trajectories were applied to obtain LMPPs and EPTs, which are a summary of the main categories found in the sample. These trajectories, thus, are not observed in individuals, but they are categories assigned according to an estimated probability. Consequently, interpretation should be made accordingly. Moreover, some trajectories, although they signified a meaningful group for the study, represented a small proportion of the sample, thus estimates should be made with caution.

Regarding the sample selection, inclusion criteria of the cases (workers with a SA due to cancer) may have introduced a selection bias given workers who have access to SA probably have better employment conditions than those who don't. Hence, most vulnerable populations in terms of employment conditions who may have gone through a cancer and are at higher risk of exclusion from labour market may not have been captured. The size of the database allowed us to match our workers with SA due to cancer to two comparison groups by age, sex, and follow-up time. This matching allowed us to compare the working life of cancer survivors with that of the general working population with or without SAs, enabling us to account not only for the disease but also for the effect of SA. The diagnoses causing SAs were medically certified by primary care

doctors rather than self-reported, enhancing the validity of our results.

Regarding **qualitative results**, the main limitation is the small sample size and limited diversity in terms of cancer diagnosis and company representants to generalise the findings to larger populations. However, to our knowledge this is the first qualitative study in Spain integrating main stakeholders' perceptions, and moreover, taking into account perspectives on the role of Social Security as an interacting institution but also as a benefit provider.

A limitation of the thesis, as a whole, is that some important social determinants of health were not available, and thus, they couldn't be taken into account in our analyses. The main variables lacking were socioeconomic status, educational level, household income and occupation. However, workers' monthly income was available which is a proxy for the socioeconomic status. Regarding occupation, as contribution group of the workers was available, it was recategorized in a proxy of occupational category. Moreover, information about economic activity of the company was available.

Regarding differences found by sex, there were not variables which allowed to draw conclusions regarding gender (i.e., civil status, reproductive work or dependants in charge).

5.6. Implications for policy and practice

1. SA benefits provided by Social Security to protect workers' health and from experiencing financial hardship may be reviewed for cancer as a disease with a longer treatment period that requires a long period of SA and which, after the acute stage, provokes long-term limiting adverse effects that greatly affect work ability. This benefit may holistically consider specific needs of cancer survivors on their working life journey as a survivor.

2. Access to permanent disability benefits should review their criteria and assessment tools taking into account specific needs of workers, workplace dependent, with long term health consequences due to cancer, which may not be as visible such as chronic fatigue and cognitive impairment.

3. More vulnerable workers should be paid special attention by social protection system after cancer, for they can be the ones suffering the most serious consequences of labour and social exclusion. These groups would include manual and non-qualified workers, workers with precarious employment conditions, women, and migrants.

4. When fitness to RTW is assessed by healthcare and/or Social Security institutions, in addition to adverse effects from the disease, the occupation with its working and employment characteristics should be considered.

5. Specific RTW regulations could be implemented. These regulations should include specific interventions and protocols that should consider specific working and employment conditions (physical and psychological demand and risk of job loss); however not forgetting each treatment and cancer type have specific adverse effects that require different adaptations and timelines. They may also intervene from the diagnosis stage, involving all stakeholders that take part in the continuum from diagnosis of cancer to RTW and work retention (social security, GPs, oncologists and cancer care professionals, companies, patient associations and survivors).

6. Social Security should have alternatives for those workers whose work ability is diminished and due to which they can't perform their job anymore, and whose company is not able to provide an alternative. Also, these cases should be closely supervised so that discriminating situations don't occur.

7. Among the interventions available now, a thorough evaluations of their effectiveness should be conducted. However, for the time being gradual RTW has already proven high satisfaction. Hence, it should be implemented.

8. Healthcare professionals should be instructed and stimulated to give at least basic advice and guidance on immediate and long-term consequences of cancer in working life. Clinical protocols should also include this vital dimension.

5.7. Future research

1. Research agenda should include a population-based studies in order to quantify adverse work outcomes in cancer survivors in comparison with the general working population, from a life course perspective.
2. Future studies should address labour trajectories of population who go through a cancer during their working life with and without SA to have bigger picture of the impact of cancer on work. This would allow to better assess factors determining usage of benefits and identify vulnerable groups.
3. Future studies should address the characterization of specific side-effects of cancer treatment impact on RTW and future work ability. Ideally, research should be carried out most prevalent treatments by cancer site, stage, age, and sex of patients.
4. Adequate measurement tools should be developed for prevention services and for social security and primary care institutions to measure work ability on cancer survivors.
5. Future survivorship research should also focus on work ability and work outcomes beyond RTW in order to assess difficulties cancer survivors may encounter.

6. Future studies should also aim to better understand administrative pathways survivors go through to facilitate the process and better comprehend how all stakeholders could be better coordinated for easier and more efficient RTW.

CONCLUSIONS

6. CONCLUSIONS

1. Most workers who have a cancer during their working life, recognised by an SA, stay employed for a long period after returning to work. However, they have a lesser probability of being employed compared to the general working population and workers with a SA due to other diagnoses.

2. Workers with an SA due to cancer showed tendencies of future working trajectories of retirement, permanent disability benefits or death than the general working population and workers with an SA due to other diagnoses.

3. Working life after an SA due to cancer showed sex differences. Men's future working trajectories showed more consistent results in terms of probability of being employed. Also, men were more likely to retire early than women. Women with an SA due to cancer showed unclear tendencies which should be interpreted with caution, while they were less likely to accumulate employment days, they seemed to have more stable working lives than their counterparts.

4. Among barriers to management of cancer's impact on work until RTW and permanence: lack of information systems, guidelines and general accompaniment, and knowledge and awareness by institutions with their consequent deficiencies, starting from the early stages of cancer are the main ones.

5. Cancer consequences on workers show a wide range of determinant factors which make very difficult a one for all solution. Hence, social protection system in coordination with healthcare

system should aim towards a more flexible care through benefits, adapting to complex necessities of workers who go through a disease like cancer.

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8. APPENDICES

- 8.1. APPENDIX I: Supplementary material**
- 8.2. APPENDIX II: Response from the reviewers**
- 8.3. APPENDIX III: Scientific conferences**
- 8.4. APPENDIX IV: Assessment report stay Karolinska Institutet**
- 8.5. APPENDIX V: Awards**

8.1. APPENDIX I: Supplementary material

STUDY I

Table 1: Cancer location in the group of workers with SA due to cancer and diagnosis underlying SAs in the comparison group with other causes by sex in Catalonia (2012-2015)

Comparison group	Men	Women
SA due to cancer diagnosis	N (%)	N (%)
Lip, oral cavity, and pharynx	3 (1.3)	2 (0.7)
Digestive organs	42 (18.7)	25 (8.6)
Respiratory system	19 (8.4)	6 (2.1)
Bone and articular cartilage	1 (0.4)	*
Skin	27 (12.0)	53 (18.2)
Connective and soft tissue	3 (1.3)	*
Breast and female genital organs	1 (0.4)	152 (52.2)
Male genital organs	52 (23.1)	*
Urinary organs	41 (18.2)	17 (5.8)
Eye, brain, and central nervous system	10 (4.4)	5 (1.7)
Endocrine glands and related structures	6 (2.7)	15 (5.2)
Secondary and ill-defined	6 (2.7)	7 (2.4)
Lymphoid, haematopoietic, and related tissue	14 (6.2)	8 (2.7)
Multiple locations	*	1 (0.3)
Total	225 (100)	291 (100)
SA due to other diagnoses	N (%)	N (%)
Infectious and parasitic diseases	33 (14.7)	32 (11.0)
In situ, benign neoplasms	*	9 (3.1)
Endocrine, nutritional, and metabolic diseases	*	2 (0.7)
Mental and behavioural disorders	15 (6.7)	22 (7.6)
Diseases of the nervous system	2 (0.9)	12 (4.1)
Diseases of the eye and adnexa	4 (1.8)	6 (2.1)
Diseases of the ear and mastoid process	4 (1.8)	7 (2.4)
Diseases of the circulatory system	10 (4.4)	12 (4.1)
Diseases of the respiratory system	46 (20.4)	47 (16.2)
Diseases of the digestive system	17 (7.6)	19 (6.5)
Diseases of the skin and subcutaneous tissue	2 (0.9)	7 (2.4)
Diseases of the musculoskeletal system and connective tissue	59 (26.2)	68 (23.4)
Diseases of the genitourinary system	10 (4.4)	10 (3.4)
Pregnancy, childbirth, and the puerperium	1 (0.4)	4 (1.4)
Symptoms, signs, and abnormal clinical and laboratory findings	4 (1.8)	17 (5.8)
Injury, poisoning, and certain other consequences of external causes	17 (7.6)	16 (5.5)
Factors influencing health status and contact with health services	1 (0.4)	1 (0.3)
Total	225 (100)	291 (100)

*N, Absences between 2012 and 2015; SA, sickness absence; MD(P25, P75), median duration and percentile 25 and 75 of the absences.

Table 2: Goodness-of-fit indicator values for each model class

	Model	E	BIC	LMR-LRT	% individuals in each class
Men	2-class	0.992	37.225.198	0.0000***	69.7, 30.3
	3-class	0.985	36.317.827	0.0340*	60.3, 11.6, 28.1
	4-class	0.981	35.642.475	0.0226*	14.5, 14.2, 60.3, 11.0
Women	2-class	0.997	46.623.942	0.0000***	77.3, 22.7
	3-class	0.997	45.720.904	0.0075**	6.4, 18.8, 74.8
	4-class	0.970	45.334.979	0.0071**	5.8, 6.6, 18.7, 68.8

E, entropy; BIC, Bayesian information criterion; LMR-LRT, Lo-Mendell-Rubin adjusted likelihood ratio test. The preferred 3-class model is presented in bold.*p<0.05, **p<0.01, ***p<0.001.

STUDY II

Table 1 Medical diagnoses of sickness absence (SA) in the comparison group with episodes due to other medical diagnoses in Catalonia (2012-2015)

Comparisson group SA due to other medical diagnosis	
	N (%)
Infectious and parasitic diseases	8 (7.1)
In situ, benign neoplasms	3 (2.7)
Mental and behavioural disorders	10 (8.9)
Diseases of the nervous system	5 (4.4)
Diseases of the eye and adnexa	2 (1.8)
Diseases of the ear and mastoid process	1 (0.9)
Diseases of the circulatory system	8 (7.1)
Diseases of the respiratory system	20 (17.7)
Diseases of the digestive system	8 (7.1)
Diseases of the skin and subcutaneous tissue	1 (0.9)
Diseases of the musculoskeletal system and connective tissue	28 (24.8)
Diseases of the genitourinary system	4 (3.5)
Pregnancy, childbirth and the puerperium	2 (1.8)
Symptoms, signs and abnormal clinical and laboratory findings	7 (6.2)
Injury, poisoning and certain other consequences of external causes	6 (5.3)
Total	113

STUDY III

Supplementary table 1: Employment-related characteristics among a sample of salaried workers with a SA due to cancer, SA due to other diagnoses, or no SA at all in Catalonia during the follow-up period (2012 and 2018), and previous employment 5 years prior to cohort entrance.

	Men (N=675)				Women (N=873)			
	SA-cancer (N=225)	SA-other diagnoses (N=225)	No SA any diagnoses (N=225)	p value	SA-cancer (N=291)	SA-other diagnoses (N=291)	No SA any diagnoses (N=291)	p value
Follow-up period								
Total accumulated days of employment	262,869	286,245	328,939		393,825	425,556	434,249	
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	
Contract type								
Permanent	178 (79.1)	188 (83.6)	194 (86.2)	0.003**	243 (83.5)	233 (80.1)	243 (83.5)	0.206
Temporary	40 (17.8)	37 (16.4)	31 (13.8)		46 (15.8)	58 (19.9)	48 (16.5)	
Working time (% weekly hours)								
Full-time (>87.5%)	184 (81.8)	195 (86.7)	190 (84.4)		206 (70.8)	213 (73.2)	218 (74.9)	
Part-time (50%-87.5%)	12 (5.3)	13 (5.8)	11 (4.9)	0.037*	59 (20.3)	48 (16.5)	45 (15.5)	0.188
Short and marginal part-time (≤37.5%-49%)	22 (9.8)	17 (7.6)	24 (10.7)		24 (8.2)	30 (10.3)	28 (9.6)	
Monthly average income (tertiles)								
High (>2370.0 €)	105 (48.2)	90 (40.2)	91 (40.8)		79 (27.7)	70 (24.2)	74 (25.6)	
Medium (1451.0 - 2370.0 €)	61 (28.0)	79 (35.3)	78 (35.0)	0.364	97 (34.0)	107 (37.0)	87 (30.1)	0.360
Low (≤1450.0 €)	52 (23.9)	55 (24.6)	54 (24.2)		109 (38.3)	112 (38.8)	128 (44.3)	
Occupational category								
Non-manual skilled	67 (29.8)	38 (16.9)	51 (22.7)		94 (32.3)	53 (18.2)	68 (23.4)	
Non-manual non-skilled	74 (32.9)	69 (30.7)	69 (30.7)	<0.0001***	129 (44.3)	129 (44.3)	121 (41.6)	<0.0001***
Manual skilled	59 (26.2)	91 (40.4)	82 (36.4)		29 (10.0)	57 (19.6)	44 (15.1)	
Manual non-skilled	14 (6.2)	21 (9.3)	15 (6.7)		28 (9.6)	40 (13.8)	38 (13.1)	
Economic activity								
Agriculture, hunting, forestry, fishing, mining, and quarrying	1 (0.4)	*	4 (1.8)		1 (0.3)	*	2 (0.7)	
Manufacturing, energy construction	52 (23.1)	89 (39.6)	67 (29.8)	0.002**	26 (8.9)	48 (16.5)	39 (13.4)	0.130
Services	162 (72.0)	132 (58.7)	146 (64.9)		258 (88.7)	237 (81.4)	242 (83.2)	
Company size								
Small-medium (≤ 100 workers)	129 (57.3)	135 (60.0)	153 (68.0)	0.001**	158 (54.3)	143 (49.1)	170 (58.4)	0.058
Big (>100 workers)	89 (39.6)	90 (40.0)	72 (32.0)		131 (45.0)	148 (50.9)	121 (41.6)	
Company ownership								
Private	161 (71.6)	179 (79.6)	175 (77.8)	0.001**	193 (66.3)	203 (69.8)	197 (67.7)	0.314
Public	44 (19.6)	29 (12.9)	28 (12.4)		64 (22.0)	57 (19.6)	53 (18.2)	
5 years prior to follow-up								
Employment time ratio (mean (SD))	90.9 (20.6)	93.1 (17.1)	93.2 (16.1)	0.019**	91.8 (17.7)	92.7 (17.2)	93.1 (16.1)	0.278

SA, sickness absence; Follow-up period ranged from 3 to 7 years from entrance to the cohort until the end of 2018;

Previous 5 years refers to each individual's entrance; SD, standard deviation. *p<0.05,

Supplementary table 2: Cancer location in the group of workers with SA due to cancer and diagnosis underlying SAs in the comparison group with other causes by sex in Catalonia (2012-2015)

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Bone and articular cartilage	1 (0.4)	*
Skin	27 (12.0)	53 (18.2)
Connective and soft tissue	3 (1.3)	*
Breast and female genital organs	1 (0.4)	152 (52.2)
Male genital organs	52 (23.1)	*
Urinary organs	41 (18.2)	17 (5.8)
Eye, brain, and central nervous system	10 (4.4)	5 (1.7)
Endocrine glands and related structures	6 (2.7)	15 (5.2)
Secondary and ill-defined	6 (2.7)	7 (2.4)
Lymphoid, haematopoietic, and related tissue	14 (6.2)	8 (2.7)
Multiple locations	*	1 (0.3)
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In situ, benign neoplasms	*	9 (3.1)
Endocrine, nutritional, and metabolic diseases	*	2 (0.7)
Mental and behavioural disorders	15 (6.7)	22 (7.6)
Diseases of the nervous system	2 (0.9)	12 (4.1)
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Diseases of the ear and mastoid process	4 (1.8)	7 (2.4)
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Diseases of the respiratory system	46 (20.4)	47 (16.2)
Diseases of the digestive system	17 (7.6)	19 (6.5)
Diseases of the skin and subcutaneous tissue	2 (0.9)	7 (2.4)
Diseases of the musculoskeletal system and connective tissue	59 (26.2)	68 (23.4)
Diseases of the genitourinary system	10 (4.4)	10 (3.4)
Pregnancy, childbirth, and the puerperium	1 (0.4)	4 (1.4)
Symptoms, signs, and abnormal clinical and laboratory findings	4 (1.8)	17 (5.8)
Injury, poisoning, and certain other consequences of external causes	17 (7.6)	16 (5.5)
Factors influencing health status and contact with health services	1 (0.4)	1 (0.3)
Total	225 (100)	291 (100)

*N, Absences between 2012 and 2015; SA, sickness absence; MD(P25, P75), median duration and 25th and 75th percentiles of the absences.

Supplementary table 3 Selection of cluster solution and cluster quality measure Average Silhouette Width (ASW) for future working life of a sample of salaried workers in Catalonia (2012-2018) with 8 possible states.

Global ASW	Women	Men
3 Clusters	0.42	0.41
4 Clusters	0.45	0.45
5 Clusters	0.47	0.48

Values closer to 1 were strongly well clustered; values closer to 0 denote weak structures that could be artificial.

STUDY IV

Table 1. Survivors' characteristics (n=22)

Characteristic	Frequency
Sex	
Female	18
Male	4
Age (years)	
30-40	4
40-50	7
50-60	9
>60	2
Cancer diagnosis	
Breast	13
Leukemia	2
Gastrointestinal	2
Lymphoma	1
Multiple myeloma	1
Vocal cord	1
Thyroid	1
Sarcoma	1

Table 2. Company representatives' characteristics (n=11)

Characteristic	Frequency
Sex	
Female	5
Male	6
Position	
Human resources department	2
Health and safety prevention department	9
Sector	
Transport	2
Healthcare	2
Insurance and financial activities	2
Higher education	1
Legal activities	1
Engineering	1
Information and communication	2

Table 3. Healthcare professionals' characteristics (n=7)

Characteristic	Frequency
Sex	
Female	6
Male	1
Position	
Oncologist	5
Psycho-oncologist	1
Primary care physician	1

Table 4: Interview guide (the questions were slightly adapted to each group in order to enquire about their involvement in the same aspects of each stage)

<p><u>Script for a qualitative study on cancer and return to work:</u></p> <p><u>focus groups of people who have had cancer.</u></p> <p>(i) Sickness absence (SA).</p> <p>Decision to interrupt your working life.</p> <p>How did they experience the process of taking time off work? How did they feel?</p>

Were they advised by their doctor or employer, or by other people around them?

What was the diagnosis motivating the SA?

Were they informed about the approximate duration of the SA in similar cases (stage and location of cancer)?

How was the fact that they took SA experienced in their work and family environment?

(ii) End of SA.

Completion of SA and return to work.

What motivated the decision to end the SA? How did they experience this process? Were they prepared to return to work? What support (people, if any) helped them to make the decision? What factors (both positive or facilitating and negative) pushed them to make the decision? and What factors held them back from taking the step to return?

If they did not return, was it because of the after-effects of the disease or because the company did not facilitate it? Were they able to apply

for a permanent disability? How did they go through the process?
Were they sure about this decision or were they advised by health professionals, family, etc.?

If they wanted and were able to return, what involvement did the person in charge of the company have in the return process? Did they find a different work reality than the one they expected?

If they made any requests for changes or adaptations to the job or had any needs such as: reducing the working day, or taking time off, how was this decision or request received in the working environment?

What involvement did the people closest to the survivor have in the process? Did they encourage the return to work or did they make it difficult? Can they specify which people (partner/husband/wife, friends, children, friends, other family members)? Did they have different positions?

(iii) After reintegration.

Were they able to carry out their usual tasks normally?

If not, did they find a friendly environment in which to communicate difficulties? How were these difficulties received? Were there any changes to improve this situation?

Did they have to change jobs due to the adverse effects of treatment or cancer? Did they experience any period of unemployment or unemployment with/without financial benefit?

If they looked for a job, did they encounter any difficulties, and what could they have been due to (age, health problems, etc.)?

If possible, have they considered early retirement as a result of the disease?

(iv) Factors found in the literature:

Being married, good socioeconomic position, being male/female, age, flexible conditions for return to work, support from superiors and colleagues, having a manual occupation, work demands, having a precarious job, stage of the disease, symptoms and adverse effects,

type of treatment... Do you think that these factors positively or negatively affected the return to work and working life after cancer?

(v) Are there any support factors (protocols, communication between all parties involved in the process such as managers and health staff) that could have facilitated your return to work or working life after the disease?

(vi) Is there anything else you would change or add to improve people's experience of returning to work in the future?

Table 5: Quotes selected for their relevance and referred to in the Results section. They follow the same order as in the Results section.

1. Early stages. Diagnosis, initiation of treatment and sickness absence.

“GF2P8: (...) Guidance on sick leave... (...) Nobody gave it any importance...and... I said, "What's going to happen to me? Do I have to take sickness absence?” (...) They didn't explain anything about that to me. And the doctors said "Well, it depends on the

work you do...you decide whether you take sickness absence or not". (...) when I started chemo the oncologist told me "There are many people who work while on chemo" and I said... "Really? but what I'm finding is that chemo leaves you very flat". If it had been for her, she would have discharged me. I was lucky that the SA was managed by the primary care doctor... I didn't believe her...I thought...I'm going to try it and, if I'm well, I'll go back to work but I can't see it clearly. But, in other words, if it's because of them... no guidance, none. "With radio a lot of people go to work...". Well, you go to radio...one day the machine breaks down, another day you're there for four hours...can people really work and go to radiotherapy? More than one of them must have been kicked out or asked "please take the sick leave, this is unbearable". And then the commute... not everyone has a hospital close to home, do they?" (discussion group 2, survivors)

"GF4P4: So... and here I agree a little with GF4P1, that we do not have...we have a lack of training, in the whole process of sick leave... I mean, I know, and I do explain to them, that they have twelve months of sick leave, and then it will be reviewable by the

ICAM, (...) and can be extended to eighteen months, right? If it is a treatment with curative intent, but otherwise, if it is better to be on sick leave, if it is better to join part-time..., at least me, I transfer this responsibility to the primary care doctor and to the company doctor, (...) But there is a lack of knowledge, at least on my part, of how far we can help them." (discussion group 4, oncologists)

2. Being on sickness absence. Receiving treatment and management of the SA benefits

"GF3P7: (...) I had breast cancer 10 years ago. At that time I had been with the company for a while and my contract was ending so they had to renew it and, as I had to undergo chemo and so on, they didn't even condescend to talk to me. I directly received a burofax saying that they had fired me because my contract had expired... I was in the middle of... well... of chemo and radio. (...)" (discussion group 3, survivors)

"GF3P3: (...) I went from a fairly good, normal health situation, to uuuf...you can't do anything, right? Well, it took me time to accept

going from 100% to mm...30-40 that you need help for almost everything, right? Well, this was the duel, wasn't it? Going from being totally self-sufficient to being dependent. And at the same time from being able to work, having your independence, your responsibility...having your...your duties at work, to have everything managed for you. In that sense, professional issues mixed with personal ones". (discussion group 3, survivors)

"II: Well, um... Normally the form of support is more... More enveloping, and more... I didn't want to say the good word, but when the... Who...who has the illness is the man and who supports is the woman. Sometimes, when it is the man who has to support, well, he doesn't support, does he? He enters into the...The most depressions and anxieties, it's more difficult for them." (individual interview, primary care physician)

"GF5P6: There are as many situations as people. There are many people who face cancer in an infinite number of ways, and I think that if we create a culture of trust in the company, we can facilitate both the management of the SA itself, as well as the subsequent

support, which I think is important, right? I do think that this is where we can make a very important contribution during the course of the illness, which, as GF5P3 said earlier, is long and hard. But well, in the end, in this process, the company is just another actor and I think it can play an important role when... when the worker feels protected and supported by the company and only focuses on getting well, knowing that they don't have to worry about additional factors, right? I think that's the most..."
(discussion group 5, company representatives)

3. End of sickness absence and return to work

"GFP3: (...) I was coming out of the chemo and he said to me "You have to go back to work now...". And ICAM... we were in the middle of COVID but ICAM called me, "As you are not dying, you are not in palliative care, you have to reincorporate now because I cannot give you a severe permanent disability for what you have, right?" (...) In my case it was totally negligent. I was treated very badly. The experience was terrible. As if I was there...mm... having to justify the fact that I had cancer...I don't know. I experienced it as something very negative, coming from all the people who had been around me, with a much more understanding attitude of

supporting and moving forward, you meet someone who says, "Well, I don't give a damn what you do or don't do, it's your problem, but you go back to work tomorrow". Well, ma'am, that's not what my oncologist says... "Well, I don't care what your oncologist says". "(discussion group 3, survivors)

"GF2P5: (...) When you go back, you go back. Of course, you can't go back to 50, 60, 40... you have to go back to 100, right, which is the eight hours... I would say that this is one of the big handicaps that we all encounter. So, of course, I think that at a general level, the treatments leave us all... very, very, very affected, they have a lot of toxicity and so forth. So, well...yes, I would say that this is one of the things...I mean, the positive part of going back to work is this...that you somehow take your reins, obviously mentally it helps you...the negative part is that of course it is all or nothing, right? (...)".(discussion group 2, survivors)

"GF4P2: (...) It also depends on the company where they work, if they can adapt the place, the workplace to their condition, right? In cases where, for example, I have patients with gastrectomy, for

example, they've had some of their stomach removed, and they have a functional problem of gastric emptying and they have an alteration, a digestive alteration, with the... with diarrhea, that they have to have a job in which..., momentarily, they have to go to the bathroom more often than usual. This is an important limitation in a patient who, perhaps, has a tumor that is undergoing a radical curative treatment, right? (...)" (discussion group 4, oncologists).

"GF6P3: Yes, the ICAM issue, it's terrible, it's terrible, the ICAM thing is brutal, and sometimes they look at survivors, we all know how they look at them. That is to say, sometimes it turns out that there are people who are very sick, and they bounce it back to you here, and they come to you with a discharge from ICAM, and you say... "well, but this man, we're back to the same thing, how can I get him to work? Now how do I get this person to work...". So, well, the company, in the end, has to make a tremendous change here, to get out of all the protocols there are, or else, the process of claiming, lawyers, trade union support, all this, which is also, which is also a mess because, in addition, ICAM is saturated... Well, I'm not telling you anything you don't already know. So, the

system is dead in the water. And what I was saying before, about the support network, that should be part of the support network, and it ends up being more of a, it is not an opportunity, it is a threat, it becomes a threat for the person who has the health problem, right? The threat that, if you need more than eighteen months, you might not get it, because there are some people in a tribunal, who say no." (discussion group, six company representantatives)

"GF2P2: Yes, it was really hard for me to go back (...) Because what you say about the arm, they take away your lymph nodes...they took away a few and then you can't lift weights (...). If I and a colleague have to lift something heavy, for example, a wild boar, I can't leave all the work to him because that person is not responsible for me being ill and then you have to deal with it, (...)" (discussion group 2, survivors)

8.2. APPENDIX II: Response to reviewers

STUDY I

RESPONSE TO REVIEWERS:

Manuscript title: Returning to work after a sickness absence due to cancer: a cohort study of salaried workers in Catalonia (Spain)

Reviewers' Comments to Authors:

Overview of the reviewer's comments: We thank the reviewer for all the interesting comments and suggestions made to the manuscript of our study. We have tried to answer them carefully both in the responses and manuscript. We appreciate the thoughtful comments on the consideration of the possibility of retirement beyond legal retirement age as an increasingly popular choice as well as the consideration of previous literature regarding marriage status and divorce, and its differential effect on future employment depending on gender. In addition, we appreciate the reflections on the generalizability of our results on self-employees. Please, find bellow a more extended response to the comments:

Reviewer 1:

This study examines the return to work after cancer diagnosis and treatment in comparison to other diseases. Returning to work is an important outcome for people with cancer and the longitudinal data is a strength. The following changes are recommended.

1) Introduction: The authors understandably focus on working age people with cancer. However, many adults choose to continue work after traditional retirement age. It might be helpful to at least note this in the introduction.

We thank the reviewer for the comment. It is true that some workers decide to continue working after reaching legal retirement age since life expectancy has increased and quality of life and health status at retirement age is not the same now as it was 50 years ago. Although, and according to the Spanish experience, they are around 16% of all retirement modalities [1]. Hence, we have acknowledged this in the Introduction section as to another possible labour outcome after legal retirement age, second paragraph.

1. Moraga M, Ramos R. Tendencias recientes en la edad de acceso a la jubilación. Artículos Analíticos. Boletín Económico. 2020.

2) Methods: I very much appreciate the need to keep certain factors static. However, I'm concerned about the limitations on generalizability due to the sample being limited to salaried workers and not including hourly paid workers or workers with other pay structures (i.e. gig work, commission based).

We thank the reviewer for pointing out the limited generalizability of the results to other types of employment such as some non-standard work arrangements. Our sample only includes salaried workers as they are the ones that have proper social security coverage in terms of SA. According to the Spanish National Institute of Statistics in 2018, the majority of workers, 84% out of the total, were employees [2]. However, there is a 12% of self-employees, like gig workers, that

are left out of our scope. We have noted this excluded population on the limitation section (Discussion, ninth paragraph).

2. INE. España en Cifras 2019 [Internet]. 2019. Available from: https://www.ine.es/prodyser/espa_cifras/2019/3/

3) Methods: For the ‘SA other diagnosis’ group, it would help contextualize the results to know which disease(s) led to the absence.

We thank the reviewer the suggestion and we have added a table containing this information to the supplementary material.

4) Results: It would be helpful to call the ‘No SA’ group ‘Cancer, no SA’ or if that group did not have cancer, that should be clarified in table captions. If this group did not have cancer, it would help to know what other diagnoses they had or what percentage had other diagnoses, maybe add this group to the appendix table.

We thank the reviewer for pointing out the lack of clarity regarding the comparison group named ‘No SA’ in table captions. This comparison group does not have any sickness absence at the entrance to the cohort. We have renamed the group to “No SA any diagnoses” on the tables in order to clarify the nature of the comparison group.

5) Figure 1: It looks like the labels for some of the trajectories are missing.

We thank the reviewer for pointing missing labour trajectories. Latent Class Growth analysis generates two curves for each trajectory

that represents a group's accumulation of days in employment throughout time points, one curve it illustrates the expected trajectory and the other one, the observed trajectory. This expected curve has the same label as the observed curve. This point has been clarified in the figure legend.

6) Discussion: For the gender differences in employment trajectories, the authors might want to consider the literature on divorce and gender after cancer diagnosis.

We thank the reviewer the suggestion of considering this literature. It is very likely that these differences have an impact on future course of employment after a breast cancer. We have added this literature on the Discussion section, fifth paragraph.

Reviewer 2:

Overview of the reviewer's comments: We thank very much appreciated all the thoughtful comments and reflections made regarding our study. We believe we have answered them clearly and attentively both in the responses and manuscript. We appreciated the deeper discussion of the matching method and the implications of its results on our study. Moreover, the impact of differential participation of women in the labour market comparing to other northern European countries and the possible impact of the welfare state regime's differences have enriched our interpretation of the results. Please, find bellow a more extended response to the comments:

Thank you for the opportunity to review your manuscript titled "Returning to work after a sickness absence due to cancer: a cohort study of salaried workers in Catalonia (Spain)". The aim of the study was to compare "chances" of long-term employment in cancer survivors compared with the general Catalonian work force with or without sickness absence due to other diagnoses than cancer.

It is a relevant topic – especially the focus on long-term employment consequences of cancer survivorship. The manuscript is well written, the tables and figures are easy to understand. I therefore recommend publication with minor revisions.

1. Abstract:

The conclusion is very different from what is written in the manuscript – please align the two.

We thank the reviewer the suggestion. We have aligned both parts of the manuscript by modifying the manuscript's Conclusion section.

2. Introduction:

What is the point in mentioning "DALYs"?

We thank the reviewer the question. It is not directly related to return to work or long-term employability. However, with this reference, we want to give an idea of the impact of the disease on cancer survivors' life, which includes the work dimension, and thus, whole life after the disease. We have tried to make this relation clearer in the Introduction section, first paragraph.

3. Returning to work is abbreviated to RTW – in general "return to work" has this abbreviation. Please go through the manuscript and correct accordingly, as "returning to work" and "return to work" is used randomly to comply with grammatical rules.

We thank the reviewer for pointing out this grammatical inconsistency, we have corrected it on the manuscript.

4. The introduction may benefit from a precision of what new insights your manuscript strives to give – the derived hypothesis seems a bit detached from the introduction.

We appreciate the reviewer's comment and we have added what we aim to contribute with our manuscript in the Introduction section third paragraph.

5. Results:

Table 1 – it seems as if the matching was more successful in the woman strata than among the men. Could you elaborate on that and you think it affected your results?

We appreciate the reviewer's comment. We conducted an individual matching according to sex, age, and availability the same week SA due to cancer ended (i.e., similar onset of time at risk) because we wanted to assess the effect of having a SA due to cancer controlling by the non-modifiable individual determinants of labour market participation. This approach has several advantages, we get comparison groups that are representative of the base groups of certain age across explanatory variables since each matched control is randomly selected from the base group, improving statistical

efficiency [3]. Hence, it allows us to measure the potentially differential effect of our explanatory variables -employment conditions- on later employability of the three comparison groups.

As the reviewer pointed out, the comparison groups resulted from matching are more similar in women than in men. However, we hypothesize that these differences could be due to gendered use of SA benefits rather than to the matching. As it has been shown, taking a SA is more common in women than men across all social security regimes, and sick-benefit access and generosity policies [4]. This lesser use found in men could be due to their breadwinner role, derived from fear to lose the job if they are absent from work because family financial stability relies on their salary. Also, men delay and seek less health care when there is a health problem because of beliefs related to masculinity [5]. There are studies that show how men have a higher likelihood for of being judged for taking a SA. In this same line of thought, women are believed to have higher SA due to double work or lower work engagement [6].

Regarding the possible effect on our results, we conclude that since we are adjusting by explanatory variables, differential distribution of men's comparison groups among employment conditions and company characteristics shouldn't be affecting our results. Nevertheless, we have added it to the limitations section (Discussion, ninth paragraph).

3. Rose S, Laan MJ Van Der. Why Match? Investigating Matched Case-Control Study Designs with Causal Effect Estimation. 2009;5. Available from:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2827892/pdf/ijb1127.pdf>

4. Mastekaasa A, Melsom AM. Occupational segregation and gender differences in sickness absence: Evidence from 17 European countries. *Eur Sociol Rev.* 2014;30:582–94.

5. Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. *Soc Sci Med* [Internet]. 2000;50:1385±1401. Available from: <http://www.postpartummen.com/pdfs/SS&M.PDF>

6. Patton E, Johns G. Women's absenteeism in the popular press: Evidence for a gender-specific absence culture. *Hum Relations.* 2007;60:1579–612.

6. First sentence page 13 "an SA" – please correct to "a" SA. Please correct similar errors on other pages.

We thank the reviewer for pointing out this misspelling. We have changed the errors on the manuscript.

7. Discussion:

Your hypothesis is better confirmed among men than among women and you give plausible explanations for that. However, structural factors in the Catalonian labor market, in particular in gender differences, is not mentioned as an explanation. To my knowledge the percentage of women that are working is much lower than for instance in the North-West part of Europe. Does it affect your interpretation? The social well-fare scheme may as well differ from other countries, which you in fact point to, but I

miss that you relate to differences in your explanation as I am not familiar with the Catalanian scheme.

We thank the reviewer for this interesting comment. This higher employment time observed in women with SA due to cancer could be linked, as the reviewer pointed out, to gender gap in employment participation. In fact, the gender gap in work force participation is higher in Catalonia, as in the rest of Spain, than in the Nordic countries. In 2020, in Catalonia female employment rate was 63.3% and 70.9% in men [7], contrasting Nordic countries such as Sweden with 78.3% in women and 83.2% in men [8]. Moreover, this gender gap could explain the differences in our results in terms of statistical significance among men and women as less women participate in labour market, and thus, the ones that are on the labour market may have a higher engagement

In relation with the second part of the reviewer's comment, in Catalonia, as in the rest of Spain, the social welfare regime is family-centred, more similar to continental European welfare model (Bismarckian) than to the Scandinavian model [9]. This family-centred welfare regime highlights the role of women as carers for their dependents. Unlike the Nordic model, women's access to social protection has traditionally been through male breadwinners instead of the direct social transfers provided by the state. Although now it is changing. In Spain, universal benefits coexist together with contributory benefits and this part of the welfare state is mainly centred on Social Security, which funds transfers of sickness absence and permanent disability benefits [10,11]. However, universal health care and education systems are funded by taxes.

Regarding access to non-work-related SA benefits, which is the one that concerns the study, in Spain a worker must have contributed 6 months in the last 5 years to social security. SA has a maximum duration of 1 year which could be extended 6 more months. Also, to access sickness benefits, the medical condition behind the SA must be medically certified. In addition, the generosity of the benefit is proportional to the worker's salary (60% until 20th day, 75% from 21st day onwards) and paid by the employer from day 4 to 15 and by the social security from day 16th on. There is a waiting period for SA benefits during the first three days unless that the collective bargaining agreement states otherwise. Therefore, SA benefits in Spain are less generous, less flexible, and have tighter eligibility criteria than Northern European countries [11].

These differences in European welfare regimes and labour market dynamics may be explaining underlying differences observed with other studies. However, it shouldn't affect our results since in our study all workers were under the same social welfare regime.

We have added this literature on the Discussion, fifth paragraph.

7. Idescat. Anuario estadístico de Cataluña. Tasa de empleo. Por grupos de edad y sexo [Internet]. [cited 2021 Nov 10]. Available from: <https://www.idescat.cat/pub/?id=aec&n=305&lang=es>

8. Eurostat. Employment - annual statistics - Statistics Explained [Internet]. [cited 2021 Nov 1]. Available from:

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Employment_-_annual_statistics

9. Bambra C. Going beyond the three worlds of welfare capitalism: Regime theory and public health research. *J Epidemiol Community Health*. 2007;61:1098–102.

10. Belmonte-Martín I, Tufté GC. Spain's and Norway's Welfare Regimes Compared: An Outcome-Based Evaluation of How Welfare Regimes Influence the Risk of Poverty and Social Exclusion. *J Poverty* [Internet]. Routledge; 2017;21:372–87. Available from: <https://doi.org/10.1080/10875549.2016.1204647>

11. Kim IH, Muntaner C, Vahid Shahidi F, Vives A, Vanroelen C, Benach J. Welfare states, flexible employment, and health: A critical review. *Health Policy (New York)*. Elsevier Ireland Ltd; 2012;104:99–127.

8. Conclusions:

The passage "Furthermore, as the number of cancer survivors increases, it is important to understand the workplace consequences of cancer and the overall effect on future working life. After patients have undergone treatment, not only the patients, but also the families, employers, social protection systems, and society, have to absorb the longer-term impact of cancer. Previous research was carried out in countries where labour market dynamics and welfare state characteristics differ.

Information on long-term job maintenance after cancer is important to designing effective labour market policies for cancer survivors." is hardly a conclusion derived from your results – you may want to delete it. Please align the conclusion with what is written in the abstract.

We appreciate the reviewer's suggestion and we have consequently deleted it for alignment with the conclusion from the abstract.

STUDY III

Response to editor and reviewers:

We thank the editors and reviewers for the opportunity to improve the manuscript with their suggestions. Below find a point-by-point answer to all the comments. The underlined text represents the new text added to the manuscript.

Editor comments

The authors examined factors associated with future labour market participation patterns among cancer patients who had sickness absence in Catalonia. Three reviewers returned the comments, and among them, two reviewers provided detailed comments. In addition to these comments, please consider the following editorial comments:

1. Study design: The authors might want to clarify if this study is a prospective cohort study or retrospective cohort study. This distinction is critically important for an epidemiological study in the public health literature.

We thank the editor for the comment, and we have accordingly specified the retrospective character of the study, both in the abstract in the Methods section:

“Methods: Retrospective dynamic cohort study of social security affiliates in Catalonia from 2012-2018.(...)” (

And in the main text in the third paragraph of the Methods section, the first line (page 5):

“We performed a retrospective dynamic cohort study among 1548 salaried workers living in Catalonia (675 men and 873 women).(...)”

2. Inclusion of workers: The authors explained that “The study sample included salaried workers who had had an SA due to a malignant neoplasm (ICD-10, C00-C97) between 2012 and 2015 (N=516, 225 men and 291 women), ...” (Page 4) Did the authors choose all the eligible workers from Continuous Working Life Sample and Spanish WORKss cohort. If so, please state so. Otherwise, the authors might want to explain in the Methods section about the number of eligible workers in these databases and how 516 workers were selected.

We appreciate the editor pointing out the lack of clarity on the selection of cases (workers with SA due to cancer) from databases. In order to clarify this point, we modified the third paragraph of the Methods section (page 5):

“(...) Firstly, all salaried workers who had had an SA due to a malignant neoplasm (ICD-10, C00-C97) between 2012 and 2015 were identified from anonymized ICAM records (N=645). These records were linked with the information of WORKss cohort (156,000 salaried workers affiliated to the general regime of social security in Catalonia), resulting in 516 workers with information in both databases (225 men and 291 women). (...)”

3. Matching process: The authors included the same number of salaried workers with sickness absence due to a medical diagnosis other than cancer (n=516) and salaried workers without sickness absence (n=516) as the exposure group (salaried

workers with sickness absence due to cancer) based on age- and sex-based matching. The authors might want to add a detailed explanation on the particular method regarding how many eligible salaried workers with sickness absence due to a medical diagnosis other than cancer and eligible salaried workers without sickness absence existed in the database(es) and what particular matching method was employed. Such descriptions may be important for readers to understand how the representativeness of the samples were secured.

We thank the editor for the comment. We used individual matching by sex, age and time at risk to achieve our final sample. We have further explained how matching was performed in the “Methods” section, third paragraph as follows:

“(…) Secondly, for each worker with SA due to cancer we individually matched two workers by age (within a 5-year range), sex, and time at risk. On the one hand, 516 salaried workers with an SA due to a medical diagnosis other than cancer (ending the same week as the SA due to cancer ended) were randomly selected from a pull of 47,663 workers from WORKss cohort among those meeting individual matching criteria. On the other hand, 516 salaried workers without an SA were randomly selected from WORKss cohort, among those meeting individual matching criteria, after excluding workers who had a SA (N= 139,744) (Supplementary Table 1 and Supplementary Table 2).”

4. Reference category of the dependent variable: In the Statistical analysis subsection of the Methods section, the authors

explained that “To measure the association between having an SA due to cancer and future LMPPs versus the comparison groups, we applied multinomial logistic regression with its relative risk ratio (RRR) and 95% confidence interval (95%CI).” Please also mention that the reference category of the outcome variable was “in a stable employment” in this sentence (although the tables and main text in the Results section clearly mentioned it).

We thank the editor for the comment and we have added the reference category of the outcome in the second paragraph of statistical analysis:

“To measure the association between having an SA due to cancer and future LMPPs versus the comparison groups, we applied multinomial logistic regression with its relative risk ratio (RRR) and 95% confidence interval (95%CI) using stable employment LMPP as a reference.”

5. Reference category of the exposure variable: In the multinomial logistic regression models, “SA due to cancer” was the reference category. And the models evaluated differences of future labour market participation patterns for workers with SA with other diagnoses and workers without SA. This point might be mentioned in the Statistical analysis subsection of the Methods section. Also, the authors might want to explain the advantages of comparing future labour market participation patterns in two ways: SA due to other diagnoses vs SA due to cancer and No SA vs SA due to cancer.

We thank the editor for the suggestion and we have added it to the methods section as follows:

“The selection of two comparison groups with and without SA was made in order to assess a potential gradient of the possible effect of cancer on working life with general working population and with workers with other health problems recognised by SA.” (Methods section, paragraph 3, page 5)

Also, in the discussion section we have added:

“(…) Having a comparison group with workers who have other health conditions, also recognised by a SA, allows us to see future differences in working life between overcoming cancer and other health problems, and how after ending SA due to cancer adverse effects may still be affecting the ability to work of survivors. Moreover, it allows us to control for the potential effect of SA, as it has been shown how SA is a determinant of low labour engagement and future SA (Roelen et al., 2011).” (Discussion section, paragraph 3, page 13)

6. Table 2: The p-value for the crude analysis for “SA-other diagnoses” regarding “Decreasing labour market engagement vs stable employment” was reported 0.360 (far from significant), although the 95% CI is marginally significant at 1.00 and 2.42. The p-value may be wrongly reported. Please check the entire Tables 2 and 3 again to ensure that the reporting was correct.

We thank the editor for detecting this error, we confirm that there was an error, and have corrected it. We also checked the rest of the table values to make sure everything was ok.

7. Descriptions of regression results: The authors reported that “Compared with the SA due to cancer reference group, workers with an SA due to other causes had a higher probability of being in a low engagement, employment instability and early retirement LMPP rather than in a stable employment LMPP (men aRRR 1.76, 95% CI: 1.00–3.11; women aRRR 1.72, 95% CI: 1.02–2.90) (Table 2).” (Page 8)

A) The sentence seems to have both statistically significant result (for women) and insignificant result (for men), although the sentence itself has no problem. Tables 2 and 3 reported p-values. Therefore, readers might have an impression that significant and insignificant results are mixed up.

We have clarified the difference in statistical significance in the reporting of these results as follows:

“Compared with the SA due to cancer reference group, workers with an SA due to other causes had a higher probability of being in a low engagement, employment instability and early retirement LMPP rather than in a stable employment LMPP, though this result was only significant in women (men aRRR 1.76, 95% CI: 1.00–3.11; women aRRR 1.72, 95% CI: 1.02–2.90) (Table 2).”

B) The sentence indicates that it is based on Table 2. However, the results seem to include results presented in both Tables 2 and 3. Please check the main text was correct.

We thank the editor for pointing out the error. We have already added the reference to Table 3 in the main document, fifth paragraph of results in page 11:

“Compared with workers with an SA due to cancer, both comparison groups showed a lower probability of death in men (no SA aRRR 0.02, 95% CI: 0.00–0.16; SA due to other causes aRRR 0.17, 95% CI: 0.06–0.46) (Table 3).”

8. Summary of the findings: The authors summarized that “This study confirms our hypothesis that workers with an SA due to cancer were more likely to retire, receive PD benefits or die than those without a previous SA. These findings are consistent after adjustment by several employment and working conditions.” The description is too general and seems not reflect significant and insignificant findings by gender in Tables 2 and 3. For example, the negative and significant results (i.e., workers with an SA due to cancer were more likely to have an unfavorable labor market outcomes) were found for the model of “Increasing PD and death” among men and the model of “death” among women. The authors are strongly recommended to reconsider the summary of the findings at the beginning of the Discussion section and Conclusions. Also, the authors are expected to reconsider the descriptions in the Discussion section based on the

findings from multinomial logistic regression models adjusted by key socioeconomic and employment-related variables.

We thank the editor for the suggestion. We agree on the fact that our findings summary is partly based on statistically non-significant results. Patterns related to retirement, permanent disability, and death, are the patterns representing the smallest proportion of the sample in both sexes (9%, 7%, 4.8% in women and 11.4%, 7.1%, and 4.7% in men, respectively). This low sample size could be a reason why we obtain non-statistically significant results in our estimates. However, it seems that compared to workers without SA in men, and both comparison groups in women, workers with SA due to cancer show trends on higher likelihood of showing this future LMPPs. These results, although small and not statistically significant are meaningful in terms of our hypothesis and the population they represent. For these reasons, we think they are important to be highlighted even though we agree with the editor that the lack of statistical significance should be clearly stated when results are interpreted and discussed. We have edited the discussion and main findings to facilitate correct interpretation:

“This study’s results go in favour of our hypothesis that workers with an SA due to cancer were more likely to retire, receive PD benefits or die than their counterparts. However, patterns depicting these outcomes represented a small proportion of the sample, the results should be interpreted with caution. Our findings are consistent after adjustment by several employment and working conditions.”

(Summary of findings, first paragraph of the discussion section, page 13)

“Most workers with an SA due to cancer have a future working trajectory in employment. However, our results show that they could be more likely to retire, receive a PD benefit or die than their counterparts of the same age and sex. Nevertheless, further studies with higher sample sizes would be necessary to confirm our trends. (...)” (First paragraph of conclusions section, page 16)

“Our results on retirement in workers with an SA due to cancer are in line with those of previous literature. We found retirement patterns in women and men. These negative results in SA due to cancer were found not statistically significant and with small estimates, especially in women. And in men, this difference was only found compared to those without SA. However, although they should be interpreted with scepticism, these tendencies are important in terms of the population they represent. (...)” (Second paragraph of discussion section, page 13)

“(...) And although not statistically significant and with lower estimates, the same result was found compared to workers without a SA. In women, we observed similar non-significant tendencies of unstable future working life among those with an SA due to other causes that became significant after adjustment by employment-related conditions. In both sexes, individual adjustment by the previous five-year attachment to labour market increased the estimations, as well as the economic activity of the company and working time. (...)” (Third paragraph of discussion section, page 14)

“(…) However, differences were not significant so future studies should look at future precarity in cancer survivor women.” (Last sentence of paragraph 4 of the discussion section, page 14)

Reviewer 1

Dear editors

This article should be published since brings new knowledge to a very important subject and on wich there are few publications both Spain and internationally.

However I recommend some changes to increase the scientific quality of it.

Thank you.

We thank the reviewer for recognition of the importance of the topic and manuscript's content, and we will try to improve some aspects.

Reviewer 2

Dear Authors,

I would like to inform you the following:

1) I explain the acronym when I use it;

We thank the reviewer for the comment and have accordingly added some acronyms' long forms in order the make the manuscript clearer. Also a list of abbreviations was added to after conclusions (Page 16)

2) In the sentence: "All workers (N=1,548, 56% women) were followed-up from the end of the SA due to cancer until the end of 2018 to characterize eight possible weekly labour states" it seems that all workers had the cancer;

We thank the reviewer for pointing out the lack of clarity in the definition of the follow-up period and the sample and we have accordingly modified it as follows:

“All workers (N=1,548, 56% women) were followed up from the entrance to the cohort until the end of 2018 to characterise nine possible weekly labour states.”

3) I don't understand the meaning of figure 1;

The DAG (1) in figure one depicts our conceptual framework, putting in schematic, visual way our theories about the causal relationship between our main explicative variable, having a SA due to cancer, and our outcome of interest which is future labour market participation (represented by “Return to work” and “Leaving labour market”). In this conceptual framework we also depict our assumptions about covariables as confounders and mediators. For example, employment and working conditions affect at two time points: conditions after the SA due to cancer, and conditions workers had before the SA. Also sociodemographic variables and previous SA are related both to the explicative variable and outcome. Finally, treatment and disease related variables could be mediating the effect of SA due to cancer on final labour market participation.

(1) Peter W G Tennant and others, Use of directed acyclic graphs (DAGs) to identify confounders in applied health research: review and recommendations, *International Journal of Epidemiology*, Volume 50, Issue 2, April 2021, Pages 620–632, <https://doi.org/10.1093/ije/dyaa213>

4) What is WORKss?;

The WORKss is the acronym for the Spanish WORKing life Social Security cohort. We describe it briefly in Methods section, and in more detail, but briefly it originated from the Continuous Working Life Sample (CWLS) generated by the General Directorate for the Organization of Social Security in Spain. The WORKss cohort exclusively includes individuals with a labour trajectory from 1981 or later. It includes sociodemographic characteristics, chronological data about employment history, retirement, permanent disability and death (2).

(2) López Gómez MA, Durán X, Zaballa E, Sanchez-Niubo A, Delclos GL, Benavides FG. Cohort profile: the Spanish WORKing life Social Security (WORKss) cohort study. *BMJ Open*. 2016 Mar 7;6(3):e008555. doi: 10.1136/bmjopen-2015-008555

5) In "Table 1 Future labor market participation patterns (LMPPs) in salaried workers living in Catalonia (2012–2018)" the columns are different; I would justify the choice

We thank the reviewer for the comment. Columns from table 1 are different between men and women, this might add difficulty to the

reader. However, since the trajectories are not exactly the same in men and women, we have tried to give them names that better describe each of them. We have clarified it at the beginning of results as follows:

“We found five LMPPs in both sexes which were named according to labour trajectories found in each sex. (...)” (results section, paragraph 1, page 6)

Reviewer 3

GENERAL COMMENT

In this manuscript, the authors have investigated labor market participation among a sample of workers in Catalonia, Spain after returning from sickness absence (SA) due to cancer compared to those returning from SA from other causes and no SA. Despite the rather complex method, as well as interesting and important topic presented by the authors, I believe that the manuscript could be improved by clarifying the methods and further developing their discussion. I have outlined my suggestions for the manuscript below.

MAJOR ISSUES

- **The overall structure of the manuscript could be improved, particularly in the methods section. Currently, it is quite difficult to follow how the authors have conducted the study. For example, this study was based on the Spanish WORKss cohort; this description could have been clarified. Some of the questions that arose while reading the authors’ methods include a description**

of the continuous working life sample, inclusion criteria that the authors have applied, cut-off for income levels, etc. This also applies to the results section, where the interpretation of the tables (in particular Tables 2 and 3) could be done separately to make their interpretation easy to follow.

We thank the reviewer for the comment and have tried to clarify our methodology and results report accordingly as follows:

Regarding the database and its description: “The study was based on the Spanish WORKing life social security (WORKss) cohort [16]. WORKss cohort is based on the Continuous Working Life Sample (CWLS), which has taken an annual random representative sample of 4% (approximately one million of workers) of affiliates of the Spanish social security system since 2004. This database contains a full employment history of each affiliate, including information such as occupational category, the company’s economic activity, employment conditions (e.g., type of contract, income, and working time), social benefits (e.g., unemployment, permanent disability [PD], and retirement), other work-related variables (e.g., company ownership and size), and date of death.” (Methods section, first paragraph, page 4)

Regarding the inclusion criteria: “We performed a retrospective dynamic cohort study among 1,548 (675 men and 873 women) affiliated salaried workers living in Catalonia. For the study population, inclusion criteria were being in the WORKss cohort, being affiliated with general regime of social security and being

residents in Catalonia during 2012 and 2015 (observational period for SA). (...)” (Methods section, third paragraph, pages 5)

Regarding cut-off for income levels: “(...) monthly average income in tertiles based on income of study population in 2012 (high [$>€2370$], medium [$€1450 - 2370$], or low [$≤€1450$]);(...)” (Methods section, paragraph 6, page 6)

Finally, to make the results section easier to follow we have interpreted women’s (Table 2) and men’s (Table 3) results separately, although still interleaving the two tables’ results:

“Table 2 shows that, taking workers with SA due to cancer as the reference group, women with an SA due to other causes had a higher probability of being in a decreasing labour market engagement LMPP rather than in a stable employment LMPP (aRRR 1.72, 95% CI: 1.02–2.90). In men (Table 3), a similar pattern was found, employment instability and early retirement LMPP, with same differences between workers with a SA due to other causes and those with SA due to cancer (aRRR 1.76, 95% CI: 1.00–3.11). These LMPPs represented the second most frequent LMPP in men and women, showing a group of workers mostly employed on permanent contracts (60.0%), but very soon they started switching to inactivity in women, whereas in men the switch was towards unemployment benefits and inactivity, or to early retirement (Figure 2).” (Results section, fourth paragraph, page 8)

“Compared with workers with an SA due to cancer, both comparison groups showed a lower probability of death in men (no SA aRRR 0.02, 95% CI: 0.00–0.16; SA due to other causes aRRR 0.17, 95%

CI: 0.06–0.46) (Table 3). This pattern depicting workers who died during follow-up consisted mainly of men with an SA due to cancer (Table 1). In women, LMPP depicting workers who died was increasing PD and death LMPP in women, and same as in men comparison groups showed a lower probability of exhibiting them (no SA aRRR 0.24, 95% CI: 0.10–0.57; SA due to other causes aRRR 0.39, 95% CI: 0.19–0.83) (Table 2). The pattern showing workers on PD was more frequent among men with an SA due to other causes (50.0%), and those aged over 55 years (55.6%) (Table 1).”

- **The authors introduced “labor market states” in their study objective. It would be helpful for the readers if this concept, including what it entails, is introduced already in their introduction.**

We appreciate the reviewer’s comments and have modified the objective as follows in order to clarify from the introduction what we mean by this term:

“The objective of this study was to analyse future labour participation trajectories, considering nine possible labour market states (temporary and permanent employment, unemployment, inactivity, permanent disability, early retirement, retirement, inactivity and premature death), in a sample of workers after an SA due to cancer and to compare their working life paths to those of a sample of workers without SA and to workers with an SA due to other diseases.” (Introduction section, paragraph 5, page 4)

- **In the methods section, the authors have explicitly written that all the analyses were stratified by sex. However, neither**

description nor discussion on gender was included in the background section. The importance of gender differences also appeared to be of importance in the discussion section, which made me wonder why this was not described and discussed a little better in the earlier sections.

We thank the reviewer for the comment and have addressed it as follows in the introduction section:

“On the one hand, sociodemographic factors such as age, sex, education level and family support influence the ability to continue work after cancer. A recent study showed that female cancer survivors dropped out of work more often than controls of both genders, were less likely to work full-time than males, and that they increased their participation in short part-time work more than male survivors (Brusletto et al., 2021).”

- **The presentation of results was quite difficult to follow. Based on my understanding of the manuscript (including the title), the authors investigated how workers who have had SA due to cancer participated in the labor market compared to those who did not have any SA and SA due to other causes. However, when I read the results, the authors presented their results as if SA due to cancer was the reference group in the study.**

We appreciate the reviewer’s comment. As the reviewer pointed out, the study aims to compare cancer survivors’ participation in labour market compared to workers with other medical diagnoses (also recognised by a SA) and to the general working population. To compare the three groups in the same model and according to the aim

of the study, we decided to consider the group of workers with a SA due to cancer as the reference category on the estimation. This is the reason why we always refer to the results comparing with those workers with SA due to cancer.

- **Some of the usage of terminologies differ in the manuscript (e.g., on page 8, interpretation of Figure 2), which made me wonder whether the authors were referring to the same terminology or introducing a new concept.**

We thank the reviewer for the appreciation, and we have amended it accordingly. All results section should have the exact names of the patterns as they appear in figure 2.

- **In their discussion, the authors confirmed their hypothesis regarding the differences in labor market participation patterns (LMPP) between workers that had SA due to cancer and no SA. However, I did not find the same effort was put in the discussion regarding the difference in LMPP between workers that had SA due to cancer compared to SA due to other causes.**

We thank the reviewer for the comment. We tried to incorporate both groups into the discussion. However, estimations of the group without SA were indeed given more thought or more discussion. One of the reasons being that there is no literature referring to a comparison group like ours. As a novel approach to the study of participation in labour market after cancer, we are still reflecting on what our results are showing. Anyhow, we did approach results related to other medical diagnoses comparison groups in the discussion. Also, we have added some discussion on the implications

of having this comparison group. We hope that future studies will shed more light on the differences between SA due to cancer and SA due to another diagnosis in future working life. We have added a reflection on the reasons behind adding this group in discussion paragraph 3, page 14:

“(…) Having a comparison group with workers who have other health conditions, also recognised by a SA, allows us to see future differences in working life between overcoming cancer and other health problems, and how after ending SA due to cancer adverse effects may still be affecting the ability to work of survivors. Moreover, it allows us to control for the potential effect of SA, as it has been shown how SA is a determinant of low labour engagement and future SA (Roelen et al., 2011).”

8.3. APPENDIX III: Scientific conferences

XXXVII Scientific Congress of Spanish Society of Epidemiology, Oviedo, 2019.

Presented work: Ayala-García A, Serra L, Ubalde-López M “Labour trajectory of a young working sample with sickness absence due to mental disorder”.

I Virtual Scientific Congress of Spanish Society of Epidemiology, 2020.

Presented work: Ayala-García A, Serra L, Portellano-Ortiz C, Benavides FG “Reincorporation to labour market of a sample of cancer survivors in Catalonia between 2012 and 2015”.

Presented work: Ayala-García A, Benavides FG, Serra L “Unemployment and return to work in Catalonian cancer survivors. A survival analysis”.

2020 DCEXS-UPF Biomedical Research Symposium, 2020.

Presented work: Ayala-García A "Working status of a sample of Catalonian workers after a sickness absence due to cancer".

CIBERESP Congress 2021.

Presented work: Ayala-García A, Serra L, Benavides FG “Relationship between sickness absence due to cancer and risk of early exit from labour market in Catalonia (Spain) (2012- 2018)”.

**XXXIX Scientific Congress of Spanish Society of Epidemiology
León, 2021.**

Presented work: Ayala-García A, Serra-Saurina L, Hernando JC, Portellano C, Benavides FG. “Probability of continuing in employment after a sickness absence due to cancer in Catalonia (2012-2015)”.

Presented work: Portellano C, Ayala-García A, Benavides FG. “Sickness absence in a cohort of Social Security affiliates in Catalonia, 2012-2015”.

28th International Symposium on Epidemiology in Occupational Health: from the workplace to the population, exposure and prevention. EPICOH, 2021. Presented work: Ayala-García A, Serra-Saurina L, Ubalde-Lopez M, “Are early working life patterns related to the course of future sickness absence due to common mental disorders?”.

Presented work: Ayala-García A, Serra-Saurina L, Portellano C, Benavides FG. “Reincorporation to labour market of a sample of cancer survivors in Catalonia (Spain) between 2012 and 2015. A comparison between women and men”.

Ex4OSH Expanding occupational safety and health an international Conference, 2021.

Presented work: Ayala García A, Serra Saurina L, Benavides FG. “Labour market permanence and risk of unemployment in breast

cancer survivors after a sickness absence in Catalonia, Spain (2012-2018)”.

CIBERESP Congress 2022, Granada.

Presented work: Ayala-García A, Benavides FG, Serra L. “Future working life after a sickness absence cancer comparing to cancer free working population in Catalonia (Spain) (2012-2018)”.

XXXIX Scientific Congress of Spanish Society of Epidemiology, 2022, San Sebastián.

Presented work: Ayala-García A, Serra L, Utzet M, Rodriguez-Arjona D, Benavides FG. “Work after a cancer leave. Perceptions of barriers and facilitators of survivors”.

European Public Health Conference (EPH), 2022, Berlín.

Presented work: Ayala-García A, Serra L, Utzet M, Rodriguez-Arjona D, Benavides FG. “Work after a sickness absence due to cancer. Perceptions of barriers and facilitators from survivors perspective”.

8.4. APPENDIX IV: Assessment report stay Karolinska Institutet



**Karolinska
Institutet**

Stockholm 28 December 2021

Department of Clinical Neuroscience
Division of Insurance Medicine

The PhD student Amaya Ayala García has spent three months at our Division of Insurance Medicine, Karolinska Institutet as a guest pre-doctoral researcher, from 15 of September to 15 of December 2021. She has been eager to learn from the work we do from the beginning of the stay and has participated in all the Division's activities including group meetings, lunch seminars, lectures, etc. Also, she has been part of the Journal Club that we do at the division with all the PhD students, sharing opinions, discussing, and critically assessing scientific articles. She has collaborated in a project we have about breast cancer, sickness absence and permanent disability. She has also been working on her thesis. Her scientific knowledge and skills in insurance medicine have developed thanks to her involvement in the seminars, presentations, thesis defences, and other social activities organized at the Division. Also, as a result of the stay, she has improved interpersonal skills such as communicating effectively with colleagues, she has gained intercultural approaches and she has strengthened cross-national networks. Her stay here has also been valuable to us, exchanging ideas and understanding of different social security systems and different approaches to the area of research.

A handwritten signature in black ink, appearing to read 'Emilie Friberg'.

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8.5. APPENDIX V: Awards and scholarships

- **XVI Award for young researchers, 2020 edition "Miguel Carrasco" 2020. Spanish Society of Epidemiology (SEE).** Economic award for training and education of young researchers and development of an epidemiology project. Award given for the project “Return to work after a cancer diagnosis”.
- **Award for best communication presented by young researchers, 2020. Spanish Society of Epidemiology (SEE).** Award given for the oral communication "Labour life trajectory after a cancer in Catalonia”.
- **XX scholarship of the Spanish Society of Epidemiology (SEE).to attend the “European Educational Programme in Epidemiology”.**
- **CIBERESP grants for short stays abroad for international stays.**