

# **WORKING PAPER**

## **LABOUR MARKET OUTCOMES FOR CANCER SURVIVORS: A REVIEW OF THE REVIEWS**

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# Labour Market Outcomes for Cancer Survivors: A Review of the Reviews\*

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## Abstract

**Objectives:** To synthesise the existing reviews conducted on the labour market outcomes of cancer survivors by focusing on (i) the convergences and divergences on the overall work-related outcomes, (ii) the moderating factors studied to date, and (iii) an identification of areas where more research is needed in the future.

**Methods:** A systematic review of the existing reviews on labour market outcomes for cancer survivors was performed. Bibliographic search for eligible studies published before January 2019 involved the following three core concepts: (i) cancer survivors, (ii) work, and (iii) review. The quality of the included reviews was assessed based on the Johns Hopkins Hospital Evidence Level and Quality Guide. Following this, a narrative synthesis of the findings was completed.

**Results:** In total, 35 articles met the inclusion criteria. The average return to work (RTW) rate varied between 54% and 66%. The self-reported work ability was consistently lower following cancer. This review also found strong converging evidence of self-reported discrimination after cancer. The effects on work performance showed several inconsistencies, possibly due to the use of different definitions of work performance. Most moderating factors for successful work outcomes showed converging evidence, except for age, marital status, cancer type, and country. We provide several possible explanations and linkages for these divergencies.

**Conclusions:** Further investigation of causal relationships by (i) using matched control groups and by (ii) gathering longitudinal data, and the use of more standardised definitions of the outcome variables are the two main future research recommendations. Furthermore, no studies have succeeded in measuring the work outcomes objectively. We provide specific recommendations from an interdisciplinary context to solve this.

**Protocol registration:** CRD42019139386.

**Keywords:** labour market outcomes, employment, return to work, cancer survivorship, review of reviews, research overview.

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# 1 Introduction

The prevalence of cancer, or the number of individuals who have been diagnosed with cancer and remain alive after a certain period of time (i.e. the survivors), has increased globally over the past few decades. The absolute number of existing cases of cancer within one year rose from 45 million in 1990 to 100 million in 2017, which corresponds with the rise in prevalence rates (percentage of cancer cases per 100,000 people) from 0.85% to 1.32% over that period<sup>[1]</sup>.

Additionally, due to recent developments in cancer screenings and improvements in cancer treatments, the risk of dying from cancer decreases year upon year<sup>[2-5]</sup>, resulting in growing numbers of people living with and surviving this illness. Current studies assume that over 60% of adults survive cancer<sup>[6,7]</sup>. Considering the rising life expectancy and increasing working age, this translates into a growing proportion of cancer survivors among the working-age population<sup>[2,4,8,9]</sup>. Hence, as this group is identified as a target group for intensive labour market assistance both in academic and in policymaking circles<sup>[8,10-12]</sup>, reintegrating cancer survivors, to the best of their abilities, into the labour market is of great importance.

The literature on this subject has proliferated in the past few decades, not only through an increase in the number of primary studies (e.g., cohort studies, randomised controlled trials), but also through an increase in the number secondary studies (e.g., meta-analyses, systematic reviews). As of today, there are a large number of reviews available stemming from various scientific fields, such as oncology, psychology, sociology, public health, and even legal practice. Additionally, each review focuses on different measures of work outcomes, different moderating factors, and different cancer types, and each review uses a different review method. Due to this wide availability of research, it becomes very difficult to process and evaluate the broad body of evidence on the labour market outcomes for cancer survivors.

By summarising, analysing, and comparing the findings of the different reviews on the topic, this paper identifies (i) the convergences and divergences in the different labour market outcomes following cancer, (ii) the convergences and divergences in the moderating factors that influence the labour market outcomes following cancer, and (iii) the areas where the present gaps in the literature lie. To the best of our knowledge, the present study is the first to review the existing reviews on the general labour market outcomes for all cancer survivors without any restrictions on the review types, work outcomes, cancer types, or moderating factors.

The broad overview obtained from this study implies very high academic and societal relevance. First, this study will accentuate whether the existing evidence on this topic is consistent or contradictory, which in turn will highlight the areas on which future research needs to focus on. Second, this study will offer a means for optimal-informed decision making for policy-makers. For example, where a systematic review merely focuses on one cancer type (e.g., breast cancer), or one population (e.g., childhood cancer survivors), this review can provide a broader picture for many cancer types in various populations. This, in turn, will

identify the groups of cancer survivors who face the highest risk of unemployment and who are therefore in need of more intense labour market assistance. Policy-makers can then direct the support and implement (re)integration interventions towards these specific groups to optimise the return to work (RTW) process.

The remainder of this article is structured as follows. In Section 2, we introduce the methodology of this study, including the search strategy, the eligibility criteria, the quality assessment, and the process of data extraction. In Section 3, we present the results, with a focus on how the results converge and diverge by review types, by labour market outcomes, and by moderating factors. This section also synthesises the principal future research implications extracted from each review. In Section 4, we present additional recommendations for future research based upon the analysis of the overall findings. Finally, the study briefly concludes in Section 5.

## 2 Method

### 2.1 Search strategy, eligibility criteria, and study selection

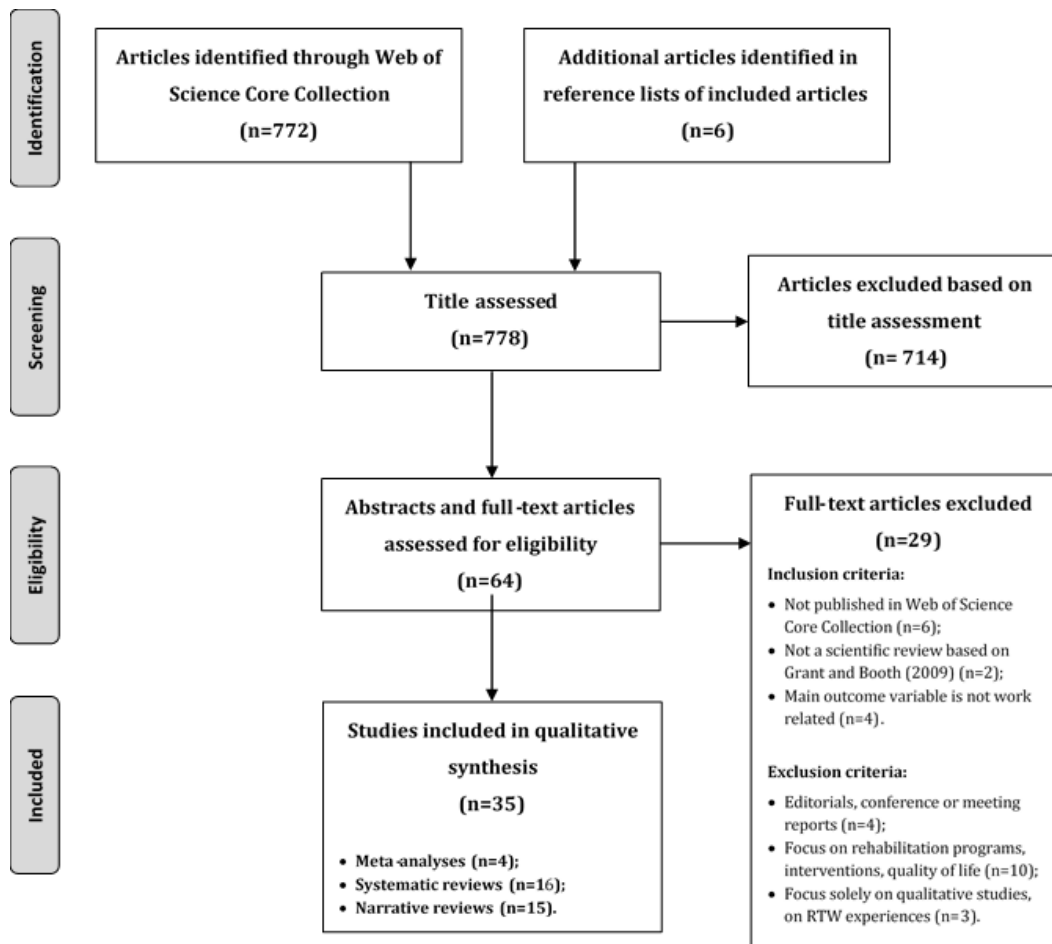
In scientific literature, reviews of reviews are referred to by several names, and a clear-cut definition is still lacking<sup>[13]</sup>. The term '*umbrella review*' was first described as a review to 'compile evidence from multiple Cochrane reviews into one accessible and usable document' as a consequence of the activities of the Cochrane Collaboration<sup>[14]</sup>. Subsequently, the Joanna Briggs Institute developed the methodology to conduct an umbrella review, which they defined as a synthesis of existing systematic reviews and meta-analyses<sup>[15]</sup>. Another possibility to refer to a review of reviews is to make a distinction between the terms '*umbrella reviews*' and '*overview of reviews*'. Umbrella reviews typically (but not exclusively) appraise systematic reviews and *aim to inform on a specific topic*, while overviews of reviews appraise only reviews and *typically (but not always) aim at informing on a specific topic*<sup>[16]</sup>. Umbrella reviews can thus be considered a broader term that includes overviews of reviews<sup>[16,17]</sup>. Regardless of the differences in the definitions, in this study we summarise, analyse, and compare the existing reviews on the general labour market outcomes for all cancer survivors.

A systematic search was performed in December 2018 for reviews published in the Web of Science Core Collection, using the following three sets of strings: [neoplasms OR cancer OR cancer survivors] AND [employment OR work OR labour] AND [review] (see online appendix, table A for the full search syntax). The review protocol is registered on the International Prospective Register of Systematic Reviews (PROSPERO) database (registration number *CRD42019139386*).

The criteria for inclusion of the studies were as follows: (1) full text is available in English; (2) the study was published in Web of Science Core Collection before January 1, 2019; (3) the

study is categorised as a review, based on the typology of the reviews by Grant and Booth (2009)<sup>[14]</sup>, with a quantitative component, or where a quantitative component forms part of the review; (4) the review includes primary or secondary studies with cancer survivors as participants (no age restrictions, no cancer type restrictions); (5) the main outcome variables are work related.

The following studies were excluded: (1) editorials, conference-, or meeting-reports; (2) studies focusing primarily on rehabilitation programs, interventions, or quality of life reviews (of which work forms only a small part); (3) studies reviewing exclusively qualitative primary studies.



**Figure 1.** Selection of the reviews flow chart, with inclusion and exclusion criteria. Study selection flow chart based on PRISMA 2009 Guidelines (from The PRISMA Group<sup>[18]</sup>).

Study selection was performed in four steps. First, the article titles that were identified during the systematic search were screened by the primary reviewer (AS). Second, the full-text articles were assessed, based on the abstracts and the contents, in terms of inclusion and exclusion criteria. During this step, we noted the specific reasons for the exclusion of each study. Third, the reference lists of the retrieved articles were manually cross-checked to identify any other relevant reviews, particularly those that were not identified in the initial step of the search. This included the articles in the reference lists of the retrieved studies and the articles citing the retrieved studies in the Web of Science Core Collection. This third step was reiterated whenever an additional relevant article was found. Lastly, in the case of doubts regarding the inclusion or

exclusion of an article, the two authors (AS and SB) discussed it, until a consensus was eventually reached. Figure 1 presents a detailed flow chart showing the selection process of the reviews.

## **2.2 Quality assessment**

The quality of the included reviews was assessed based on the Johns Hopkins Hospital Evidence Level and Quality Guide<sup>[19]</sup>. Articles were categorised according to evidence levels (I - V) based on the type of review. Twenty reviews were at level III: a systematic review with or without meta-analysis. Fifteen reviews were at level V: a literature review. Appraisal was then undertaken based on the associated appraisal tool and defined by the quality guidelines (A - C). Thirty-one reviews were of high quality (A) and four reviews were of good quality (B).

## **2.3 Data extraction**

Based on the reviewers' manual of the Joanna Briggs Institute, a standardised data collection process was employed to maximise consistent extraction of data on labour market outcomes after cancer<sup>[15,20]</sup>. Prior to the analysis of the reviews, we decided to extract the following data: authors, year of publication, type of review, time frame for the collection of primary studies, specific characteristics of the participants (in case only certain cancer types, ages, countries, or job types were studied), work-related outcome measures, moderators for the labour market outcomes of cancer survivors considered, findings concerning the labour market outcomes of cancer survivors, and finally, future research directions. The original primary studies and the individual study-level data were not taken into consideration and fall beyond the scope of this review. This section details the types of data extracted and the approach we used to present our findings in Section 3.

### **2.3.1 Types of reviews**

The main three types that are included in this review are as follows: a narrative (literature) review, a systematic review, or a meta-analysis. In general, systematic reviews and meta-analyses are the preferred alternatives to narrative reviews. The reason for this is the lack of systematic evidence search and synthesis associated with the latter studies, which results in an increased chance of incorporating bias and less reliable evidence<sup>[20]</sup>.

### **2.3.2 Types of outcome measures**

To achieve an overall examination of the labour market outcomes for cancer survivors, we first directly collected every work-related outcome reported in the review. Next, to render this general overview of labour market outcomes possible, we augmented the inquiries from the reviews into the following categories: relative unemployment rate, RTW rate, work performance, work ability, and self-reported discrimination.

First, relative unemployment rate is the rate of unemployment of cancer survivors relative to healthy-control participants. It is mostly calculated alongside the likelihood of being unemployed for cancer survivors relative to healthy-control participants.

Second, RTW rate is the rate of cancer survivors able to work after a certain period of time. Overall, this percentage is assumed to increase with increasing time intervals and is otherwise named in reviews as 'duration until RTW'<sup>[3,8,21–28]</sup>.

Third, we define work performance as occupational outcomes of employed survivors<sup>[29]</sup>. The following outcome variables are mentioned in the reviews: absenteeism (absence from scheduled work due to health problems among employed people), presenteeism (impaired on-the-job performance due to health problems among employed people), work productivity in terms of total output of the survivor, duration of sick leave, and the number of worked hours. This way, we categorise in this group the performance-related outcomes that are measured by certain existing standards (such as absent days, realised production, worked hours).

Fourth, work ability is categorised in this study as cognitive and physical capabilities of the survivor, and any self-reported measures of work limitations experienced at work. In general, this is a category that, in contrast to work performance, includes work-related outcome measures related to the ability to perform (this does not necessarily mean that the survivors will perform at that certain level).

Self-reported discrimination is the fifth group of work-related outcome variables. It encompasses any self-reported measures of discrimination in the labour market, be it at the workplace or during the job search. Some examples are hiring discrimination based on misperceptions or stigma of cancer by employers, job rejection, job loss, harassment and hostility at the workplace, differential treatment, forced job reassignment, loss of job responsibilities, or denial of promotion.

### 2.3.3 Types of moderators

Moderators are contributing factors that increase or decrease the chance of successful work outcomes following cancer. This study focuses on the risk factors, i.e. identifying the characteristics that impede or decrease the chance of successful work outcomes. Additionally, we use the term 'inconsistent factors' for moderators that showed mixed evidence in the considered review (these factors were found to be prognostic in some primary studies while acting as risk factors in other primary studies). The term 'insignificant factors' is used to denote moderators that showed no significant association with the principal work outcomes in the study.

The factors were aggregated into the following categories: person-related factors, disease-related factors, work-related factors, and environment-related factors. Person-related factors are age, education, ethnicity, financial status, intelligence quotient, gender, marital status, medical health status, personal value towards work, and well-being. Disease-related factors are cancer type, cancer stage, cognitive impairments, depressive symptoms, fatigue presence,

treatment type, and physical symptoms. Work-related factors are colleagues' support, colleagues' misperceptions of survivor's work ability, employers' support, employer' misperceptions of survivor's work ability, contract type, intellectual demands of the job, flexitime possibility, job stress, job type, physical demands of the job, sector, previous period of unemployment before cancer diagnosis, self-reported work discrimination, seniority on the job, sick leave duration, and union membership. Finally, environment-related factors include country, family support, healthcare providers' support, need of assistance with transportation, social insurance system type, social norms towards RTW of cancer survivors, and provided integration care.

Important to note, in primary studies the work-related outcomes are considered to be measured with the amount of time that has passed since diagnosis or treatment. For instance, the RTW rate can be formulated at 6 months post-diagnosis or at 5 years post-treatment. Given that there is a general consensus in the literature that successful work outcomes tend to increase with increasing time intervals following cancer diagnosis<sup>[3,8,21,23,24,26-29]</sup>, and data extraction from primary studies falls beyond the scope of this review, we did not admit this moderator into our analysis.

### **3 Results**

The systematic search yielded 772 unique articles. Among them 714 articles were excluded after the initial screening of the titles. The remaining articles were retrieved for a manual search of the reference lists and a full text screening. Following the application of the inclusion and exclusion criteria, this resulted in the final sample of 35 reviews. Out of 35 reviews, 4 are meta-analyses (11%), 16 are systematic reviews (46%), and another 15 are narrative reviews (43%).

A schematic overview of the findings can be found in Table 1. It shows the extracted data from meta-analyses, systematic reviews, and narrative reviews. In the following subsections, we identify and analyse convergences and divergences from the reviews, focusing first on the overall labour market outcomes for cancer survivors, then on the moderators for the labour market outcomes of cancer survivors, and lastly, on the implications for future research.

<Table 1 about here>

#### **3.1 Labour market outcomes after cancer**

##### **3.1.1 Relative unemployment rate**

Relative unemployment rate varies between 4% and 82% in the four meta-analyses<sup>[30-33]</sup>, corresponding with evidence level III from the Johns Hopkins Hospital Evidence Level and Quality Guide<sup>[19]</sup>. Two of these studies focus solely on childhood cancer survivors<sup>[30,32]</sup>, and one review



focuses solely on breast cancer survivors<sup>[33]</sup>. Furthermore, two narrative reviews, corresponding with the evidence level V<sup>[19]</sup>, confirm the results of higher relative unemployment rates following cancer<sup>[7,34]</sup>. One of the studies<sup>[34]</sup> focuses solely on the self-employed cancer survivors and finds in general a higher relative unemployment rate among all cancer survivors, but to a lesser extent for the self-employed cancer survivors than for the salaried cancer survivors.

From this we find a clear convergence in the four meta-analyses and two narrative reviews on the relative unemployment rate of cancer survivors: all studies report a higher unemployment rate after cancer in comparison with the healthy population, including in the samples that consist of childhood cancer survivors, breast cancer survivors, and self-employed cancer survivors.

### 3.1.2 RTW rate

RTW rate is the most frequently studied work outcome, studied in 25 of 35 reviews. Fifteen reviews report actual rates<sup>[2,6,36-40,7,21,24-28,35]</sup>, while the other ten reviews report only the direction of the RTW rates following cancer<sup>[3,5,8,10,22,23,29,41-43]</sup>. The RTW rates extracted from primary studies and reported in six systematic and eight narrative reviews vary between 16% and 94%. We calculated for each review the spread of the RTW rates as the difference between the highest and the lowest reported RTW rate of each primary study. The dispersion of the spreads varies between 20 and 70 percentage points. The average RTW rates reported in two systematic reviews and three narrative reviews, however, do not know such wide dispersion: 64%<sup>[24]</sup>, 54%<sup>[38]</sup>, 64%<sup>[25]</sup>, 62%<sup>[26]</sup>, and 66%<sup>[40]</sup>. The remaining ten studies, where solely the direction of RTW rates is presented, also report consistently lower RTW rates after cancer. As a result, we find a wide dispersion of the RTW rates, but the average RTW rates vary between 54% and 66%, showing a clear convergence.

### 3.1.3 Work performance

Work performance is considered in 18 of 35 reviews, 11 of which are systematic<sup>[2,3,43,5,22-24,29,35,37,42]</sup> and 7 of which are narrative<sup>[25,28,34,39,40,44,45]</sup>. On the one hand, we find that all systematic reviews report a lower level of work performance following cancer. Further, one study makes an important distinction regarding the time frame wherein work performance is measured<sup>[3]</sup>. Within the first 5 years post-diagnosis, work performance for cancer survivors is significantly lower than that of controls. When analysing work performance over 5 years post-diagnosis, however, there is no significant difference between the work performance of cancer survivors and that of controls.

On the other hand, the evidence on work performance is divergent in the seven narrative reviews. Merely four out of seven studies find evidence supportive of the analysis from the systematic reviews<sup>[25,28,44,45]</sup>.

The divergence stems from the following three studies. One literature review finds no substantial association between work performance and cancer survivorship<sup>[39]</sup>. Another literature

review focuses on the work performance of self-employed cancer survivors and reports a higher work performance among the self-employed survivors than that of the salaried survivors<sup>[34]</sup>, important to note however, is the fact that the authors did not have a control group without a history of cancer. Therefore, we cannot generalise this result into this study. Another contrasting finding is that of the third literature review: work performance cannot be consistently associated with cancer survivorship<sup>[40]</sup>.

A potential explanation for this divergence concerns the use of different definitions of work performance. Indeed, in the primary studies of [34] and [40], cancer survivors disclose work performance defined as ‘worked hours’, which are higher after cancer diagnosis<sup>[34,40]</sup>. In contrast, work performance when defined as ‘work productivity’ or ‘output produced per hour’, might be negatively associated with history of cancer. Thus, it is plausible that survivors who return to work, work more hours than an age- and gender-matched control group in order to compensate for a possibly lower level of work productivity.

### 3.1.4 Work ability

Work ability is investigated in 18 of 35 reviews (9<sup>[2,22,23,29,35,38,41–43]</sup> of evidence level III and 9<sup>[6,11,25,27,28,34,39,40,45]</sup> of evidence level V). Without a single review contradicting the results, we find a clear convergence on this work outcome: work ability is lower following cancer. In addition, two of these reviews focus on specific samples and measurements. The first study focuses solely on breast cancer survivors and finds the work ability lower for survivors with more physical symptoms<sup>[22]</sup>. The second study finds a reduction in physical or mental work ability of up to 26% after surviving cancer<sup>[24]</sup>. This is the only review in our sample that reports a percentage reduction of work ability; it does this by extracting self-reported survey data on work-related abilities from primary studies.

### 3.1.5 Self-reported discrimination

We present 12 of 35 reviews with self-reported discrimination as a work outcome<sup>[2,12,45,46,21,24,25,29,30,38,39,44]</sup>. In one meta-analysis with a focus on childhood cancer survivors, significant levels of experienced discrimination after cancer are apparent, yet they are apparent only in the United States and not in Europe<sup>[30]</sup>. Next, four systematic reviews also report significant experienced discrimination<sup>[2,24,29,38]</sup>. It should be noted that three of those reviews<sup>[2,24,29]</sup> also mention self-reported discrimination as a moderating risk factor for the RTW. We will return to the use of self-reported discrimination as a moderator in the next section.

Lastly, seven narrative studies also record positive self-reported discrimination after the experience of cancer<sup>[12,21,25,39,44–46]</sup>. [44] details a primary study that estimates up to 90% of patients returning to work might face discrimination<sup>[44]</sup>. The study also shows, from other primary studies, that between 13% and 45% of cancer survivors report job rejections due to cancer diagnosis. Another narrative review includes 29 primary studies that examine workplace discrimination, with the majority using quantitative methods, such as surveys, to quantify survivors’ perceived rates of discrimination<sup>[46]</sup>. These self-reported rates vary from 0% to 58%.

Another measure of self-reported discrimination is job loss as a result of experienced discrimination. One study reports percentages of survivors who lost their jobs due to a cancer diagnosis as between 47% and 53%<sup>[24]</sup>. Thus, despite accounting for a broad definition of this outcome variable, we find converging evidence of existing self-reported discrimination after cancer.

## 3.2 Moderators for work outcomes after cancer

### 3.2.1 Person-related moderators

We find converging evidence on the following person-related factors: lower educational level, female gender, lower overall medical health status (or co-morbidity with other illnesses), lower levels of well-being, and minority ethnicity. We find, on the other hand, diverging evidence for age and marital status.

Eighteen studies report *older* age as a consistent *risk* factor for lower survivors' work outcomes<sup>[3,5,29,35,36,38-41,44,6,7,10,11,21,24,25,27]</sup>. Eight other studies do not support these results, however<sup>[2,26,28,30-33,37]</sup>. For instance, one meta-analysis, focusing on childhood cancer survivors diagnosed under the age of 18, concludes that *younger* age is a risk factor for a higher relative unemployment rate<sup>[30]</sup>. A follow-up meta-analysis, also focusing on childhood cancer survivors diagnosed under the age of 18, concludes that age is an insignificant factor for survivors' work outcomes<sup>[32]</sup>. A third meta-analysis focusing on breast cancer survivors, grouped the age variable in increments of 10 years and found no significant association of that moderator with the labour market outcomes for cancer survivors<sup>[33]</sup>. Similarly, a systematic review focusing on blood cancer survivors, grouped the age variable into <35, 35-49, and >50 years<sup>[8]</sup>. The authors report no significant association of age with the work outcomes in longitudinal primary studies. Another example is the systematic review focusing on cancer survivors in Spain<sup>[38]</sup>. The study finds that age >45 years is a strong moderator for lower RTW but not for work ability. Finally, a systematic review focusing on RTW in European cancer survivors, finds age on average to be an inconsistent factor, defining both younger age <30 and older age >50 to be risk factors<sup>[2]</sup>. Thus, it appears that for adult cancer survivors older age at the time of diagnosis is a risk factor, whereas for childhood cancer survivors younger age at the time of diagnosis is a risk factor.

In total, only nine studies make use of marital status as a moderator for the work outcomes of cancer survivors<sup>[2,3,8,24,26,33,35-37]</sup>. Solely three systematic reviews exhibit a consensus that being married or being non-single is a risk factor for survivors' work outcomes<sup>[24,35,36]</sup>.

Two systematic reviews conclude, however, that being single is a risk factor for survivors' work outcomes<sup>[2,3]</sup>. Another two studies, a meta-analysis focusing on breast cancer survivors in the United States, Europe, South-Korea, and Canada, and a systematic review focusing on blood cancer survivors in the United States and Europe, find marital status to be an insignificant factor for survivors' RTW<sup>[8,33]</sup>. Lastly, there is also a systematic review focusing on breast cancer survivors in the United States, Europe, and South-East Asia, that shows marital status as an inconsistent

factor for survivors' RTW<sup>[37]</sup>. Placing evidence from these studies side by side, these conflicting findings may reflect different interactions between moderators that correlate with the country of residence, e.g., through the social security system. We revisit this in the subsection on environment-related moderators.

### 3.2.2 Disease-related moderators

This study finds converging evidence concerning almost all disease-related moderators. The severity of the treatment (e.g. use of chemotherapy, radiotherapy, and/or extensive surgery), advanced cancer stage, presence of physical symptoms, presence of depressive symptoms, and presence of fatigue are the principal disease-related risk factors that result in survivors' lower work outcomes. Moreover, skin cancers and cancers of male reproductive organs are found to be prognostic factors for successful work outcomes in two other systematic reviews<sup>[29,35]</sup>.

Yet, small divergences in the literature are found with regard to the treatment type, certain symptoms, and cancer type. As to the treatment type, one study reports radiotherapy and endocrine therapy as insignificant treatment factors for RTW among breast cancer survivors<sup>[37]</sup>. Concerning the symptoms, cognitive impairments represent a risk factor in two systematic reviews<sup>[23,32]</sup> and in three narrative reviews<sup>[11,25,28]</sup>. Contradictory is the result of another study focusing solely on breast cancer survivors, where the presence of cognitive impairments is an inconsistent moderator for work outcomes<sup>[22]</sup>. A final inconsistency is presented by the systematic review which concludes that the cancer stage, depressive symptoms, fatigue presence, and treatment type are inconsistent factors for RTW among blood cancer survivors<sup>[8]</sup>.

### 3.2.3 Work-related moderators

These results show no divergent findings regarding the principal work-related moderators. The following moderators are considered risk factors and are used in the majority of studies: absence of colleagues' support, absence of employers' support, absence of flexitime possibility, job stress, blue collar jobs, and physically more demanding jobs. Another work-related factor, studied in 9 out of 35 studies, is self-reported discrimination. Four systematic reviews<sup>[2,24,29,37]</sup> and three narrative reviews<sup>[11,27,46]</sup> conclude that self-reported work discrimination is a risk factor for RTW rates, while two other studies (a systematic and a narrative review) conclude that self-reported discrimination is an inconsistently associated moderator for RTW rates<sup>[5,26]</sup>.

The following risk factors appear in the minority of reviews: smaller company size<sup>[35]</sup>, larger company size<sup>[44]</sup>, private sector<sup>[35]</sup>, lower seniority on the job<sup>[35]</sup>, union membership<sup>[24,27,29]</sup>, no disclosure of cancer at work<sup>[24]</sup>, self-employment as contract type<sup>[2,38]</sup>, permanent contract<sup>[2]</sup>, intellectually more demanding jobs<sup>[2,43]</sup>, longer sick leave duration<sup>[6,29,47]</sup>, previous period of unemployment before cancer diagnosis<sup>[29,41]</sup>, and colleagues' and employers' misperceptions of the survivor's work ability<sup>[23]</sup>.

### 3.2.4 Environment-related moderators

Similar to the findings associated with the disease- and work-related moderators, the literature is very diverse but not inherently contradictory on the environment-related moderators. The main risk factors to worsen the survivors' work outcomes are as follows: absence of healthcare providers' support<sup>[2,24–26,29,34–37,44]</sup>, absence of continuous integration care<sup>[6,24,38]</sup>, and rather negative social norms towards RTW of cancer survivors<sup>[2,26,29,40,45,46]</sup>. The latter social norms include norms and beliefs on the employability of cancer survivors, myths and beliefs on cancer (such as fear of cancer in general or beliefs that cancer is contagious), and misperceptions about survivors' work abilities and productivity. Two other risk factors that are considered in the reviews are the absence of family support<sup>[28,35,37]</sup>, and need of assistance with transportation<sup>[27,39]</sup>.

Two of the most important moderators are the considered country and the social security system in that country. Naturally, the two correlate because the differences in the social welfare systems (health insurance systems and disability pensions) are country-specific. Six systematic<sup>[5,24,33,35–37]</sup> and five narrative<sup>[6,11,25,34,40]</sup> reviews demonstrate that access to public health insurance or the availability of universal health care in the country (in the case of Scandinavian countries, for example) is a risk factor for survivors' RTW or a prognostic factor for higher unemployment. Nevertheless, two meta-analyses<sup>[30,32]</sup> report that residing in the United States is a risk factor for higher relative unemployment rates. A plausible explanation for this divergence lies in the fact that the two latter reviews focus on childhood cancer. Thus, in a country without universal health care provision, such as the United States, the health insurance for adult survivors is usually provided through the employer, and the need to maintain this health insurance incentivises RTW<sup>[33]</sup>. For childhood survivors, however, this is not the case, as they are not active in the labour market at the time of the diagnosis, resulting in a higher risk of being unemployed after childhood cancer.

## 3.3 Implications for future research

To synthesise what remains unknown in the literature and what recommendations are for future research, we present the final column of Table 1. First, 18 of 35 reviews recommend investigating causal relationships by using matched control groups and by gathering longitudinal data. The second most observed recommendation (16 of 35 reviews) is to use more standardised definitions in the future and to objectively measure the outcome variables of 'RTW rate', 'work performance', 'work ability', and 'work discrimination'. Specifically for 'work performance', 'work ability' and 'work discrimination', reviews recommend developing an objectively measurable tool<sup>[22,35,38,42]</sup>. Another 11 of 35 reviews argue for increasing the external validity of the primary studies by using larger and more diverse populations. This is especially the case for the inclusion of participants from various ethnical backgrounds, with various cancer types, from various age groups, from various countries, and in various health insurance systems, thus covering the existing divergencies in the literature on certain moderators (age groups, marital status, countries, and health

insurance systems). Lastly, six reviews also call for future studies to focus on the mechanisms. More specifically:

1. The mechanism behind faster RTW among the self-employed survivors: is shorter sick leave the result of their greater flexibility to RTW or of the experienced pressure to continue to work because of a stronger financial motivation?
2. The mechanism behind the self-perceived discrimination of cancer survivors: is the self-perceived discrimination the result of stigmatisation by employers, or of the misperceptions of employers on the work abilities of the survivors, or of the fear of cancer recurrence, and, thus, the possibility of rising healthcare costs for the employers?
3. The mechanism behind the effect of the treatment type on work outcomes: is a certain treatment inherently affecting work outcomes, or is it the experienced symptoms related to this treatment that hinder the RTW process?

## 4 Discussion and study limitations

This is the first review to summarise, analyse, and compare the findings of the various reviews regarding the labour market outcomes for cancer survivors. By looking at the findings of the studies that have been conducted thus far, there are some important points to be made. First, the future research implications in the reviews recommend the use of standardised work outcomes. Nonetheless, none of the studies recommends the use of *objectively measurable* labour market discrimination. An example is the field experiment conducted in Belgium to measure hiring discrimination in the labour market based on the disclosure of former depression<sup>[48]</sup>. Second, the use of 'income loss' as a work outcome is limited<sup>[7,34]</sup>. This work outcome could be measured, both through administrative and survey data. The third important aspect that emerged from the findings is the limited use of economic moderators per country. In the studies conducted thus far, only 'country' and 'health insurance type' have been accounted for. We would argue, however, for a further and more accurate decomposition of these environment-related moderators into the following: health insurance type per country, long-term unemployment benefits per country, and the invalidity benefits per country. Three studies also suggested that several of these economic factors be taken into consideration<sup>[7,33,34]</sup>. After all, the choice of the survivor to return to the labour market depends on the level of financial support provided by the environment.

Due to the broad focus of this review, the authors did not look further into the primary studies of the reviews, as this process would prove to be time-consuming and slowing the production of the review, which might go against the overview's scope<sup>[49]</sup>. This limitation might be addressed in future reviews. Nonetheless, as this review is the first of its kind on the topic of general work-related outcomes following cancer diagnosis, the main strength of this study

consists of the gathered evidence for decision makers and comparing the different outcomes over multiple populations and cancer types.

## **5 Conclusion**

This study was a systematic review of existing reviews and provided an overall examination of the body of information that is available on labour market outcomes following cancer diagnosis. This paper found overall convergences in the principal work outcomes. First, the relative unemployment rate of cancer survivors in comparison with the healthy population varied between 4% and 82%. Second, the average RTW rates varied between 54% and 66%, indicating that most cancer survivors are able to return to the labour market but that the share of participants active on the labour market is significantly lower after cancer survivorship. Third, work performance was lower after cancer in all systematic reviews (evidence level III), but not in the narrative literature reviews (evidence level V). A potential explanation for this divergence, even though stemming from a lower evidence level, concerned the absence of a more standardised and uniform definition of 'work performance'. Fourth, we reported a clear convergence from the research evidence that work ability decreased following cancer. Lastly, we also found converging evidence of significant self-reported labour market discrimination after cancer.

This paper also identified convergences and divergences in the moderating factors for the work outcomes of cancer survivors. Most inconsistencies were found in the person-related factors age and marital status. Other ambiguities in the moderating factors concerned certain cancer types, corresponding treatment types, and the considered country.

In terms of recommendations for future research, most reviews advocated, first of all, investigating causal relationships by using matched control groups and by gathering longitudinal data. Second main goal for future studies was to use more standardised definitions of the outcome variables such as 'work performance', 'work ability', and 'self-reported work discrimination', and to succeed in measuring these objectively. A third direction for future studies aimed to increase the external validity of the primary studies by using larger and more diverse populations. More specifically, more research is needed with participants from various ethnical backgrounds, from various countries, from various age groups, with various cancer types, and in various health insurance systems. With further examination of the work outcomes after cancer under these circumstances, the unknown gaps in the literature will cover the existing divergencies on certain moderators.

## Compliance with Ethical Standards

**Conflict of interest:** The authors declare that they have no conflict of interest.

**Research involving human participants and/or animals:** This article does not contain any studies with human participants or animals performed by any of the authors.

**Informed consent:** Since this research did not involve human participants, informed consent was not obtained for the purpose of this manuscript.

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**Table 1.** Results: summary of the reviews.

Study	Method <sup>3</sup>	Work-related outcomes	Moderators considered	Main findings	Main directions for future research
A. Meta-analyses.					
de Boer et al. (2006)	Meta-analysis of 24 studies published between 1966 and 2006. Focus on childhood cancer survivors. Level III - A	Relative unemployment rate. Self-reported work discrimination. <sup>4</sup>	Person-related: age, education, intelligence quotient, gender, medical health status. <sup>5</sup> Disease-related: cancer type, physical symptoms. <sup>6</sup> Environment-related: country.	Relative unemployment rate varies between 20 and 50%. - Risk factors: younger age, lower education, lower intelligence quotient, female gender, lower medical health status (co-morbidity with epilepsy), certain cancer types (nervous system cancers), more physical symptoms, geographical location: United States of America (USA). Self-reported work discrimination positive after cancer experience in USA.	Increase external validity by using larger and more diverse populations, with various cancer types, from various countries (Europe versus USA). Investigate causal relationships by using matched control groups and by gathering longitudinal data.
de Boer et al. (2009)	Meta-analysis of 36 studies published between 1966 and 2008. Level III - A	Relative unemployment rate.	Person-related: age. Disease-related: cancer type. Environment-related: country.	Relative unemployment rate on average about 34%. - Risk factors: certain cancer types (gastrointestinal cancers, nervous system cancers, breast cancers, cancers of female reproductive organs). - Insignificant factors: certain cancer types (blood cancers, cancers of male reproductive organs). - Inconsistent factors: age, country.	Investigate unexploited work-related outcomes: work ability, income changes, RTW rate in various types of social insurance systems, RTW rate for various cancer types. Increase external validity by using larger and more diverse populations. Investigate causal relationships by using matched control groups and by gathering longitudinal data.
Mader et al. (2017)	Meta-analysis of 27 studies and systematic review of 56 studies published between 2006 and 2016. Focus on childhood cancer survivors.	Relative unemployment rate.	Person-related: age, education, gender, medical health status. Disease-related: cancer type, cognitive impairments, treatment type, <sup>7</sup> physical symptoms. Environment-related: country.	Relative unemployment rate varies between 4 and 82%, on average about 16%. - Risk factors: lower education, female gender, lower medical status (co-morbidity with heart disease, diabetes, epilepsy), certain cancer types (central nervous system cancers), cognitive impairments, certain treatment types (radiotherapy), more physical symptoms,	

<sup>3</sup> Evidence level and quality rating based on Dearholt and Dang (2017).

<sup>4</sup> Hiring discrimination based on misperceptions or stigma of cancer, job rejection, harassment and hostility at the workplace, changes in relationships with employers and colleagues, differential treatment, forced job reassignment, job responsibilities loss, job loss, forced to quit, denial of promotion, decreased job mobility or job lock (being unable to leave a job because of the loss of health benefits).

<sup>5</sup> General medical health of the individual, mental health, physical fitness level of the individual, co-morbidity with other (chronic) diseases, perceived/self-rated health.

<sup>6</sup> Physical pain, nausea, vomiting, poor sleep quality, motor impairments such as arm disability, upper body limitations, hearing loss, hot flushes.

<sup>7</sup> Treatment of cancer varies depending on the type of cancer, the stage of the cancer, and the general health of the survivor: it can include surgery, radiation therapy, chemotherapy, immunotherapy, hormonal therapy, a combination of the above treatments, and/or some other less used approaches. In this study we assume the severity of the cancer treatment increases with the use of more treatments, more invasive treatments, and treatments with more harmful side effects or risks.

	Level III - A			geographical location: USA, Canada. - Insignificant factors: age.	
Wang et al. (2018)	Meta-analysis of 26 studies published between 1966 and 2008. Focus on breast cancer survivors. Level III - A	Relative unemployment rate.	Person-related: age, education, ethnicity, financial status, marital status, children presence. Disease-related: cancer stage, <sup>8</sup> treatment type. Work-related: contract type, <sup>9</sup> employers' support, flexitime possibility, intellectual demands of the job, job stress, job type, <sup>10</sup> physical demands of the job. Environment-related: social insurance system type.	Relative unemployment rate varies between 15 and 27%. - Risk factors: lower education, African-American ethnicity, lower financial status, childlessness, advanced stages, certain treatment types (chemotherapy, mastectomy), lower employers' support, lower flexitime possibility, intellectually more demanding jobs, job stress presence, physically more demanding jobs, public health insurance systems. - Insignificant factors: age, marital status, certain treatment types (radiotherapy, endocrine therapy), contract type, job type.	–

#### B. Systematic reviews.

Bijker et al. (2018)	Systematic review of 20 studies published between 2000 and 2016. Focus on breast cancer survivors. Level III - A	RTW rate. Work performance: absenteeism, sick leave, worked hours, work productivity. Work ability: work limitations.	Person-related: well-being. <sup>11</sup> Disease-related: cognitive impairments, physical symptoms.	RTW rate, work performance, work ability lower for survivors with more physical symptoms. RTW rate, work performance, work ability inconsistently associated with survivors' well-being, or cognitive impairments.	Investigate unexploited work-related outcomes: objectively measured work participation, changes in work activities, worked hours.
Chow et al. (2014)	Systematic review of 27 studies published between 1990 and 2013. Level III - A	RTW rate. Work performance: absenteeism, sick leave. Work ability: cognitive capabilities, physical capabilities.	Person-related: age, education, financial status, gender, marital status, medical health status, value towards work. <sup>12</sup> Disease-related: cancer stage, cancer type, depressive	RTW rate varies between 45 and 89%. - Risk factors: older age, lower education, lower financial status, non-single marital status, <sup>13</sup> lower medical health status, lower value towards work, advanced stages, certain cancer types (lung cancers, nervous system cancers, stomach cancers, liver cancers, colorectal cancers), certain	Use more standardised measures for: 'work ability'. Investigate unexploited work-related outcomes: objectively measured work ability, differentiate between cognitive and mental capabilities, objectively measured employers' support, colleagues' support, healthcare providers'

<sup>8</sup> The extent to which a cancer has developed, taking into account the size of the initial tumor, whether or not the cancer has spread to lymph nodes, and whether or not it has spread to different body parts. Most cancer types have four stages, numbered from I to IV. Stage I: cancer is relatively small and contained within the organ in which it originated; stage IV: cancer has spread into surrounding tissues, including lymph nodes in the area, and to other body organs (metastatic cancer).

<sup>9</sup> Temporary or permanent contract type.

<sup>10</sup> Blue or white collar job type (manual versus desk job).

<sup>11</sup> General self-rated well-being, emotional and social functioning (pursuing social activities, emotional stability, stress and frustration resilience), life satisfaction, optimism, prioritising personal life over work life, lifestyle.

<sup>12</sup> Job commitment, work as part of the survivor's identity, personal belief in high value of the practiced work, personal motivation to RTW.

<sup>13</sup> Non-single marital status includes people not belonging to the following groups: single, separated, divorced, or widowed; or thus married individuals, or individuals in a legally recognised cohabiting state.

symptoms, fatigue, treatment type.

Work-related: colleagues' support, company size, employers' support, physical demands of the job, sector, seniority on the job.

Environment-related: family support, healthcare providers' support, social insurance system type.

treatment types (chemotherapy, radiotherapy), lower colleagues' support, smaller company size, lower employers' support, physically more demanding jobs, private sector, lower seniority (junior position), lower family support, lower healthcare providers' support, public health insurance systems.

- Prognostic factors: certain cancer types (skin cancers, cancers of male reproductive organs).

Work performance, work ability lower after cancer experience.

- Risk factors: female gender, lower medical health status, certain cancer types (breast cancers), depressive symptoms, certain treatment types (chemotherapy, radiotherapy), fatigue presence.

support, work performance for specific occupations.

Cocchiara et al. (2018)

Systematic review of 26 reviews published between 2004 and 2017.

Focus on breast cancer survivors.

Level III - A

RTW rate.

Person-related: age, education, ethnicity, financial status, marital status, medical health status, well-being.

Disease-related: cancer stage, depressive symptoms, fatigue, treatment type, physical symptoms.

Work-related: colleagues' support, employers' support, flexitime possibility, job stress, physical demands of the job.

Environment-related: healthcare providers' support, social insurance system type.

RTW rate varies between 27 and 93%.

- Risk factors: older age, lower education, African-American ethnicity, Latin-American ethnicity, lower financial status, non-single marital status, lower medical health status, lower well-being, advanced stages, more depressive symptoms, fatigue presence, certain treatment types (chemotherapy, radiotherapy, extensive surgery), more physical symptoms, lower colleagues' support, lower employers' support, lower flexitime possibility, job stress presence, physically more demanding jobs, lower healthcare providers' support, public health insurance systems.

Use more standardised measures for: 'RTW rate'.

den Bakker et al. (2018)

Systematic review of 8 studies published between 1966 and 2018.

Focus on colorectal cancer survivors.

Level III - A

RTW rate.

Work ability: work limitations.

Person-related: age, education, gender, medical health status.

Disease-related: cancer stage, treatment type.

Work-related: job type, previous period of unemployment before cancer diagnosis.

RTW rate lower after cancer experience.

- Risk factors: older age, lower medical health status, certain treatment types ((neo)adjuvant therapy).
- Inconsistent factors: education, job type.

Work ability lower after cancer experience.

- Risk factors: previous unemployment period before cancer diagnosis, certain treatment types (invasive surgery).

Use more standardised measures for: 'RTW rate', 'work ability'.

Investigate unexploited work-related outcomes: RTW rate, work ability in various types of social insurance systems, for various cancer types.

Duijts et al. (2014)	Systematic review of 30 studies published between 2000 and 2013. Focus on employed cancer survivors. Level III - A	Work performance: work productivity. Work ability: cognitive capabilities, physical capabilities, work limitations.	Disease-related: cognitive impairments, depressive symptoms, fatigue, physical symptoms. Work-related: colleagues' misperceptions of survivor's work ability, employers' misperceptions of survivor's work ability, job stress.	Work performance lower after cancer experience. - Risk factors: more cognitive impairments, more depressive symptoms, fatigue presence, more physical symptoms, colleagues' and employers' misperceptions of survivor's work ability, job stress presence. Work ability lower after cancer experience. - Risk factors: more cognitive impairments, more depressive symptoms, fatigue presence, more physical symptoms.	Investigate causal relationships by gathering longitudinal data.
Feuerstein et al. (2010)	Systematic review of 45 studies published between 2000 and 2010. Level III - A	RTW rate. Work performance: absenteeism, sick leave, worked hours, work productivity. Work ability: cognitive capabilities, physical capabilities, work limitations. Self-reported work discrimination.	Person-related: age, gender, financial status, medical health status, value towards work, well-being. Disease-related: cancer stage, cancer type, cognitive impairments, depressive symptoms, fatigue, treatment type, physical symptoms. Work-related: colleagues' support, employers' support, job stress, job type, previous period of unemployment before cancer diagnosis, physical demands of the job, union membership.	RTW rate lower after cancer experience. - Risk factors: older age, female gender, lower financial status, lower medical health status, lower value towards work, lower well-being, advanced stages, certain cancer types (gastrointestinal cancers, liver cancers, lung cancers, nervous system cancers, pancreatic cancers), more cognitive impairments, more depressive symptoms, fatigue presence, certain treatment types (chemotherapy), more physical symptoms, lower colleagues' support, lower employers' support, job stress presence, blue collar jobs, previous period of unemployment before cancer diagnosis, physically more demanding jobs, members of employee union. - Prognostic factors: certain cancer types (skin cancers, cancers of male reproductive organs). Work performance lower after cancer experience. Work ability lower after cancer experience. Self-reported work discrimination positive after cancer experience.	Use more standardised measures for: 'work ability'. Investigate unexploited work-related outcomes: 'cognitive capabilities', 'physical capabilities', 'emotional capabilities', 'social capabilities'. Investigate causal relationships by using matched control groups and by gathering longitudinal data.
Islam et al. (2014)	Systematic review of 26 studies published between 2003 and 2013.	RTW rate. Work performance: absenteeism, worked hours.	Person-related: age, ethnicity, education, financial status, marital status, medical health status, children presence, well-being.	RTW rate varies between 27 and 93%. - Risk factors: Latin-American ethnicity, lower financial status, lower medical health status, lower well-being, advanced stages, more depressive symptoms, fatigue presence, certain	Use more standardised measures for: 'RTW rate'. Increase external validity by using larger and more diverse populations, including

	Focus on breast cancer survivors. Level III - A		Disease-related: cancer stage, depressive symptoms, fatigue, treatment type, physical symptoms. Work-related: colleagues' support, employers' support, job stress, job type, physical demands of the job, self-reported work discrimination, union membership. Environment-related: family support, healthcare providers' support, social insurance system type.	treatment types (chemotherapy, invasive surgery), more physical symptoms, lower colleagues' support, lower employers' support, job stress presence, blue collar jobs, physically more demanding jobs, self-reported work discrimination, lower family support, lower healthcare providers' support, public health insurance systems. - Prognostic factors: non-Latin white ethnicity, Chinese ethnicity, African-Caribbean ethnicity, Malay ethnicity. - Insignificant factors: children presence, certain treatment types (radiotherapy, endocrine therapy). - Inconsistent factors: age, education, marital status. Work performance lower after cancer experience for members of employee union.	non-white individuals, from various age groups, backgrounds, countries, socio-economic status. Investigate the mechanisms behind the type of treatment and the work outcome: is a certain treatment inherently affecting RTW or is it the experienced symptoms that hinder RTW?
Gagnano et al. (2018)	Systematic review of 6 reviews and 9 studies published between 1994 and 2016. Level III - A	RTW rate.	Person-related: age, education, financial status, gender, medical health status. Disease-related: cancer stage, depressive symptoms, fatigue, physical symptoms, treatment type. Work-related: employers' support, flexitime possibility, job stress, job type, physical demands of the job.	RTW rate lower after cancer experience. - Risk factors: older age, lower education, lower financial status, female gender, lower medical health status, advanced stages, more depressive symptoms, fatigue presence, more physical symptoms, certain treatment types (chemotherapy, invasive surgery), lower employers' support, lower flexitime possibility, job stress presence, blue collar jobs, physically more demanding jobs.	Investigate unexploited work-related outcomes: perceived work ability, health care providers' and employers' perspectives.
Horsboel et al. (2012)	Systematic review of 8 studies published between 1986 and 2011. Focus on blood cancer survivors. Level III - A	RTW rate.	Person-related: age, education, financial status, gender, marital status, medical health status. Disease-related: cancer stage, depressive symptoms, fatigue, physical symptoms, treatment type. Work-related: job type.	RTW rate lower for survivors with blue collar jobs. - Inconsistent factors: age, education, gender, cancer stage, depressive symptoms, fatigue presence, treatment type. - Insignificant factors: financial status, marital status.	Use more standardised measures for: 'RTW rate'. Investigate causal relationships by using matched control groups and by gathering longitudinal data.
Kamal et al. (2017)	Systematic review of 62 studies published	Work performance: absenteeism, presenteeism, sick leave,	Disease-related: cancer stage, depressive symptoms, fatigue,	Work performance lower after cancer experience. - Risk factors: advanced stages, certain treatment types (chemotherapy, multimodal treatments).	Investigate unexploited work-related outcomes: objectively measured work performance,



	between 1966 and 2016. Level III - A	worked hours, work productivity. Work ability: cognitive capabilities, physical capabilities, work limitations.	treatment type, physical symptoms.	Work ability lower after cancer experience. - Risk factors: more depressive symptoms, fatigue presence, certain treatment types (chemotherapy, multimodal treatments), more physical symptoms.	objectively measured work ability, for various types of social insurance systems.
Mehnert (2011)	Systematic review of 64 studies published between 2000 and 2009. Level III - A	RTW rate. Work performance: sick leave, worked hours. Work ability: cognitive capabilities, physical capabilities, work limitations. Self-reported discrimination.	Person-related: age, education, financial status, gender, marital status, medical health status. Disease-related: cancer stage, cancer type, depressive symptoms, fatigue, physical symptoms, treatment type. Work-related: colleagues' support, disclosure of cancer, employers' support, flexitime possibility, job type, self-reported work discrimination, sick leave duration, union membership. Environment-related: healthcare providers' support, provided integration care, social insurance system type.	RTW rate varies between 24 and 94%, on average about 64%. - Risk factors: older age, lower education, lower financial status, female gender, non-single marital status, lower medical health status, advanced stages, certain cancer types (lung cancers), more depressive symptoms, fatigue presence, more physical symptoms, certain treatment types (invasive surgery), lower colleagues' support, no disclosure of cancer, lower employers' support, lower flexitime possibility, blue collar jobs, self-reported work discrimination, longer sick leave duration, members of employee union, lower healthcare providers' support, continuous integration care absence, public health insurance systems. Work performance lower after cancer experience. - Risk factors: older age, lower education, female gender, lower medical health status, advanced stages, fatigue presence, members of employee union. Work ability up to 26% lower after cancer experience. Self-reported discrimination positive after cancer experience.	Use more standardised measures for: 'cognitive capabilities'. Investigate causal relationships by gathering longitudinal data. Investigate unexploited work-related outcomes: objectively measured work performance (productivity, absenteeism).
Molina and Feliu (2013)	Systematic review of 8 studies published between 1995 and 2010. Focus on studies conducted in Spain. Level III - B	RTW rate. Work ability: work limitations. Self-reported work discrimination.	Person-related: age, education, gender. Disease-related: cancer stage, depressive symptoms, fatigue, physical symptoms, treatment type. Work-related: colleagues' support, contract type, employers' support, flexitime possibility.	RTW rate varies between 16 and 70%, on average about 54%. - Risk factors: older age, lower education, female gender, advanced stages, more depressive symptoms, fatigue presence, more physical symptoms, certain treatment types (chemotherapy), lower colleagues' support, self-employment, lower employers' support, lower flexitime possibility, continuous integration care absence. Work ability lower after cancer experience.	Increase external validity by using larger and more diverse populations. Investigate causal relationships by using matched control groups. Investigate unexploited work-related outcomes: objectively measured discrimination, objectively measured work ability.

			Environment-related: provided integration care.	<ul style="list-style-type: none"> <li>- Risk factors: fatigue presence.</li> <li>- Insignificant factors: age, cancer treatment.</li> </ul> Self-reported work discrimination positive after cancer experience.	
Paltrinieri et al. (2018)	Systematic review of 12 studies published between 2010 and 2018. Focus on studies conducted in Europe. Level III - A	RTW rate. Work performance: sick leave, worked hours. Work ability: cognitive capabilities. Self-reported work discrimination.	Person-related: age, education, financial status, gender, marital status, children presence. Disease-related: cancer type, physical symptoms, treatment type. Work-related: intellectual demands of the job, colleagues' support, contract type, employers' support, flexitime possibility, physical demands of the job, self-reported work discrimination. Environment-related: healthcare providers' support, social insurance system type, social norms towards RTW of cancer survivors. <sup>14</sup>	RTW rate varies between 39 and 77%. <ul style="list-style-type: none"> <li>- Risk factors: lower education, lower financial status, female gender, single marital status, childlessness, certain cancer types (lung cancers), more physical symptoms, certain treatment types (chemotherapy), intellectually more demanding jobs, lower colleagues' support, permanent contract, self-employment, lower employers' support, lower flexitime possibility, physically more demanding jobs, self-reported work discrimination, lower healthcare providers' support.</li> <li>- Inconsistent factors: age.</li> </ul> Work performance lower after cancer experience. <ul style="list-style-type: none"> <li>- Risk factors: certain cancer types (lung cancers, gastrointestinal cancers), physically more demanding jobs, permanent contract, lower healthcare providers' support.</li> </ul> Work ability lower for survivors with chemotherapy treatment. Self-reported discrimination positive after cancer experience. <ul style="list-style-type: none"> <li>- Risk factors: female gender, lower employers' support, lower colleagues' support, lower flexitime possibility, worse social climate.</li> </ul>	Investigate unexploited work-related outcomes: RTW rates in various types of social insurance systems. Increase external validity by using larger and more diverse populations, including countries from Central and Mediterranean Europe.
Soejima and Kamibeppu (2016)	Systematic review of 26 studies published between 1996 and 2015. Level III - A	Work performance: absenteeism, presenteeism.	Person-related: age, education, ethnicity, financial status, gender, marital status, children presence, well-being. Disease-related: cancer type, treatment type. Work-related: colleagues' support, contract type,	Work performance lower within 5 years after cancer experience. <ul style="list-style-type: none"> <li>- Risk factors: older age, lower education, African-American ethnicity, lower financial status, female gender, single marital status, children presence, lower well-being.</li> </ul> Work performance not associated after 5 years with cancer experience.	Use more standardised measures for: 'work performance', 'work ability'.

<sup>14</sup> Present social norms and beliefs on employability of cancer survivors; these are lower if there are any (mis)perceptions and myths on cancer, such as fear of cancer in general, beliefs that cancer is contagious, or beliefs about survivors' work abilities and productivity.

employers' support, job type, physical demands of the job, seniority on the job.

Stone et al. (2017)	<p>Systematic review of 23 studies published between 2003 and 2015.</p> <p>Focus on young adult survivors between ages 15 and 39.</p> <p>Level III - A</p>	<p>Work performance: work productivity.</p> <p>Work ability: cognitive capabilities, physical capabilities.</p>	<p>Disease-related: cancer type, depressive symptoms, fatigue, physical symptoms, treatment type.</p> <p>Work-related: intellectual demands of the job, colleagues' support, employers' support, job type, physical demands of the job.</p>	<p>Work performance lower after cancer experience.</p> <ul style="list-style-type: none"> <li>- Risk factors: certain treatment types, intellectually more demanding jobs, physically more demanding jobs.</li> </ul> <p>Work ability lower after cancer experience.</p> <ul style="list-style-type: none"> <li>- Risk factors: more depressive symptoms, more physical symptoms, fatigue presence.</li> </ul>	<p>Investigate unexploited work-related outcomes: RTW rates in young adult survivors, healthcare providers' support.</p>
Van Muijen et al. (2012)	<p>Systematic review of 28 studies published between 1987 and 2011.</p> <p>Level III - A</p>	<p>RTW rate.</p> <p>Work performance: absenteeism, sick leave, worked hours, work status.</p>	<p>Person-related: age, education, ethnicity, gender, financial status.</p> <p>Disease-related: cancer type, cancer stage, treatment type.</p> <p>Work-related: physical demands of the job, self-reported work discrimination.</p> <p>Environment-related: social insurance system type.</p>	<p>RTW rate and work performance lower after cancer experience.</p> <ul style="list-style-type: none"> <li>- Risk factors: older age, lower education, female gender, lower financial status, certain cancer types (lung cancers, colorectal cancers), advanced stages, certain treatment types (chemotherapy, invasive surgery), physically more demanding jobs, public health insurance systems.</li> </ul> <p>RTW rate and work performance inconsistently associated with self-reported work discrimination.</p>	<p>Investigate causal relationships by gathering longitudinal data.</p>

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C. Narrative reviews.

Amir and Brocky (2009)	<p>Narrative review of studies published between 1995 and 2010.</p> <p>Focus on studies conducted in UK.</p> <p>Level V - A</p>	<p>RTW rate.</p> <p>Self-reported work discrimination.</p>	<p>Person-related: age, education, financial status.</p> <p>Disease-related: cancer stage, cancer type, depressive symptoms, fatigue, treatment type, physical symptoms.</p> <p>Work-related: colleagues' support, employers' support, physical demands of the job.</p>	<p>RTW rate varies between 25 and 89%.</p> <ul style="list-style-type: none"> <li>- Risk factors: older age, lower education, lower financial status, advanced stages, certain cancer types (lung cancers, gastrointestinal cancers, nervous system cancers), more depressive symptoms, fatigue presence, certain treatment types (chemotherapy, invasive surgery, radiotherapy), more physical symptoms, lower colleagues' support, lower employers' support, physically more demanding jobs.</li> </ul> <p>Self-reported discrimination positive after cancer experience.</p>	<p>Investigate unexploited work-related outcomes: objectively measured healthcare providers' support.</p> <p>Increase external validity by using larger and more diverse populations, from various countries (Europe or UK versus US).</p> <p>Investigate causal relationships by gathering longitudinal data.</p>
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Hoffman (2005)	Narrative review of studies published between 1959 and 2005. Level V - B	RTW rate. Work performance: absenteeism, work productivity. Work ability: cognitive capabilities, physical capabilities, work limitations. Self-reported work discrimination.	Person-related: age, education, financial status, medical health status. Work-related: job type, physical demands of the job. Environment-related: need of assistance with transportation.	RTW rate varies between 62 and 84%. - Risk factors: older age, lower education, lower medical health status, blue collar jobs, physically more demanding jobs. Work performance not associated with cancer experience. Work ability lower after cancer experience. Self-reported discrimination positive after cancer experience in blue-collar jobs.	Use more standardised measures for: 'cancer-related problems', 'discrimination'. Increase external validity by using larger and more diverse populations. Investigate causal relationships by using matched control groups.
Kurtzman et al. (1988)	Narrative review of studies published between 2002 and 2017. Level V - B	RTW rate. Work performance: sick leave, worked hours, work productivity. Self-reported work discrimination.	Person-related: age, gender, medical health status. Disease-related: cancer type, depressive symptoms, physical symptoms, treatment type. Work-related: company size, colleagues' support, employers' support, flexitime possibility, physical demands of the job. Environment-related: healthcare providers' support.	RTW rate and work performance lower after cancer experience. - Risk factors: older age, lower medical health status, certain cancer types (lung cancers, nervous system cancers), more depressive symptoms, more physical symptoms, certain treatment types (chemotherapy), larger companies, lower colleagues' support, lower employers' support, lower flexitime possibility, physically more demanding jobs, lower healthcare providers' support. Self-reported work discrimination varies between 13 and 90%. - Risk factors: older age, female gender, large company size.	–
Mehnert et al. (2013)	Narrative review of studies published between 1966 and 2003. Level V - A	RTW rate. Work performance: sick leave, work productivity. Work ability: cognitive capabilities, physical capabilities. Self-reported work discrimination.	Person-related: age, education, ethnicity, gender, value towards work. Disease-related: cancer stage, cancer type, cognitive impairments, fatigue, physical symptoms, treatment type. Work-related: colleagues' support, employers' support, flexitime possibility, job type, physical demands of the job, sick leave duration.	RTW rate varies between 24 and 94%, on average about 64%. - Risk factors: older age, lower education, non-Caucasian ethnicity, female gender, lower value towards work, advanced stages, fatigue presence, more physical symptoms, certain treatment types (invasive surgery), lower colleagues' support, lower employers' support, lower flexitime possibility, blue collar jobs, physically more demanding jobs, longer sick leave duration, lower healthcare providers' support. Work performance lower after cancer experience. - Risk factors: certain cancer types (breast cancers, nervous system cancers).	Use more standardised measures for: 'work performance', 'work ability'. Increase external validity by using larger and more diverse populations, with various cancer types, from various age groups, countries. Investigate causal relationships by gathering longitudinal data. Investigate unexploited work-related outcomes: objectively measured work performance, objectively measured work ability.

			Environment-related: healthcare providers' support, social insurance system type.	Work ability lower after cancer experience. <ul style="list-style-type: none"> <li>- Risk factors: cognitive impairments, fatigue presence.</li> </ul> Self-reported discrimination positive after cancer experience.	
Munir et al. (2009)	Narrative review of studies published between 1999 and 2008. Level V - A	Work performance: sick leave, worked hours, work productivity. Work ability: cognitive capabilities, physical capabilities, work limitations. Self-reported work discrimination.	Person-related: gender, medical health status, value towards work, well-being. Disease-related: cancer type, depressive symptoms, fatigue, physical symptoms, treatment type. Work-related: colleagues' support, employers' support, flexitime possibility. Environment-related: social norms towards RTW of cancer survivors.	Work performance and work ability lower after cancer experience. <ul style="list-style-type: none"> <li>- Risk factors: female gender, lower medical health status, lower value towards work, lower well-being, certain cancer types (breast cancers), more depressive symptoms, fatigue presence, more physical symptoms, certain treatment types (chemotherapy), lower colleagues' support, lower flexitime possibility, lower employers' support, worse social climate.</li> </ul> Self-reported work discrimination positive after cancer experience.	Use more standardised measures for: 'work performance', 'work ability'. Investigate unexploited work-related outcomes: objectively measured discrimination, objectively measured work ability, objectively measured employers' support, colleagues' support. Investigate causal relationships by gathering longitudinal data.
Rick et al. (2012)	Narrative review of studies published between 2002 and 2012. Level V - A	RTW rate. Work ability: cognitive capabilities, physical capabilities, work limitations.	Person-related: age, education, gender. Disease-related: cancer stage, cancer type, cognitive impairments, physical symptoms, treatment type. Work-related: colleagues' support, employers' support, sick leave duration. Environment-related: provided integration care, social insurance system type.	RTW rate varies between 58 and 82%. <ul style="list-style-type: none"> <li>- Risk factors: older age, lower education, female gender, advanced stages, certain cancer types (lung cancers, gastrointestinal cancers), more cognitive impairments, more physical symptoms, certain treatments (chemotherapy, invasive surgery), lower colleagues' support, lower employers' support, longer sick leave duration, continuous integration care absence, public health insurance systems.</li> </ul> Work ability lower after cancer experience.	Investigate unexploited work-related outcomes: RTW rates in various types of social insurance systems.
Seifart and Schmielau (2017)	Narrative review of studies published between 2002 and 2017. Level V - B	Relative unemployment rate.	Person-related: age, education, medical health status, value towards work. Disease-related: cancer stage, cancer type, fatigue, treatment type.	Relative unemployment rate on average about 34%. <ul style="list-style-type: none"> <li>- Risk factors: older age, lower education, lower medical health status, lower value towards work, advanced stages, certain cancer types (lung cancers, nervous system cancers), fatigue presence, certain treatments (chemotherapy), lower colleagues' support, lower employers' support.</li> </ul>	–

Work-related: colleagues' support, employers' support, physical demands of the job.

Sharp et al. (2017)	<p>Narrative review of studies published between 2008 and 2016.</p> <p>Focus on self-employed cancer survivors.</p> <p>Level V - A</p>	<p>Relative unemployment rate.</p> <p>Work performance: sick leave, work participation.</p> <p>Work ability: cognitive capabilities, physical capabilities.</p>	<p>Work-related: colleagues' support, employers' support, physical demands of the job.</p> <p>Environment-related: healthcare providers' support, social insurance system type.</p>	<p>Relative unemployment rate higher after cancer experience, but to a lesser extent for self-employed than for salaried survivors.</p> <p>Work performance higher for self-employed than for salaried survivors.</p> <p>Work ability lower for self-employed than for salaried survivors.</p> <ul style="list-style-type: none"> <li>- Risk factors for self-employed: lower colleagues' support, lack of employers' support, physically more demanding jobs, lower healthcare providers' support, various social insurance systems have lower social welfare provisions for self-employed than salaried workers.</li> </ul>	<p>Investigate unexploited work-related outcomes: RTW rates for self-employed in various education levels, from various socio-economic statuses, sectors, occupations, types of social insurance systems, geographic locations.</p> <p>Investigate the mechanisms behind faster RTW of the self-employed survivors: is shorter sick leave the result of their greater flexibility, or of the experienced pressure to continue to work because of a stronger financial motivation?</p>
Spelten et al. (2002)	<p>Narrative review of studies published between 1985 and 1999.</p> <p>Level V - A</p>	<p>RTW rate.</p>	<p>Person-related: age, education, gender, marital status, medical health status.</p> <p>Disease-related: cancer stage, depressive symptoms, fatigue, physical symptoms.</p> <p>Work-related: colleagues' support, employers' support, flexitime possibility, job type, physical demands of the job, self-reported work discrimination.</p> <p>Environment-related: healthcare providers' support, social norms towards RTW of cancer survivors.</p>	<p>RTW rate varies between 30 and 93%, on average about 62%.</p> <ul style="list-style-type: none"> <li>- Risk factors: lower medical health status, more depressive symptoms, fatigue presence, more physical symptoms, lower colleagues' support, lower employers' support, lower flexitime possibility, blue collar jobs, physically more demanding jobs.</li> <li>- Insignificant factors: education, gender, marital status, self-reported work discrimination.</li> <li>- Inconsistent factors: age, cancer stage.</li> </ul>	<p>Use more standardised measures for: 'work performance', 'work ability', 'RTW rate'.</p> <p>Investigate causal relationships by gathering longitudinal data.</p> <p>Investigate the mechanisms behind the treatment type and the work outcome: is radiotherapy per se affecting work outcomes or is it the experienced symptoms (fatigue) that hinder RTW?</p>
Steiner et al. (2004)	<p>Narrative review of studies published between 1966 and 2003.</p> <p>Level V - A</p>	<p>RTW rate.</p> <p>Work performance: sick leave, worked hours, work productivity.</p> <p>Work ability: cognitive capabilities, physical capabilities, work limitations.</p>	<p>Person-related: age, education, ethnicity, gender, financial status, medical health status.</p> <p>Disease-related: cancer stage, cancer type, depressive symptoms, fatigue, treatment type, physical symptoms.</p> <p>Work-related: physical demands of the job.</p>	<p>RTW rate varies between 24 and 72%, on average about 66%.</p> <ul style="list-style-type: none"> <li>- Risk factors: older age, lower education, ethnic minority background, female gender, lower financial status, lower medical health status, advanced stages, certain cancer types, more depressive symptoms, fatigue presence, certain treatment types, more physical symptoms,</li> </ul>	<p>Use more standardised measures for: 'work performance', 'work ability'.</p> <p>Investigate unexploited work-related outcomes: changes in work content, income changes, other financial (dis)incentives.</p> <p>Increase external validity by using larger and more diverse populations.</p>

			Environment-related: social insurance system type, social norms towards RTW of cancer survivors.	physically more demanding jobs, public health insurance systems, worse social climate. Work performance inconsistently associated with the cancer experience. Work ability lower after cancer experience.	Investigate causal relationships by using matched control groups and by gathering longitudinal data.
Steiner et al. (2010)	Narrative review of studies published between 1966 and 2008.  Level V - A	RTW rate. Work ability: work limitations.	Person-related: age, education, ethnicity, gender, medical health status. Disease-related: cancer stage, cancer type, depressive symptoms, fatigue, physical symptoms, treatment type. Work-related: employers' support, flexitime possibility, physical demands of the job, self-reported work discrimination, union membership. Environment-related: need of assistance with transportation.	RTW rate varies between 64 and 84%.  - Risk factors: older age, lower education, ethnic minority background, female gender, lower medical health status, advanced stages, certain cancer types (gastrointestinal cancers, hematological cancers, lung cancers, nervous system cancers), more depressive symptoms, fatigue presence, more physical symptoms, certain treatment types (chemotherapy), lower employers' support, lower flexitime possibility, physically more demanding jobs, self-reported work discrimination, members of employee union, higher difficulty with transportation.  Work ability lower after cancer experience.	–
Stergiou-Kita et al. (2017)	Narrative review of studies published between 1980 and 2014.  Level V - A	RTW rate. Self-reported work discrimination.	Disease-related: cancer type. Work-related: self-reported work discrimination. Environment-related: social norms towards RTW of cancer survivors.	RTW rate lower after cancer experience.  - Risk factors: self-reported work discrimination, worse social climate.  Self-reported discrimination rates vary between 0 and 58%, with different rates depending on cancer type.	Use more standardised measures for: 'discrimination'. Investigate unexploited work-related outcomes: work discrimination for various age groups, cancer types, and job types, employers', colleagues' perspectives regarding work participation, objectively measured healthcare providers' support.  Investigate the mechanisms behind the discrimination against cancer survivors.
Sun et al. (2017)	Narrative review of studies published between 2004 and 2014. Focus on breast cancer survivors.  Level V - A	RTW rate. Work performance: sick leave, work productivity. Work ability: cognitive capabilities, physical capabilities, work limitations.	Person-related: age, education, ethnicity, well-being. Disease-related: cognitive impairments, depressive symptoms, fatigue, physical symptoms. Work-related: colleagues' support, employers' support.	RTW rate varies between 44 and 82%.  - Risk factors: lower education, African-American ethnicity, Latin-American ethnicity, lower well-being.  Work performance and work ability lower after cancer experience.  - Risk factors: more cognitive impairments, more depressive symptoms, fatigue presence, more physical symptoms, lower colleagues' support,	Use more standardised measures for: 'work performance', 'work ability', 'discrimination'. Increase external validity by using larger and more diverse populations. Investigate unexploited work-related outcomes: objectively measured discrimination, loss of work ability.

Taskila and Lindbohm (2007)	Narrative review of studies published between 2002 and 2007. Level V - A	RTW rate. Work ability: cognitive capabilities, physical capabilities.	Environment-related: family support, social norms towards RTW of cancer survivors.  Person-related: age, education, medical health status, value towards work. Disease-related: cancer type, cancer stage, cognitive impairments, depressive symptoms, fatigue, physical symptoms, treatment type. Work-related: colleagues' support, employers' support, flexitime possibility, job type, physical demands of the job, self-reported work discrimination. Environment-related: healthcare providers' support, provided integration care, social insurance system type, social norms towards RTW of cancer survivors.	lower employers' support, lower family support, worse social climate.  RTW rate and work ability lower after cancer experience. - Risk factors: older age, lower education, worse medical health status, lower value towards work, certain cancer types (blood cancers, lung cancers, nervous system cancers), advanced stages, more cognitive impairments, more depressive symptoms, fatigue presence, more physical symptoms, certain treatment types (chemotherapy), lower colleagues' support, lower employers' support, lower flexitime possibility, blue collar jobs, physically more demanding jobs, self-reported work discrimination, lower healthcare providers' support, continuous integration care absence, public health insurance systems, worse social climate.	Use more standardised measures for: 'work ability'. Investigate unexploited work-related outcomes: objectively measured work discrimination, worked hours, income changes. Increase external validity by using larger and more diverse populations, with various cancer types. Investigate causal relationships by gathering longitudinal data. Investigate the mechanisms behind the treatment type and the work outcome: is a certain treatment inherently affecting the work outcomes or is it the experienced treatment-related symptoms that hinder RTW?
Valdivieso et al. (2012)	Narrative review of studies published between 2004 and 2014. Focus on studies conducted in the United States. Level V - A	RTW rate. Self-reported work discrimination.	-	RTW rate lower after cancer experience. Self-reported work discrimination positive after cancer experience.	-



## Appendix

**Table A.** Web of Science Core Collection search strategy.

Search	Query	Items found
# 1	TI= ((cancer OR cancer survivor OR survivorship OR cancer patients OR oncology OR neoplasm OR leukemia OR leukaemia OR sarcoma OR carcinoma OR lymphoma OR melanoma OR radiotherapy OR chemotherapy) AND (employment OR unemployment OR work OR work outcome OR labor OR labour OR labor market OR labour market OR return to work OR reintegration OR rehabilitation OR vocational rehabilitation OR vocational guidance OR job satisfaction OR discrimination OR stigma OR worker OR working)) AND TS=(review) AND LANGUAGE: (English)	623
# 2	TI= ((cancer OR cancer survivor OR survivorship OR cancer patients OR oncology OR neoplasm OR leukemia OR leukaemia OR sarcoma OR carcinoma OR lymphoma OR melanoma OR radiotherapy OR chemotherapy) AND (employment OR unemployment OR work OR work outcome OR labor OR labour OR labor market OR labour market OR return to work OR reintegration OR rehabilitation OR vocational rehabilitation OR vocational guidance OR job satisfaction OR discrimination OR stigma OR worker OR working) AND (review)) AND LANGUAGE: (English)	224
# 3	TI= ((cancer OR cancer survivor OR survivorship OR cancer patients OR oncology OR neoplasm OR leukemia OR leukaemia OR sarcoma OR carcinoma OR lymphoma OR melanoma OR radiotherapy OR chemotherapy) AND (employment OR unemployment OR work OR work outcome OR labor OR labour OR labor market OR labour market OR return to work OR reintegration OR rehabilitation OR vocational rehabilitation OR vocational guidance OR job satisfaction OR discrimination OR stigma OR worker OR working)) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Review)	378
# 4	#1 OR #2 OR #3 Filters: Publication date until January 1, 2019	772

Notes.

TI = Title; searches the terms in the title within a record.

TS = Topic; searches the terms in the following fields within a record: title, abstract, author keywords, and keywords plus.

Synthesis of the 1st search: Title = ( [cancer] AND [work] ) AND Topic = [review] AND Language = [English].

Synthesis of the 2nd search: Title = ( [cancer] AND [work] AND [review] ) AND Language = [English].

Synthesis of the 3rd search: Title = ( [cancer] AND [work] ) AND Document type = [review] AND Language = [English].

Synthesis of the 4th search: Remove duplicates from previous three searches AND Publication date up until January 1, 2019.