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Educational attainment and work disability in cancer survivors: Do diagnosis and comorbidity affect this association?

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Abstract

Objectives: To study whether educational attainment had less impact on work disability in cancer survivors than in individuals without cancer. To study whether comorbidity had a higher impact on work disability in low-educated cancer survivors than in high-educated and whether this impact differed when compared with individuals without cancer.

Methods: Linkage of population-based public health survey data and the Danish Cancer Registry formed two groups: cancer survivors (*n* = 3,514) and cancer-free individuals (*n* = 171,262). In logistic regression models, the risk of experiencing an 8-week sick leave spell and the granting of disability pension within a 3-year follow-up period was studied in three educational levels and whether these associations were modified by history of cancer and comorbidity. Odds ratios (OR) with 95% confidence intervals (CI) are reported.

Results: Non-stratified adjusted risk of experiencing an 8-week sick leave spell (OR: 1.41, 95% CI (1.33–1.49)) or being granted a disability pension (OR: 1.61, 95% CI (1.31–1.97)) was significantly higher in low-educated than in high-educated respondents. Cancer or comorbidity did not significantly interact with education on the risk of work disability.

Conclusions: A moderate impact of low education on future work disability was found for all respondents, neither history of cancer nor comorbidity modified this association.

KEYWORDS
cancer survivors, disability evaluation, educational status, population health, registries, sick leave

1 | INTRODUCTION

In Denmark, the incidence of cancer is approximately 41,000 cases per year, and almost 300,000 persons are presently living with the consequences of cancer diagnosis and treatment (Engholm et al., 2017; Talbäck et al., 2017). Up to 40% of these cancer survivors are of working age, that is 15–59 years at time of diagnosis (Engholm et al., 2017). In 2010, the most prevalent cancer diagnoses in working-age Danish women and men combined were breast (22%), melanoma (15%), brain and central nervous system (10%), gynaecological (10%) and testicular (9%), whereas prostate (2%) and lung (2%) cancer were the least frequent diagnoses (The Danish Health Authority, 2011). Population-based register

studies have consistently demonstrated that cancer patients have a worse labour market prognosis than individuals without a previous cancer diagnosis in The Nordic countries (Carlsen, Oksbjerg, Frederiksen, Diderichsen, & Johansen, 2008; Horsboel, Nielsen, Andersen, Nielsen, & de Thurah, 2014; Syse & Tonnessen, 2012; Syse, Tretli, & Kravdal, 2008; Torp, Nielsen, Fossa, Gudbergsson, & Dahl, 2013; Torp, Nielsen, Gudbergsson, Fossa, & Dahl, 2012), the Netherlands (Paalman et al., 2016) and USA (Kent et al., 2018). These studies, however, also showed that low educational attainment was associated with increased risk of poor work outcomes for both cancer survivors and cancer-free controls. In two studies by Torp et al. (2013), Torp et al. (2012), it was found that educational attainment (>12 years) overall increased employment and reduced sickness absence, respectively, in cancer survivors and controls (Torp et al., 2013, 2012). However, interactional effects of cancer diagnosis were solely present among females' employment chances in gender-stratified analyses (Torp et al., 2013, 2012). Study findings of Hoersboel et al. (2014) on haematological malignancies may question Torp et al.'s (2013) conclusion. That is, they questioned the influence of social position on the association between cancer and the risk of being granted a disability pension (Horsboel et al., 2014). They hypothesised that the impact of being diagnosed with cancer on the risk of being granted a disability pension is so predominant that it diminishes the effect of educational attainment and household income. This ambiguity in findings of Torp et al. (2013), Torp et al. (2012) and Horsboel et al. (2014) has led to the first hypothesis of the current study; educational attainment has less impact on work disability in cancer survivors than in individuals without a history of cancer.

Cancer survivors have increased risk of comorbidities, such as cardiovascular diseases or diabetes (Demark-Wahnefried, Aziz, Rowland, & Pinto, 2005). There is, however, sparse knowledge on whether comorbidity affects the relationship between social position and work disability in persons diagnosed with cancer differently compared with persons without a history of cancer (van Muijen, Duijts, Beek, & Anema, 2013a; van Muijen et al., 2013b). In a population-based register study, it was found that low income and comorbidity had a strong influence on the risk of getting a disability pension in both cancer patients and controls (Carlsen et al., 2008). However, they did not investigate whether comorbidity or income modified the association between cancer and disability pension. Horsboel et al. (2014) concluded that the effect of comorbidity was not as strong in the haematological cancer patients' risk of receiving disability pension compared with the controls (Horsboel et al., 2014). A study in breast cancer survivors showed that the risk of experiencing work disability was significantly higher among low-educated than among high-educated survivors, and comorbidity did not explain this risk difference (Thielen, Kolodziejczyk, Andersen, Heinesen, & Diderichsen, 2015); thus, no interaction was found. A second hypothesis in this study was formulated; when focusing on multiple cancer sites, comorbidity has a higher impact on work disability in low-educated cancer survivors than in high-educated. Furthermore, this impact will be significantly different when compared with individuals without a history of cancer.

1.1 | Objectives

The overall aim was to study the association between educational attainments and work disability, viz. 8-week sick leave spell and disability pension respectively.

2 | METHODS

2.1 | Design

A 3-year population-based follow-up study was conducted. The respondents to the Danish National Health Survey ("How are you?") from 2010 (Larsen, Ankersen, & Poulsen, 2011) were followed for 3 years on register-based work disability outcomes. The aim of the survey was to monitor the public health and well-being of the adult Danish population. Each resident in Denmark is assigned a 10-digit unique personal identification (CPR) number, and the respondents' CPR number enabled linkage of the survey data to the Danish Cancer Registry (CAR) and multiple registers from Statistics Denmark.

2.2 | Study population

In January 2010, a representative sample of 20- to 60-year-old Danes was randomly drawn from the Danish Civil Registration System (Larsen et al., 2011). In total, 188,078 individuals were invited to participate in "How are you?". Written information was given about the aim and that their voluntary completion and return of the survey counted as written consent. Of those, 11,981 were no longer available for the labour market due to immigration (n = 423), and age-related pension and disability pension (n = 11,558). Of the remaining 176,097 participants, 101,500 (58%) responded.

Cancer survivors were identified in CAR, which contains information on individuals diagnosed with cancer since 1943 (Gjerstorff, 2011). First incident cancers were identified from 1943 until January 2010 (n = 4,835), using cancer diagnoses as defined by NORDCAN (Engholm et al., 2010). Respondents who were solely diagnosed with non-melanoma skin cancer were excluded (n = 1,321), as documentation of this diagnosis is considered heterogeneous and incomplete (Engholm et al., 2010).

2.3 | Exposures—educational attainment, history of cancer and self-reported comorbidity

Social position has been defined in a number of different ways; as the outcome was work-related, educational attainment was chosen,

because it has been shown to determine a person's occupation and income and thereof encompass some of these factors' effects on health (Galobardes, Shaw, Lawlor, Lynch, & Davey Smith, 2006).

Educational attainment, that is the highest educational attainment in 2010, was identified in Statistics Denmark. Educational attainment was categorised as *low* (primary education; lower secondary education; vocational training), *medium* (upper secondary education; short-cycle higher education) and *high* (medium- and long-cycle higher education; research training (reference group)).

History of cancer was derived from CAR. The first incident cancers apart from non-melanoma skin cancer were identified from 1943 to January 2010 and categorised according to the NORCAN classification (breast, melanoma skin, brain/central nervous system, testicular, gynaecological, lymphoma, colorectal, oral, bladder, leukaemia, thyroid, prostate, kidney, lung and other). The same categorisation was used as did Friis, Larsen, Nielsen, Momsen, and Stapelfeldt (2018) in their study on health behaviour among cancer survivors based on the "How are you?" survey data from 2013 (Friis et al., 2018). The respondents who did not have a record in CAR were categorised as "no history of cancer."

Self-reported comorbidity was based on 18 comorbidity questions recommended by WHO in population-based surveys on public health (Buratta et al., 2003). It was asked whether (with four response categories: no/never, yes/present, yes/previously, if previously yes, do you have any late complications?) the respondent suffered from this particular disease or had suffered from the disease (i.e., asthma, allergies, diabetes, hypertension, coronary thrombosis, angina, cerebral thrombosis, chronic obstructive pulmonary disease, osteoarthritis, rheumatoid arthritis, osteoporosis, cancer, migraine, minor psychiatric disorder, major psychiatric disorder, herniated disc or other back disorders, cataract and tinnitus). Comorbidities (except for cancer) were categorised in *zero* (reference group), *1–2 and 3+.*

2.4 | Two outcomes—8-week sick leave spell and disability pension

Work disability was operationalised in two outcomes. Information on work disability was derived from the Danish Register for Evaluation of Marginalization (DREAM; Rasmussen, 2017), in which type of social security benefits are registered on a weekly basis, since 1991, for example, self-support (no benefits), sickness benefits, unemployment benefits or other social benefits indicative of being fit for work, modified jobs due to reduced work ability (flexi-job benefits), disability pension and age-related pensions. *Eight-week sick leave spells* reflect the time at which the municipal authority responsible for the sickness benefit payout is legally bound to discuss vocational rehabilitation with the absentees (The Danish Ministry of Employment). *Disability pension* is granted if a person's capacity for work is reduced to such an extent that it makes self-support impossible, even in flexible working arrangements. Disability pension is available to people aged 18–65 years. However, a reform of the legislation in 2013 has made the granting of disability pension to persons younger than 40 years stricter than before the reform (The Danish Ministry of Employment). Thus, the follow-up period in the present study was 3 years, marking the start of this reform.

2.5 | Potential confounders

Gender, (male, being the reference group) and *age*, by 1 January 2010 used as a continuous variable, were both derived from the 10-digit unique CPR number.

Self-reported health was based on the SF12 question: "In general, would you say your health is: excellent, very good, good, fair or poor" (Bjorner, Thunedborg, Kristensen, Modvig, & Bech, 1998). The variable was dichotomised in *good* and *bad*, with the responses "excellent," "very good" and "good" allocated to the category *good* (reference group) and "fair" and "poor" to the category *bad*.

Number of sick leave weeks, 1 year prior to responding to the survey, was derived from DREAM and was categorised in 0, 1–26 and 27 + weeks, with zero sickness absence weeks being the reference group.

Work status was identified in DREAM, based on the type of social security benefit the respondent received in the first week of January 2010. It had three categories: *self-support* (reference group); *sickness benefits, unemployment benefits or other social benefits indicative of being fit for work and modified job due to reduced work ability (flexi-job benefits);* and *state education grant*.

Time since cancer diagnosis was based on date of cancer diagnosis identified in CAR, for example date of first incident cancer diagnosis subtracted from the 1 January 2010 and categorised in +5, 1–5 and 0–1 years since cancer diagnosis.

2.6 | Statistical analyses

The rather low response rate to the survey "How are you?" threatened the representativeness of the study population. Therefore, to improve the representativeness, Statistics Denmark linked both respondents and non-respondents to Danish national registers. For both groups, register-based information was retrieved on gender, age, municipality of residence, educational attainment, income, and marital status, country of birth, visit to the general practitioner, hospitalisation, occupational status and owner/tenant status. Thus, a weight was estimated to account for differences in selection probabilities and for differences in response rates for different subgroups, using a model-based calibration approach (Särndal & Lundström, 2005). In all analyses, the adjustment weight was assigned to each survey respondent, in which respondents in under-represented subgroups got a weight larger than 1 and those in over-represented subgroups got a weight smaller than 1, making it possible to weight data to represent the Danish population.

Descriptive statistics for baseline characteristics were stratified in two groups: those without a history of cancer and

those with. Respondents were followed in the DREAM register from entry date 1 January 2010 until the outcomes occurred, end of follow-up (1 January 2013), competing risks (disability pension in the analyses of 8-week sick leave spell, age-related pension or death) or emigration, whichever occurred first. Those who experienced the event at entry time were excluded from the analyses. The work disability outcomes were dichotomised in whether events occurred before competing risks

TABLE 1 Baseline characteristics of the 2010-survey

	No history of cancer	Cancer
	(n = 171,262)	(n = 3,514)
	% (95% CI)	% (95% CI)
Gender (men)	51.0 (50.6–51.3)	40.5 (38.2–42.8)
Age, mean (95% CI)	39.8 (39.7–39.9)	48.4 (48.0–48.9)
Number of comorbidities other than cancer		
0	45.0 (44.7–45.4)	39.5 (37.3–41.8)
1–2	44.9 (44.5–45.2)	46.8 (44.5–49.1)
3+	10.1 (9.9–10.3)	13.7 (12.1–15.3)
Self-reported general health		
Excellent, very good, good	90.4 (90.2–90.6)	81.2 (79.2–83.0)
fair, poor	9.6 (9.4–9.8)	18.8 (17.0–20.8)
Educational attainment		
High	29.2 (28.9–29.5)	32.2 (30.0–34.3)
Medium	18.1 (17.9–18.4)	11.3 (9.8–12.9)
Low	52.7 (52.3–53.0)	56.6 (54.3–58.8)
Number of sick leave weeks 1 year prior to survey,		
Mean (95% CI)	1.32 (1.28–1.36)	4.69 (4.20–5.17)
Work status		
Self-support	75.4 (75.1–75.7)	76.0 (74.0–78.0)
Sickness, unemployment or other social benefits	14.6 (14.3–14.8)	20.8 (18.9–22.7)
State education grant	10.0 (9.8–10.3)	3.2 (2.3–4.4)
Diagnosis (NORDCAN)		
Breast		20.6 (18.9–22.4)
Melanoma skin		14.5 (13.0–16.1)
Testicular		11.2 (9.7–12.9)
Brain and central nervous system		10.6 (9.2–12.1)
Gynaecological		10.0 (8.7–11.4)
Lymphoma		7.5 (6.3–8.8)
Colorectal		5.3 (4.4–6.4)
Bladder		2.6 (2.0–3.4)
Thyroid		2.5 (1.9–3.3)
Oral		2.3 (1.7–3.1)
Prostate		2.2 (1.6–3.0)
Kidney		1.8 (1.2–2.5)
Leukaemia		1.6 (1.1–2.4)
Lung		1.6 (1.1–2.3)
Other		5.9 (4.9–7.1)
Years since cancer diagnosis		
+5		55.5 (53.2–57.7)
1–5		30.9 (28.9–33.1)
0–1		13.6 (12.1–15.2)

or emigration did, within the 3-year follow-up or not. Those who experienced competing risks or emigrated were kept in the analyses but as non-events. Cox regression models were not used as assumptions of parallel hazard rates were not fulfilled. Three separate multiple logistic regression models were applied:

- *Model 1:* An odds ratio (OR) was estimated of medium- and low-educated respondents' risk of experiencing the two work disability outcomes within 3 years of follow-up, compared with high-educated respondents. ORs are presented as crude and adjusted (on gender, age, sick leave 1 year prior to survey response, baseline work status, self-rated health, comorbidity, history of cancer and time since cancer diagnosis). Furthermore, history of cancer was entered to the model as an interaction term with education.
- *Models 2 and 3:* Model 1 was repeated, but analyses were carried out in two strata: *model 2*) cancer survivors and *model 3*) those without a history of cancer. Furthermore, comorbidity was entered as an interaction term with education and history of cancer in the models. Due to lack of statistical power in the analyses stratified on comorbidity, we combined the *1–2* and *3+* categories.

Wald's test was performed to establish the overall difference in OR between education categories and experiencing the two work disability outcomes and the overall difference between education categories and history of cancer and comorbidity respectively. Finally, Wald's test was performed to test whether the potentially modifying effect of comorbidity on the association between education and work disability differed between cancer survivors and those without a history of cancer. ORs were accompanied by 95% confidence intervals (CI). Significance level was set at $p < .05$. The statistical software package STATA version 14.2 was used (StataCorp: StataCorp LP., 2015).

3 | RESULTS

3.1 | Study population characteristics

Within the study population (N = 174,776), 3,514 (2%) had survived cancer, of those, 55.5% had survived for more than 5 years. Men were less prevalent among cancer survivors (40.5%) than among those without a history of cancer (51.0%), and overall, cancer survivors were older (mean age 48.4 years), than those without a history of cancer (mean age 39.8 years). Breast cancer (20.6%) and melanoma (14.5%) were the most prevalent diagnoses in survivors. Three or more comorbidities were more prevalent among the survivors (13.7%) than among those without a history of cancer (10.1%). Medium educational attainment was less prevalent among the survivors (11.3%) than those without a history of cancer (18.1%, Table 1).

In total, 3,732 respondents experienced the 8-week sick leave spell at entry time, leaving 171,044 for analyses. Of those, 5,226 experienced competing risks during follow-up (died (0.22%), disability pension (0.83%) and old-age pension (2.00%)). Among those without a history of cancer, 17,881 (10.7%) and those with 553 (17.4%), respectively, experienced at least one 8-week sick leave spell within the 3-year follow-up period. For disability pension, 174,776 individuals were available for analyses. Of those, 4,687 experienced one of the competing risks during follow-up (died (0.40%) and old-age pension (2.28%)). Among the non-cancer group, 2,457 (1.4%) and the cancer survivors, 189 (5.4%), respectively, were granted a disability pension during follow-up (results not shown).

3.2 | Risks of work disability among the cancer survivors

A clear dose–response effect of time since cancer diagnosis was observed—long survival time was associated with low work disability

TABLE 2 The risk of experiencing an eight-week sick leave spell or being granted a disability pension within 3 years follow-up among cancer survivors

Educational attainment and time since cancer diagnosis	8-week sick leave Risk, % (95% CI)	Disability pension Risk, % (95% CI)
High education and		
Survived > 5 years	12.59 (9.83–15.35)	2.60 (1.30–8.90)
Survived 1–5 years	13.90 (9.95–17.85)	3.15 (1.23–5.08)
survived < 1 year	25.00 (16.34–33.66)	5.26 (1.71–8.81)
Medium education and		
Survived > 5 years	12.25 (7.76–16.75)	4.37 (1.58–7.16)
Survived 1–5 years	20.00 (12.35–27.65)	7.56 (2.81–12.31)
Survived < 1 year	36.11 (20.42–51.80)	No information
Low education and		
Survived > 5 years	17.43 (15.20–19.67)	4.18 (3.02–5.33)
Survived 1–5 years	20.46 (17.14–23.78)	7.64 (5.57–9.72)
Survived < 1 year	24.86 (18.49–31.23)	12.94 (9.05–16.83)

probabilities. The 8-week sick leave spell risks were higher than the disability pension risks and dependent on time survived. The crude risks for being granted a disability pension, stratified on educational attainment and time since cancer diagnosis and ranged between 2.60% (95% CI 1.30–8.90) for high-educated and more than 5-year survivors and 12.94% (95% CI 9.05–16.83) for low educated and survived <1 year (Table 2).

3.3 | Association between educational attainment and work disability (Model 1)

Overall, low-educated respondents' adjusted ORs of experiencing an 8-week sick leave spell (1.41, 95% CI (1.33–1.49)) or being granted a disability pension (1.61, 95% CI (1.31–1.97)) was statistically significantly higher than in high-educated (Table 3). Stratifying the analyses in whether respondents had a history of cancer or not, no substantial changes were found.

Among those without a history of cancer, medium educational attainment remained significantly protective against work disability compared with high educational attainment. However, there was no significant interaction between educational attainment, history of cancer and the 8-week sick leave spell (*p* = .44) or being granted a disability pension (*p* = .50, Table 3). The analyses were repeated on the most prevalent cancer diagnosis among women (breast) and among men (testicular) for the 8-week sick leave spell outcome (Table S1a,b). The results from Table 3 were more or less replicated, with a tendency of higher ORs in both cancer groups for experiencing long-term sick leave. The interactional effects remained insignificant.

3.4 | Effect modification of comorbidity on the association between educational attainment and work disability (Models 2 and 3)

Model 2 Among cancer survivors, no tendency of increased ORs of experiencing the two work disability outcomes was observed in cancer survivors with comorbidity compared with those without comorbidity (Table 4). No significant interaction between educational attainment, comorbidity and the 8-week sick leave spell (*p* = .97) or being granted a disability pension (*p* = .41) was present (Table 4).

Model 3 Among the group without a history of cancer, the associations between educational attainment and work disability were largely unaffected in the two comorbidity strata. No significant interactions between educational attainment, comorbidity and the two work disability outcomes were observed, accordingly (Table 4).

Lastly, the overall modifying effect of history of cancer and comorbidity on the association between educational attainment and experiencing the 8-week sick leave (*p* = .84) and disability pension (*p* = .37) were both non-significant (results not shown).

TABLE 3 The impact of cancer on the association between education and work disability

| | Crude | | No history of cancer | | Cancer survivor | | | |
	Adjusted^a	p-Value**	Adjusted*	p-Value**	Adjusted*	p-Value**	***	****
The odds of an 8-week sick leave spell within a 3-year follow-up period:								
Educational attainment, OR (95% CI)								
High	ref.	<.0001	ref.	<.0001	ref.	.20		.44
Medium	0.69 (0.64–0.75)		0.90 (0.82–0.98)		1.11 (0.70–1.77)		.35	
Low	1.52 (1.44–1.60)		1.41 (1.33–1.50)		1.32 (0.97–1.70)		.68	
The odds of a disability pension within a 3-year follow-up period:								
Educational attainment, OR (95% CI)								
High	ref.	<.0001	ref.	<.0001	ref.	.86		.50
Medium	1.12 (0.84–1.50)		1.20 (0.87–1.67)		1.25 (0.42–3.71)		.95	
Low	3.17 (2.63–3.81)		1.65 (1.32–2.05)		1.17 (0.64–2.16)		.30	

^aAdjusted for age, gender, sick leave 1 year prior to survey, work status at baseline, self-reported health, comorbidity, history of cancer, years since cancer diagnosis.

**Wald's test for overall difference between education categories.

***Test for interaction between education categories and history of cancer.

****Wald's test for overall difference between education categories and cancer/non-cancer groups.

TABLE 4 The impact of comorbidity on the association between education and work disability in cancer survivors and participants with no history of cancer

	No comorbidity			Comorbidity[a]			
	Crude		p-Value**		p-Value**	p-Value***	p-Value****
Cancer survivors							
The odds of an 8-week sick leave spell within a 3-year follow-up period:							
Education, OR (95% CI)		Adjusted[a]		Adjusted[a]			
High	ref.	ref.	.50	ref.	.33		.97
Medium	1.07 (0.68–1.70)	1.14 (0.49–2.66)		1.01 (0.57–1.79)		.82	
Low	1.48 (1.11–1.97)	1.38 (0.79–2.41)		1.30 (0.90–1.88)		.86	
The odds of a disability pension within a 3-year follow-up period:							
Education, OR (95% CI)							
High	ref.	ref.	.64	ref.	.33		.41
Medium	1.30 (0.54–3.15)	1.83 (0.49–6.37)		1.16 (0.25–5.32)		.68	
Low	2.28 (1.32–3.95)	0.91 (0.34–2.43)		1.74 (0.82–3.67)		.30	
No history of cancer							
The odds of an 8-week sick leave spell within a 3-year follow-up period:							
Education, OR (95% CI)		Adjusted[a]		Adjusted[a]			
High	ref.	ref.	<.0001	ref.	<.0001		.41
Medium	0.69 (0.63–0.75)	0.87 (0.74–1.02)		0.91 (0.82–1.02)		.61	
Low	1.52 (1.44–1.60)	1.50 (1.35–1.66)		1.40 (1.30–1.50)		.37	
The odds of a disability pension within a 3-year follow-up period:							
Education, OR (95% CI)							
High	ref.	ref.	<.0001	ref.	.0001		.37
Medium	1.15 (0.85–1.56)	1.38 (0.96–1.99)		0.90 (0.44–1.86)		.41	
Low	3.27 (2.69–3.97)	1.79 (1.39–2.30)		1.56 (0.99–2.46)		.52	

[a]Adjusted for age, gender, sick leave 1 year prior to survey, work status at baseline, self-reported health, time since cancer diagnosis.

**Wald's test for overall difference between education categories.

***Test for interaction between education categories and comorbidity

****Wald's test for overall difference between education categories and comorbidity.

4 | DISCUSSION

In general, a low educational attainment increased the risk of experiencing an eight-week sick leave spell and being granted a disability pension compared with having a high educational attainment, within 3 years of follow-up. Both among cancer survivors and those without a history of cancer, comorbidity did not modify the effect of educational attainment on the risk of work disability. And significant proofs of interactional effects were present neither in the cancer survivor group nor in the group without a history of cancer. Therefore and due to few events in the cancer survivor group, the hypothesis of less effects of low educational attainment in cancer survivors' risk of work disability than in cancer-free individuals was inconclusive. Likewise, the hypothesis of comorbidity having a higher impact on cancer survivors' risk of work disability than in cancer-free individuals was inconclusive.

4.1 | Interpretation of findings

Horsboel et al. (2014) hypothesised that haematological malignancies reduced the negative effect of low education on the risk of being granted a disability pension when compared to a matched reference group (Horsboel et al., 2014). This hypothesis could not be supported in the present study. We would have liked to adjust for cancer sites; unfortunately, insufficient statistical power prevented this. However, previous research has shown that clinical factors, such as diagnosis and extent of malignancy explain very little of the variation in employment status in cancer survivors over time, compared with socio-demographics, such as educational attainment (Torp et al., 2013). Thus, vocational rehabilitation stakeholders need to focus on supporting low-educated cancer survivors and offer relevant interventions, as they are less frequently attending rehabilitation activities in general and report more unmet needs than high-educated survivors (Holm et al., 2013).

Torp et al. (2013) showed that high educational attainment statistically significantly increased the chance of being employed 5 years after diagnosis in women with and without cancer. Moreover, the association was significantly stronger in the cancer survivors than in the controls (Torp et al., 2013). Among male cancer survivors and controls, this was not the case though (Torp et al., 2013). In the present study, we adjusted for gender and it did not affect study findings (results not shown).

Thielen et al. (2015) concluded that in breast cancer survivors, comorbidity did not explain the increased risk of experiencing work disability in low-educated compared with high-educated (Thielen et al., 2015). The present study results were in line with Thielen et al. (2015), both in cancer sites combined and separately for breast and testicular cancers. Moreover, the present study found consistent evidence for comorbidity not modifying the association between education and work disability, nor in cancer survivors and neither in the cancer-free population.

The prevalence of self-reported more than two comorbidities varied between the cancer survivors and those without a history of cancer in our study. This may partly stem from using prevalent rather than incident sampled respondents, increasing the probability of sampling long-term cancer survivors and thus more likely to have developed comorbidity. Many studies use Charlson's comorbidity index to measure the presence of coexisting morbidity at diagnosis, which has been shown to be predictive of mortality (Charlson, Pompei, Ales, & MacKenzie, 1987). However, it is unclear whether Charlson gives adequate information about needs that should be addressed in vocational rehabilitation in order to prevent work disability. Thielen et al. (2015) defined comorbidity as the number of hospitalisations, general practitioner visits and prescriptions, which revealed considerably higher comorbidity prevalence (66%) across educational attainments in breast cancer survivors (Thielen et al., 2015) than the 13.7% in the present study derived from self-report. It calls for future research on which comorbidities are relevant in vocational rehabilitation in cancer survivors and how and when assessment should be performed.

4.2 | Methodological strengths and limitations

A large Danish national survey on public health was used and merged with CAR, enabling the identification of a population of potentially occupationally active cancer survivors and a cancer-free comparison group. Several strengths arose from that approach. Register data were obtained from both responders and non-responders to the surveys, by which data weights were calculated. Thus, study findings are expected to be representative for the Danish population. As cancer was not specifically targeted by the "How are you?" survey, the cancer prevalence observed in the present study could be questioned. However, 2010 prevalence data derived from CAR (The Danish Health Authority, 2011) resembled our numbers. In addition, the two outcome measures were all based on the DREAM-registered social benefits, which have been found to give valid information on long-term sick leave spells (Stapelfeldt, Jensen,

Andersen, Fleten, & Nielsen, 2012) and granted disability pensions (Tuchsen, Christensen, Lund, & Feveile, 2008). Thus, the risk of misclassification was considered minimal. A seemingly high prevalence of respondents without a history of cancer experienced an 8-week sick leave spell (10%). However, a Danish report supports a high prevalence of long-term sickness absence among paid employees (Thorsen, Flyvholm, & Bultmann, 2016); between 2010 and 2014, 5.3% had long-term sickness absence per year. In the present study, we also included individuals with no employment, who have an even higher sick leave rate than employed.

We kept respondents, who experienced competing risks during the 3-year follow-up period, to avoid the introduction of selection bias, which may otherwise have increased the odds of work disability particular among the low-educated cancer survivors.

The operationalisation of social position was based on register data on the highest achieved educational attainment, by which misclassification was minimised compared with the use of self-reported data (Jensen & Rasmussen, 2011).

Survival bias is inherent in this study design as individuals with severe cancer have died and thus unable to participate in the survey. Adjustment for time since cancer diagnosis was performed in order to limit the confounding effect. Due to few observations, it was not possible also to adjust for cancer site. However, separate analyses performed in men survived from testicular and women survived from breast cancer seemed to increase the relationship between educational level and the risk of work disability, by which confounding effects from cancer site cannot be ruled out.

For those without a history of cancer, medium-level educational attainment seemed to be protective of experiencing an 8-week sick leave compared with high-level educational attainment. Confounding by job type may explain this result, which we were unable to adjust for.

As mentioned, the study lacked power in the analyses of disability pension risk and may have caused type II bias, by which the hypotheses were falsely rejected.

5 | CONCLUSION

A moderate impact of low educational attainment on future work disability was found in both cancer survivors and in those without a history of cancer. This increased risk was neither modified by a history of cancer nor with comorbidity across three educational attainments.

CONFLICT OF INTEREST
All authors declare that they have no conflict of interest.

ETHICS STATEMENT
The study was reported to and approved by the Danish Data Protection Agency (1–16–02–719–14). According to Danish law, approval from the Danish National Committee on Biomedical Research

Ethics (www.cvk.sum.dk) was not relevant, as this is only provided for projects using biological material or involves biomedical treatment. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards (World Medical Association, 2013).

DATA AVAILABILITY STATEMENT

The data sets generated and analysed during the current study are not publicly available or by request to the corresponding author due to the General Data Protection Regulation (GDPR, 2016/679) within the EU.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.