

# The transition between work, sickness absence and pension in a cohort of Danish colorectal cancer survivors

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**To cite:** Carlsen K, Harling H, Pedersen J, *et al*. The transition between work, sickness absence and pension in a cohort of Danish colorectal cancer survivors. *BMJ Open* 2013;**3**:e002259. doi:10.1136/bmjopen-2012-002259

► Prepublication history for this paper are available online. To view these files please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2012-002259>).

Received 25 October 2012  
Revised 20 December 2012  
Accepted 29 January 2013

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## ABSTRACT

**Objectives:** The aim of this study was to evaluate the impact of socioeconomic and clinical factors on the transitions between work, sickness absence and retirement in a cohort of Danish colorectal cancer survivors.

**Design:** Register-based cohort study with up to 10 years of follow-up.

**Setting:** Population-based study with use of administrative health-related and socioeconomic registers.

**Participants:** All persons (N=4343) diagnosed with colorectal cancer in Denmark during the years 2001–2009 while they were in their working age (18–63 years) and who were part of the labour force 1 year postdiagnosis.

**Primary and secondary outcome measures:** By the use of multistate models in Cox proportional hazards models, we analysed the HR for re-employment, sickness absence and retirement in models including clinical as well as health-related variables.

**Results:** 1 year after diagnosis, 62% were working and 58% continued until the end of follow-up. Socioeconomic factors were found to be associated with retirement but not with sickness absence and return to work. The risk for transition from work to sickness absence increased if the disease was diagnosed at a later stage (stage III) 1.52 (95% CI 1.21 to 1.91), not operated curatively 1.35 (95% CI 1.11 to 1.63) and with occurrence of postoperative complications 1.25 (95% CI 1.11 to 1.41). The opposite was found for the transition from sickness absence back to work.

**Conclusions:** This nationwide study of colorectal cancer patients who have survived 1 year shows that the stage of disease, general health condition of the individual, postoperative complications and the history of sickness absence and unemployment have an impact on the transition between work, sickness absence and disability pension. This leads to an increased focus on the rehabilitation process for the more vulnerable persons who have a combination of severe disease and a history of work-related problems with episodes outside the working market.

## INTRODUCTION

In 2008, nearly 500 000 persons in Europe were diagnosed with colorectal cancer,

## ARTICLE SUMMARY

### Article focus

- How many colorectal cancer survivors return to work, stay at sickness absence, get unemployed or become pensioners in the years following diagnosis?
- Does socioeconomic position or clinical factors predict re-employment, sickness absence, unemployment or pension in this cohort?

### Key messages

- First study to differentiate between re-employment, sickness absence, unemployment and retirement in a cohort of colorectal cancer survivors.
- One year after diagnosis, 62% had resumed work.
- Socioeconomic factors were associated with early retirement, whereas clinical factors were found to be associated with sickness absence and re-employment.

### Strengths and limitations of this study

- This is a longitudinal nationwide population-based study including more than 4000 persons diagnosed with colorectal cancer.
- The study identifies an association between socioeconomic position/clinical factors and re-employment/sickness absence/pension, but is not able to identify the mechanisms behind them.

making it the most common cancer and the second most common cause of cancer deaths in Europe.<sup>1</sup> From 1995 to 2007, the survival from colorectal cancer has steadily improved among all age groups<sup>2</sup> and the relative 5-year survival increased in the years 1990–2002 from 50% to 60% among persons aged 15–59 years.<sup>3</sup>

Throughout Europe, life expectancy has increased, leading to higher age at pension and longer time in the workforce. As the risk of colorectal cancer increases with age, it can be expected that still more persons will be diagnosed with colorectal cancer while they are an active part of the workforce.

Few studies have analysed the impact of colorectal cancer on work participation in the years following diagnosis and treatment. The existing studies reported that two-third of those working at the time of diagnosis resume work in the years after treatment. Risk factors for work cessation were higher age, radiation therapy and comorbidity.<sup>4 5</sup> Several studies<sup>6–9</sup> have shown a negative social gradient in survival of colorectal cancer, but the social consequences have not been studied despite the fact that a negative social gradient in return to work has been observed among cancer survivors in general.<sup>10–17</sup> Compared to persons diagnosed with testicular, breast, endocrine or skin cancer, patients with colorectal cancer had a higher risk of not resuming work and had longer time on sickness absence.<sup>13 18–22</sup>

In order to get a better understanding of the occupational consequences of colorectal cancer, it is important to take both socioeconomic and health-related factors into account and to differentiate more specifically between the different reasons for not working. In the majority of studies, the outcome is 'not returning to work', which is a mix-up of different reasons for not working, that is, unemployment, sickness absence or disability pension, and the transition from a cancer diagnosis to one of these outcomes could very well differ according to the different risk factors.

These transitions between different states (eg, from sickness absence to work, or from sickness absence to disability) can be modelled by using multistate models.<sup>23</sup> Multistate models are well-known statistical models used for event history analysis, for example, the study of survival. The application of statistical models for survival analysis in the analysis of sickness absence is relatively new,<sup>24 25</sup> and the use of multistate models is mainly due to Lie *et al.*,<sup>26</sup> but multistate models have also been applied by other researchers.<sup>27 28</sup>

By the use of detailed, nationwide, population-based registers, the aim of this study is to evaluate the impact of both socioeconomic and clinical factors on the transitions between work, sickness absence and retirement in a cohort of colorectal cancer survivors and to test them for interaction between clinical and socioeconomic factors.

## MATERIALS AND METHODS

This study is based on Danish population-based registers linked with the unique personal identification code given to all Danish residents.

### Danish Colorectal Cancer Group

The study population was derived from the national database of Danish Colorectal Cancer Group (DCCG), which includes around 93% of patients in Denmark with a first-time adenocarcinoma of the rectum (*the International Classifications of Diseases* (ICD)-10: C20) or colon (ICD-C18). This database comprises prospectively collected data registered by surgeons. The database has previously been used in epidemiological studies and is

described in detail elsewhere.<sup>29</sup> From the database, we obtained clinical data with relevance to the probability of returning to work after treatment. Entry into the study was equal to the date of surgery and was used to calculate the follow-up time. Variables describing the disease were cancer type and tumour stage classified according to the International Union Against Cancer (UICC). Information about surgical procedure was included as a curative operation (yes/no) and type of operation (1, rectal resection; 2, colonic resection; 3, explorative laparotomy; or formation of an ostomy; 4, local procedures). Health status at the time of surgery was measured by the American Society of Anesthesiologists (ASA) score where patients are categorised into five subgroups by preoperative physical fitness reaching from I-A completely healthy to V-A moribund patients who is not expected to live 24 h with or without surgery. ASA scores III–V was collapsed into one group of patients with severe systemic diseases. Postoperative complications were grouped as no complications or one or more complications. The latter group included postoperative bleeding, problems with the ostomy, intraabdominal infections or infections in the wound, lack of passage through the intestine, leak from the intestine or postoperative rupture of the wound.

### Statistics Denmark

Information on a number of demographic and socioeconomic characteristics was obtained from the population-based Integrated Database for Labour Market Research (IDA), which has been administrated by Statistics Denmark since 1980.<sup>30</sup> From IDA, we had information about the country of origin (grouped as born in Denmark or born outside Denmark) and marital status (married or cohabiting, single including widows and unknown). Education was classified according to the length of study (primary school 9–12 years of education, vocational and short-term education 13–15 years, medium-term and long-term education more than 16 years and unknown). Job type was classified as management and knowledge work (eg, leaders, doctors and teachers at high school), office and sale (eg, secretary, police and nurses) and manual work (eg, farmers, craftsmen and social and healthcare assistants). In order to obtain information on disposal income for the family, we also identified partners and their income. Disposal income was calculated as the average of the family income 3 years before the year of diagnosis and was deflated according to the 2000 value of the Danish kroner.

Education, job type and disposal income were combined under the heading socioeconomic status (SES).

### The Danish National Patient Registry

This register holds information on all hospitalisations and outpatient visits in Denmark since 1978. In this study, we used the information of date of admission and discharge and the diagnosis coded according to ICD-10.<sup>31</sup>

### The Register of Medical Product Statistics

Since 1995, every medical product sold on prescription by Danish pharmacies has been registered. From this register, we had information on the date of redemption of the prescription and substance classified according to the *anatomical-therapeutic-chemical* (ATC) system.<sup>32</sup>

Comorbidity in the preceding 5 years before the year of diagnosis was obtained from National Patient Registry (NPR) and Register of Medical Product Statistics (RMPS). As comorbidity, we included cardiovascular disease, chronic obstructive pulmonary disease, diabetes and liver, kidney or connective tissue diseases—diseases which are all part of the Charlson index. Comorbidity was stated if one or more of these diseases were present at the time of diagnosis.

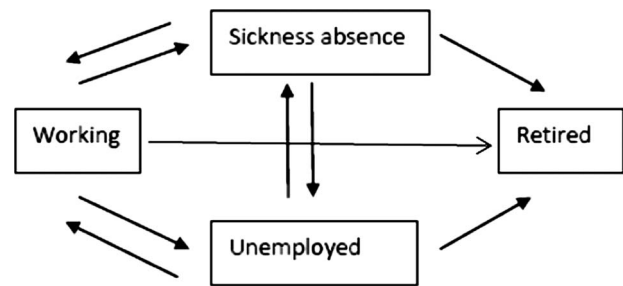
### Danish Register-based Evaluation of Marginalization

The Danish labour market is characterised as a flexicurity system with a high degree of economic compensation in case of unemployment or reduced work ability (security) but also with a high turnover rate (flexible). Unemployed persons are warranted economic compensation if they are actively seeking a job. During the study period, it was possible to receive a maximum of 4 years of unemployment benefit. After the end of these 4 years or if a person is not qualified for unemployment benefit (ie, not member of a union), it is possible to receive social income. If a person is unable to work due to illness or disability, it is possible to receive sickness benefit for a maximum of 52 weeks during a period of 2 years or to apply for early retirement if the work ability is reduced to a level where it is not possible to hold a job. This holds for all Danish citizens independent of job type. During the study period, the retirement age was 64 years of age.

The outcome of the study was receipt of social transfer payments or in work. Information about social transfer payments was obtained from the Danish population-based administrative register DREAM (Danish Register-based Evaluation of Marginalization). DREAM covers all residents in Denmark who have received social transfer payments from the state<sup>33</sup> in any given week since 1991. In the present study, we included data from DREAM from week 1 of 2001 until week 13 of 2011. In work was defined as not receiving any social transfer payments for 6 consecutive weeks. Transfer income obtained from DREAM was divided into sickness benefit, unemployment benefit and permanent withdrawal from the workforce due to early retirement pension or post-employment benefit, which is an optional withdrawal from the workforce not caused by disability.

### Study population

During the years 2001–2009, 31 570 persons were diagnosed with colorectal cancer in Denmark. The majority of these persons were diagnosed after the age of retirement and the study population consisted of 4343 persons aged 18–63 years, who were part of the



**Figure 1** Transition states between labour market outcomes in Denmark. Work, sickness absence and unemployment covers persons in the workforce while retirement independent of the reason (disability or age) is an irreversible state, where persons are considered to leave the workforce forever.

workforce and survived the first postoperative year (figure 1). The follow-up period of this population was between 65 (for persons diagnosed in the last week of 2009) and 535 weeks (for persons diagnosed in the first week of 2001), leading to 12 569 person-years.

### Outcome data

For every person in the study population, a labour market status was recorded on a weekly basis until the person reached the age limit of 63 years, emigrated, died or until the end of follow-up, whichever came first. Labour market status was categorised in four different 'states': work, sickness absence, unemployment and disability. The multistate model is a model for the nine possible transitions between these four states (figure 2).

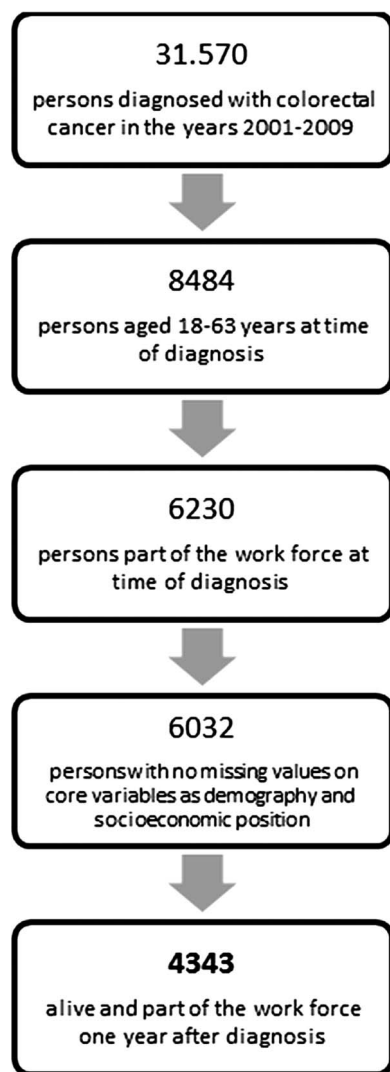
### Statistical analysis

Descriptive analysis by the use of  $\chi^2$  and t tests was conducted in order to examine the characteristics of the sample. The outcome data were recoded, and for each person the time spent in one of the four states was registered. Furthermore, it was registered if a transition from one state to another occurred at the end of the person's stay in the state, and, if so, what state the person shifted to. The time spent in the state was censored if the person died, emigrated or shifted to a social transfer payment that did not fit into any of the four states.

Each of the nine possible transitions shown in figure 2 was analysed using the Cox proportional hazards model in SAS (The PHREG procedure, SAS V.9.2). The time scale used was the duration of stay in the current state.

Variables such as education, disposal income, job type, type of cancer, cancer stage, comorbidity, ASA score, curative operation, type of operation and postoperative complications were included as time constant covariates. Three time-dependent covariates were also included: number of times the person had been employed, sick-listed or unemployed since the start of follow-up.

Because the baseline hazard for each state was allowed to vary freely, the covariate relied on the assumption of proportionality.



**Figure 2** Flow chart showing the selection of persons from the total database to the final study population. From January 2001 to December 2009 a total of 31 570 persons were diagnosed with colonic or rectal cancer. In total we excluded 25 538 persons: 23 086 persons as they were not in their working age (18–63 years) at the time of diagnosis, 2254 had retired due to disability before diagnosis and 198 because of missing values on demographic or socioeconomic variables. In addition, 1689 persons died or withdrew from the workforce within the first year after diagnosis.

## RESULTS

Table 1 shows the baseline characteristics for all patients stratified on those excluded during the first year after diagnosis (N=1689) and the study population (N=4343). Compared to the excluded population, the study population was diagnosed with significantly less severe disease and higher SES at the time of inclusion.

One year after the operation, 62% of the study population were in work while 32% were sick listed and 6% were unemployed (table 2). Of those who were working, 58% continued working for an average of 136 weeks.

Tables 3 and 4 show the HRs for transitions between work and sickness absence, and reverse. Previous periods of sickness absence and unemployment reduced the rate of returning to work with 7–12% per episode, whereas previous episodes of work increased the rates of both work and sickness absence. In addition, we found that increasing levels of education increased the rate of transition from work back to sickness absence.

Return to work after a period of sickness absence (table 3) was less common among cancer survivors who were operated in an advanced stage of disease, who did not have curative surgery and who suffered postoperative complications.

Sickness absence following a period of work was primarily associated with disease-related factors (table 4). In contrast to return to work, patients diagnosed with rectal cancer had an increased risk for sickness absence (HR=1.17 (1.03 to 1.32)) compared to those operated for colonic cancer. Furthermore, we found that an ASA score on III increased the risk for sickness absence with almost 40%.

The risk factors associated with permanent withdrawal from the labour market 1 year after the operation are shown in table 5. Since the transition from work and unemployment to retirement follows the same pathways, these groups were joined in order to gain more power. The risk for retirement was related not only to the disease but also to SES. Manual work and increasing disposal income reduces the risk for retirement after an episode of sickness absence and work, respectively. Compared to the HR of patients in work, the ratio for retirement was 5.89 (3.46 to 10.03) among unemployed survivors.

Advanced stage at diagnosis and high ASA score increased the risk for retirement among both the groups.

Finally, we analysed the data for effect modification by adding an interaction in the logistic model between disposal income as the strongest socioeconomic predictor and type of cancer, stage of disease, type of operation and postoperative complications. We did not find any significant effect modification between socioeconomic factors and disease-related factors (data not shown).

## DISCUSSION AND CONCLUSION

In this cohort study including 4343 Danish colorectal cancer patients, who were part of the workforce after the first postoperative year, we found that 62% were working 1 year after operation.

One year after the operation, previous episodes of sickness absence and unemployment, cancer stage at diagnosis, curative operation and postoperative complications were associated with labour market affiliation during follow-up, whereas SES was only weakly associated with the transition between the different occupational states.

The observed rate of return to work is in accordance with the previous studies on colorectal cancer survivors,

**Table 1** Characteristics of the colorectal cancer patients diagnosed in Denmark while in their working age and part of the work force, 2001–2009 (N=6032)

	Excluded during the first year N (%)	Included after the first year N (%)	p Value
Education			<0.0001
Primary school	584 (35)	1244 (29)	
Vocational and short-term education	781 (46)	2037 (47)	
Medium-term and long-term education	324 (19)	1062 (24)	
Unknown	0 (0)	0 (0)	
Disposal income (DKr)			<0.0001
Mean	192 206	210 807	
Job type			<0.0001
Management and knowledge work	190 (11)	740 (17)	
Office and sale (non-manual)	401 (24)	1414 (33)	
Manual	893 (53)	1661 (38)	
Other	205 (12)	528 (12)	
Gender			0.03
Women	691 (41)	1913 (44)	
Men	998 (59)	2430 (56)	
Age			<0.0001
Mean	56.6	53.8	
Country of birth			0.02
Denmark	1637 (97)	4150 (96)	
Other	52 (3)	193 (4)	
Marital status			<0.0001
Married/cohabiting	1042 (62)	3162 (73)	
Single	494 (29)	1154 (26)	
Unknown	153 (9)	27 (1)	
Year of operation			0.55
2001	104 (6)	309 (7)	
2002	178 (10)	458 (10)	
2003	176 (10)	439 (10)	
2004	213 (13)	494 (11)	
2005	210 (12)	486 (11)	
2006	199 (12)	568 (13)	
2007	211 (12)	545 (13)	
2008	197 (12)	530 (12)	
2009	201 (12)	514 (12)	
Type of cancer			<0.0001
Colonic	1063 (63)	2464 (57)	
Rectal	626 (37)	1879 (43)	
Stage			<0.0001
I	306 (18)	1535 (35)	
II	43 (3)	146 (3)	
III	351 (21)	1411 (32)	
IV	858 (51)	760 (18)	
Unknown	131 (8)	491 (11)	

Continued

**Table 1** Continued

	Excluded during the first year N (%)	Included after the first year N (%)	p Value
Comorbidity			<0.0001
No	1447 (86)	4018 (93)	
Yes	224 (14)	325 (7)	
ASA			<0.0001
I	484 (29)	2168 (50)	
II	771 (46)	1731 (40)	
>III	240 (14)	172 (4)	
Unknown	194 (11)	272 (6)	
Curative operation			<0.0001
Yes	677 (40)	3278 (75)	
No	884 (52)	867 (20)	
Unknown	128 (8)	198 (5)	
Type of operation			<0.0001
Rectal resection	228 (14)	206 (5)	
Colonic resection	306 (18)	1352 (31)	
Explorative laparotomy or formation of an ostomy	537 (32)	1445 (33)	
Local procedures	367 (22)	1197 (28)	
Unknown	251 (15)	143 (3)	
Postoperative complications			0.44
No	1448 (86)	3689 (85)	
Yes	241 (14)	654 (15)	

Divided into those who were excluded during the first year due to retirement or death (N=1689) and the included persons (N=4343). ASA, the American Society of Anesthesiologists; DKr, Danish kroner.

where return to full-time employment was reported in 60–89% of cases depending on the time since diagnosis, definition of return to work and severity of the disease.

In this study, we decided only to include survivors, who were still part of the workforce 1 year after the operation, based on a notion that it is not clinically relevant to study full return to work before the end of a 1-year survival period. In this selected group of patients, the observed resumption of work was rather low compared to previous studies where up to 89% of patients had returned to work at some point after diagnosis.<sup>34</sup> This could be caused by the fact that there is a lack of consensus regarding the definition and measurement of return to work. Thus, in some studies, return to work is simply the number of persons working at the time of follow-up divided by the number working at baseline.<sup>10 35</sup> In other studies, return to work is measured among those persons who are part of the workforce at the time of follow-up, and still in other studies working

**Table 2** Mean number of weeks from one state of employment to the next among 4343 patients aged 18–63 years diagnosed with colorectal cancer in the years 2001–2009 and part of the workforce at the time of follow-up

Mean time in weeks from 1 year after the operation and first change in employment state (% of population)	To				
	work	sickness absence	unemployment	retirement	censoring due to age, death, migration or end of follow-up
From work (N=2679/62%)	–	57 (31%)	63 (10%)	75 (1%)	136 (58%)
From sickness absence (N=1406/32%)	16 (34%)	–	29 (9%)	30 (28%)	36 (30%)
From unemployment (N=258/6%)	22 (47%)	28 (17%)	–	63 (13%)	77 (23%)

is self-reported and covers from 1 week to permanent re-employment.<sup>34</sup>

The lack of a clear definition can result in misinterpretation of factors related to the disease and SES since the underlying mechanisms in the transition from sickness absence back to work or to disability pension seem to follow different pathways. Leaving the workforce for any type of pension is an irreversible process and is assigned when work demands exceed health and mental resources and is thus dependent on both health-related and work-related factors. However, unemployment and sickness absence both include conditions with an expectation of resuming work and are more related to either SES or health, respectively.

The exclusion of persons who take disability pension in the first year and the lower 1-year survival after colorectal cancer among the socially deprived might explain our finding of no effect of SES on work and sickness absence 1 year after the diagnosis of colorectal cancer. It seems as a 'healthy worker effect' where the most affluent survive the first year without leaving the workforce for disability pension.

In the present study, the transition between work, sickness absence and disability pension 1 year after the operation was primarily associated with factors related to the cancer.

The risk for transition from work to sickness absence increased if the disease was diagnosed at a later stage, not operated curatively and with occurrence of post-operative complications. The opposite was found for the transition from sickness absence back to work. The association between disease-related factors and resumption of work after a cancer diagnosis including colorectal cancer has been observed in other studies where tumour stage,<sup>13 36</sup> treatment,<sup>4 36</sup> physical symptoms<sup>16</sup> and ASA score were reported to be negatively associated with return to work.

We found that persons diagnosed with rectal cancer had a significantly increased risk for sickness absence and retirement possibly due to the fact that this patient group in contrast to colon cancer patients will more often have to learn to take care of an ostomy or suffer from abnormal bowel and urinary function years after the operation.<sup>37</sup> Unfortunately, we could not account for these factors in our analysis.

### Strengths and limitations

The present study is based on data from a well-defined clinical database of all Danish colorectal cancer patients. The database has a high completeness and data validity, and missing values are random and not associated with the outcome under study whereby selection bias is removed. Variables regarding socioeconomic position and affiliation to the labour market are administrative data collected prospectively on why recall bias is eliminated.

However, this study has some limitations. First of all, we were not able to include complementary treatment such as chemotherapy and radiation, reduced working hours or job changes in our analysis. Complementary cancer treatment can have a negative effect on the physical and psychological work ability and has been shown to be associated with reductions in work hours and reassignment to other work tasks.<sup>11 16 36</sup> We defined return to work as not receiving any transfer payments for 6 consecutive weeks. This can lead to misclassification of persons leaving the workforce without receiving economic compensation from the state. This is, however, very seldom in Denmark and can be ignored in this study.

The present study is conducted in a Nordic welfare system with high turnover rates on the labour market, high rates of participation and high degrees of social security. Despite the fact that the expenditure on social protection in the Nordic countries, including Denmark, is higher compared to the rest of the European Union and countries like the USA and Canada all have some degree of social welfare systems and universal health-care. The size of economic compensation and duration of sickness absence might have an impact on the consequence of a chronic disease, but the risk factors and reasons for being on sickness absence or return to work is not influenced by the political context.

### CONCLUSION

This nationwide study of colorectal cancer patients who have survived 1 year shows that the stage of disease, general health state of the individual (ASA score), post-operative complications and the history of sickness absence and unemployment have an impact on the transition between work, sickness absence and disability pension. This leads to an increased focus on the

**Table 3** HR (95% CI) for return to work after sickness absence in relation to socioeconomic and clinical factors among 4343 patients aged 18–63 diagnosed with colorectal cancer in the years 2001–2009, and part of the workforce at the time of follow-up

Sickness   absence→work	HR—unadjusted (events: 2125)	HR—adjusted for SES†	HR—adjusted for SES† and confounders‡	HR—adjusted for SES†, confounders and clinical variables
<b>Education</b>				
Primary school	1	1	1	1
Vocational and short-term education	0.87 (0.76 to 0.98)	0.91 (0.79 to 1.05)	0.91 (0.78 to 1.04)	0.92 (0.79 to 1.06)
Medium-term and long-term education	1.01 (0.91 to 1.13)	1.09 (0.96 to 1.24)	1.08 (0.95 to 1.23)	1.06 (0.93 to 1.21)
<b>Disposal income§</b>				
Lowest quartile	1	1	1	1
Second lowest quartile	1.11 (0.97 to 1.26)	1.03 (0.90 to 1.17)	1.01 (0.88 to 1.15)	1.07 (0.94 to 1.22)
Second highest quartile	1.27 (1.12 to 1.44)*	1.14 (1.00 to 1.29)	1.12 (0.98 to 1.27)	1.15 (1.00 to 1.31)
Highest quartile	1.25 (1.10 to 1.42)*	1.15 (1.00 to 1.33)	1.14 (0.99 to 1.32)	1.16 (1.00 to 1.34)
<b>Job type</b>				
Management and knowledge work	1.18 (0.95 to 1.22)	1.10 (0.90 to 1.28)	1.10 (0.94 to 1.28)	1.11 (0.95 to 1.30)
Office and sale (non-manual)	1.07 (0.97 to 1.17)	1.07 (0.97 to 1.19)	1.09 (0.98 to 1.22)	1.10 (0.99 to 1.23)
Manual	1	1	1	1
Other	0.71 (0.58 to 0.87)	0.71 (0.57 to 0.86)*	1.17 (0.50 to 2.29)	0.88 (0.37 to 1.73)
Previous periods of work	1.01 (1.01 to 1.02)*	1.13 (1.11 to 1.16)**	1.13 (1.11 to 1.16)**	1.13 (1.11 to 1.16)**
Previous periods of sickness absence	1.05 (1.04 to 1.05)**	0.94 (0.92 to 0.96)**	0.94 (0.92 to 0.96)**	0.93 (0.91 to 0.95)**
Previous periods of unemployment	0.98 (0.98 to 0.99)*	0.89 (0.87 to 0.91)**	0.89 (0.87 to 0.91)**	0.88 (0.87 to 0.90)**
<b>Type of cancer</b>				
Colonic	1			1
Rectal	1.01 (0.93 to 1.10)			0.96 (0.84 to 1.08)
<b>Stage</b>				
I	1			1
II	0.73 (0.56 to 0.94)*			0.82 (0.62 to 1.06)
III	0.76 (0.69 to 0.84)**			0.74 (0.66 to 0.82)**
IV	0.36 (0.31 to 0.41)**			0.53 (0.41 to 0.68)**
Unknown	1.14 (1.00 to 1.30)			1.15 (0.96 to 1.39)
<b>Comorbidity</b>				
No	1			1
Yes	0.81 (0.73 to 0.89)*			0.90 (0.82 to 1.00)
<b>ASA</b>				
I	1			1
II	0.84 (0.77 to 0.92)*			0.93 (0.85 to 1.03)
III	0.67 (0.52 to 0.84)*			0.85 (0.65 to 1.07)
Unknown	0.89 (0.73 to 1.06)			1.07 (0.79 to 1.41)
<b>Curative I operation</b>				
Yes	1			1
No	0.43 (0.38 to 0.49)**			0.69 (0.55 to 0.86)*
Unknown	0.83 (0.68 to 1.02)			0.90 (0.62 to 1.26)
<b>Type of operation</b>				
Rectal resection	1			1
Colonic resection	0.95 (0.85 to 1.05)			0.95 (0.83 to 1.09)
Explorative laparotomy or formation of an ostomy	0.99 (0.89 to 1.10)			1.06 (0.91 to 1.23)
Local procedures	0.65 (0.50 to 0.83)*			0.76 (0.57 to 1.00)*
Unknown	0.33 (0.22 to 0.48)**			0.48 (0.30 to 0.75)*
<b>Postoperative complications</b>				
No	1			1
Yes	0.84 (0.74 to 0.94)**			0.82 (0.72 to 0.92)*

\*Significant at 0.05 level.

\*\*Significant at &lt;0.0001 level.

†SES (socioeconomic status): education, disposal income and job type.

‡Confounders: gender, age at time of diagnosis, country of birth, marital status and year of operation.§Depending on the year, the highest disposal income ranged from 175 500 DKr in 2001 to 299 717 DKr in 2009.

ASA, the American Society of Anesthesiologists; DKr, Danish krone.

**Table 4** HR (95% CI) for sickness absence after an episode of work in relation to socioeconomic and clinical factors among 4343 patients aged 18–63 diagnosed with colorectal cancer in the years 2001–2009, and part of the work force at the time of follow-up

Work→sickness absence	HR—unadjusted (events: 2296)	HR—adjusted for SES†	HR—adjusted for SES† and confounders‡	HR—adjusted for SES†, confounders‡ and clinical variables
Education				
Primary school	1	1	1	1
Vocational and short-term education	1.25 (1.11 to 1.41)*	1.10 (0.96 to 1.27)	1.10 (0.96 to 1.27)	1.07 (0.93 to 1.23)
Medium-term and long-term education	1.40 (1.26 to 1.56)**	1.22 (1.08 to 1.38)*	1.21 (1.07 to 1.37)*	1.18 (1.04 to 1.34)*
Disposal income§				
Lowest quartile	1	1	1	1
Second lowest quartile	1.18 (1.04 to 1.33)	1.18 (1.05 to 1.34)*	1.17 (1.03 to 1.33)	1.13 (0.99 to 1.28)
Second highest quartile	1.02 (0.91 to 1.16)	1.04 (0.92 to 1.18)	1.02 (0.90 to 1.16)	1.00 (0.88 to 1.14)
Highest quartile	0.82 (0.73 to 0.94)*	0.99 (0.87 to 1.14)	0.99 (0.86 to 1.14)	0.96 (0.84 to 1.11)
Job type				
Management and knowledge work	0.69 (0.61 to 0.78)**	0.96 (0.83 to 1.12)	0.97 (0.84 to 1.14)	0.95 (0.82 to 1.11)
Office and sale (non-manual)	0.89 (0.82 to 0.98)	1.00 (0.91 to 1.10)	1.00 (0.91 to 1.12)	1.00 (0.90 to 1.11)
Manual	1	1	1	1
Other	0.67 (0.54 to 0.83)*	0.84 (0.67 to 1.04)	1.00 (0.48 to 1.82)	1.06 (0.51 to 1.93)
Previous episodes of work	1.03 (1.03 to 1.03)**	1.02 (1.01 to 1.04)*	1.02 (1.01 to 1.04)*	1.03 (1.01 to 1.04)*
Previous episodes of sickness absence	1.10 (1.09 to 1.11)**	1.08 (1.06 to 1.09)**	1.08 (1.06 to 1.09)**	1.08 (1.06 to 1.09)**
Previous episodes of unemployment	1.01 (1.01 to 1.02)**	0.98 (0.97 to 0.99)*	0.98 (0.97 to 0.99)*	0.98 (0.97 to 0.99)*
Type of cancer				
Colonic	1			1
Rectal	1.10 (1.01 to 1.19)			1.17 (1.03 to 1.32)*
Stage				
I	1			1
II	0.97(0.74 to 1.25)			0.99(0.75 to 1.28)
III	1.29 (1.16 to 1.41)*			1.24 (1.11 to 1.37)*
IV	1.63 (1.40 to 1.88)**			1.52 (1.21 to 1.91)*
Unknown	1.11 (0.98 to 1.25)			1.08 (0.91 to 1.29)
Comorbidity				
No	1			1
Yes	0.99 (0.90 to 1.08)			1.05 (0.96 to 1.16)
ASA				
I	1			1
II	1.09 (1.00 to 1.19)			1.09 (0.99 to 1.20)
III	1.42 (1.12 to 1.75)*			1.33 (1.05 to 1.67)*
Unknown	1.02 (0.85 to 1.21)			0.92 (0.70 to 1.19)
Curative operation				
Yes	1			1
No	1.43 (1.26 to 1.61)**			1.35 (1.11 to 1.63)*
Unknown	1.05 (0.87 to 1.29)			1.07 (0.77 to 1.45)
Type of operation				
Rectal resection	1			1
Colonic resection	1.0 (0.91 to 1.11)			1.10 (0.97 to 1.25)
Explorative laparotomy or formation of an ostomy	0.91 (0.82 to 1.01)			1.05 (0.91 to 1.22)
Local procedures	0.72 (0.56 to 0.91)*			0.78 (0.60 to 1.01)
Unknown	0.93 (0.66 to 1.26)			0.81 (0.53 to 1.20)
Postoperative complications				
No	1			1
Yes	1.18 (1.05 to 1.31)*			1.25 (1.11 to 1.41)*

\*Significant at 0.05 level.

\*\*Significant at &lt;.0001 level.

†SES (socioeconomic status): education, disposal income and job type.

‡Confounders: gender, age at time of diagnosis, country of birth, marital status and year of operation.

§Depending on the year, the highest disposal income ranged from 175 500 DKr in 2001 to 299 717 DKr in 2009.

ASA, the American Society of Anesthesiologists; DKr, Danish krone.



**Table 5** HR (95% CI) for retirement in relation to socioeconomic and clinical factors among 4343 patients aged 18–63 diagnosed with colorectal cancer in the years 2001 to 2009, and part of the work force at the time of follow-up

Mutually adjusted and controlled for confounders†	HR for transition from sickness absence—retirement (number of events: 569)	HR for transition from work/unemployed -> retirement (number of events: 109)
Status		
Working	–	1
Unemployed		5.89 (3.46 to 10.03)**
Education		
Primary school	1	1
Vocational and short-term education	1.13 (0.85 to 1.51)	1.29 (0.65 to 2.69)
Medium-term and long-term education	1.06 (0.81 to 1.41)	1.24 (0.64 to 2.53)
Disposal income‡		
Lowest quartile	1	1
Second lowest quartile	0.95 (0.76 to 1.19)	0.49 (0.27 to 0.85)*
Second highest quartile	0.77 (0.60 to 0.98)*	0.47 (0.25 to 0.83)*
Highest quartile	0.79 (0.60 to 1.04)	0.29 (0.14 to 0.57)*
Job type		
Management and knowledge work	0.59 (0.42 to 0.82)*	0.93 (0.85 to 1.03)
Office and sale (non-manual)	0.72 (0.58 to 0.89)*	0.96 (0.86 to 1.06)
Manual	1	1
Other	1.05 (0.06 to 4.85)	0.38 (0.12 to 1.37)
Previous episodes of work	0.98 (0.95 to 1.00)	0.93 (0.85 to 1.03)
Previous episodes of sickness absence	1.00 (0.97 to 1.02)	0.96 (0.86 to 1.06)
Previous episodes of unemployment	1.03 (1.00 to 1.05)*	1.02 (0.94 to 1.11)
Type of cancer		
Colonic	1	1
Rectal	1.32 (1.04 to 1.67)*	1.33 (0.75 to 2.34)
Stage		
I	1	1
II	0.85 (0.46 to 1.46)	1.70 (0.49 to 4.51)
III	1.13 (0.89 to 1.44)	1.91 (1.15 to 3.21)*
IV	1.58 (1.04 to 2.42)*	2.30 (0.88 to 6.14)
Unknown	1.01 (0.68 to 1.50)	1.72 (0.82 to 3.59)
Comorbidity		
No	1	1
Yes	1.03 (0.85 to 1.24)	1.17 (0.76 to 1.77)
ASA		
I	1	1
II	1.31 (1.08 to 1.58)*	1.56 (1.00 to 2.44)*
III	2.16 (1.49 to 3.06)*	2.57 (1.03 to 5.75)*
Unknown	1.29 (0.76 to 2.09)	1.64 (0.50 to 4.24)
Curative operation		
Yes	1	1
No	1.30 (0.89 to 1.86)	1.80 (0.77 to 3.84)
Unknown	1.41 (0.75 to 2.51)	1.05 (0.19 to 4.01)
Type of operation		
Rectal resection	1	1
Colonic resection	1.42 (1.11 to 1.81)*	1.36 (0.74 to 2.51)
Explorative laparotomy or formation of an ostomy	1.06 (0.78 to 1.43)	1.23 (0.55 to 2.32)
Local procedures	1.01 (0.53 to 1.84)	0.39 (0.08 to 1.26)
Unknown	1.45 (0.93 to 2.18)	0.84 (0.16 to 3.13)
Postoperative complications		
No	1	1
Yes	1.23 (1.00 to 1.51)*	0.86 (0.47 to 1.46)

\*Significant at 0.05 level.\*\*Significant at &lt;0.0001 level.

†Confounders: gender, age at time of diagnosis, country of birth, marital status and year of operation.‡Depending on the year, the highest disposal income ranged from 175 500 DKr in 2001 to 299 717 DKr in 2009.

ASA, the American Society of Anesthesiologists; DKr, Danish krone.

rehabilitation process for the more vulnerable persons who have a history of work-related problems with episodes outside the working market. In addition, special attention should be on the impact that complications and stage of disease have on the work ability in order to reduce the risk for sickness absence and retirement years after the operation.

**Contributors** All authors were involved in the study conception and design, interpretation of data and writing of the manuscript. MO and KC were involved in the acquisition of data; KC in the data analysis. All authors have read and approved the final manuscript.

**Funding** This work is funded by The Danish Cancer Society and The Novo Nordisk Foundation and is part of The Centre for Integrated Rehabilitation of Cancer Patients (CIRE).

**Competing interests** None.

**Ethics approval** The study was based solely on national and administrative registers and did not require any approval from the ethics committee according to national regulations.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** No additional data are available.

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