

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

Journal:	BMJ Open
Manuscript ID:	bmjopen-2012-002259
Article Type:	Research
Date Submitted by the Author:	25-Oct-2012
Complete List of Authors:	Carlsen, Kathrine; Glostrup University Hospital, Research Centre for Prevention and Health Harling, Henrik; Bispebjerg University Hospital, Department of Surgery Pedersen, Jacob; National Research Centre for the Working Environment, Osler, Merete; Glostrup University Hospital, Research Centre for Prevention and Health
<b>Primary Subject Heading</b> :	Oncology
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, Gastrointestinal tumours < ONCOLOGY, SOCIAL MEDICINE



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

ΒY

Kathrine Carlsen, MSc, MPH, PhD\*<sup>1</sup> Henrik Harling, MD, Clinical Doctor<sup>2</sup> Jacob Pedersen, MSc, Statistician<sup>3</sup> Merete Osler, MD, Professor<sup>4</sup>

# E-mail addresses and affiliations:

\* Corresponding author; kathrine.carlsen@regionh.dk, phone: +45 38633384, Fax: +45 38633977

1: kathrine.carlsen@regionh.dk. Research Centre for Prevention and Health, Glostrup University

Hospital, 2600 Glostrup, Denmark

2: hhar0002@bbh.regionh.dk. Department of Surgery, Bispebjerg University Hospital, 2400

Copenhagen, Denmark

3: jpe@nrcwe.dk. National Research Centre for the Working Environment, 2100 Copenhagen, Denmark

4: merete.osler@regionh.dk. Research Centre for Prevention and Health, Glostrup University

Hospital, 2600 Glostrup, Denmark

Number of words: 2499

Abstract: 268 words

Number of references: 32

# Abstract

<u>Objectives:</u> 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.

<u>Participants:</u> All persons (N=4343) diagnosed with colorectal cancer in Denmark in the years 2001-2009 while they were in their working age (18-63 years) and who were part of the labor force one year post diagnosis.

<u>Primary and secondary outcome measures</u>: By use of multi-state models in Cox proportional hazards models we analyzed the hazard ratio for re-employment, sickness absence and retirement in models including clinical as well as health related variables.

<u>Results:</u> One year after diagnosis 62% were working and 58% continued until 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 was increased if the disease was diagnosed at a later stage (stage III) 1.52 (95% CI: 1.21-1.91), not operated curatively 1.35 (95% CI: 1.11-1.63) and with occurrence of post-operative complications 1.25 (95% CI: 1.11-1.41). The opposite was found for the transition from sickness absence back to work. <u>Conclusion:</u> Stage of disease, general health state, 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 early detection of colorectal cancer, and the importance of avoidance of post-operative complications.

# 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:

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

# What is new in this paper:

Very few studies have analyzed the impact colorectal cancer has on the affiliation to the labor market. In this study we are able to identify clinical and socioeconomic risk factors for sickness absence, work resumption and retirement.

#### **1. Introduction**

In 2008 nearly 500.000 persons in Europe were diagnosed with colorectal cancer 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 to 2002 from 50% to 60% among persons aged 15 to 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 analyzed the impact of colorectal cancer on work participation in the years following diagnosis and treatment. The existing studies reported that 2/3 of those working at time of diagnosis resume work in the years after treatment. Risk factors for work cessation were high age; radiation therapy and co-morbidity <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 has 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 transitions between sickness absence and work it is important to take both socioeconomic and health related factors into account and to look more in depth on the different pathways in and out of the workforce.

#### **BMJ Open**

By 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.

## 2. Materials and methods

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

# Danish Colorectal Cancer Group (DCCG)

The study population was derived from the national database of DCCG which includes around 93% of patients in Denmark with a first-time adenocarcinoma of the rectum (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 details elsewhere <sup>23</sup>. From the database we obtained clinical data with relevance for the probability of returning to work after treatment. Entry into the study was equal to date of surgery and was used to calculate the follow-up time. Variables describing the disease were cancer type and tumor stage classified according to the International Union Against Cancer (UICC). Information about surgical procedure was included as 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 time of surgery was measured by ASA score (according to the American Society of Anesthesiologists) and postoperative complications.

### 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>24</sup>. From IDA we had information about country of origin, marital status, education and job type. 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 three years before the year of diagnosis and was deflated according to the 2000 value of the Danish kroner.

# The Danish National Patient Registry (NPR)

This register holds information on all hospitalizations and outpatient visits in Denmark since 1978. In this study we used information of date of admission and discharge and diagnosis coded according to *the International Classifications of Diseases* (ICD-10)<sup>25</sup>.

# The Register of Medical Product Statistics (RMPS)

Since 1994 every medical product sold on prescription by Danish pharmacies has been registered. From this register we had information on date for redemption of the prescription and substance classified according to the *anatomical-therapeutic-chemical* (ATC) system <sup>26</sup>.

Co-morbidity preceding five years before the year of diagnosis was obtained from NPR and RMPS. The following co-morbidities from the Charlson index were included and dichotomized to yes/no: Cardiovascular disease, chronic obstructive pulmonary disease, diabetes and liver, kidney or connective tissue diseases.

Register based Evaluation of Marginalization (DREAM)

The Danish labor market is characterized as a flexicurity system. Unemployed persons are warranted economic compensation if they are actively seeking job. If a person is unable to work due to illness or disability it is possible to receive sickness benefit or apply for early retirement if needed. The pathways between these different states are shown in figure 1, where the four outcomes represent four different and mutually separated states.

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. DREAM covers all residents in Denmark who have received social transfer payments from the state <sup>27</sup> in any given week since 1991until week 13 in 2001. In work was defined as not receiving any social transfer payments for six consecutive weeks. Transfer income was divided into sickness benefit, unemployment benefit and permanent withdrawal from the workforce due to disablement.

# Study population

The study population comprised 31.570 persons diagnosed with colorectal cancer between 2001 and 2009. Of these, we included 4343 persons aged 18-63 years, who were part of the workforce and survived the first postoperative year (see figure 2) leading to 12.569 person years and minimum 65 weeks of follow-up.

#### Statistical analysis

The time duration of a given transfer payment was registered from the payment-starting week until the week the payment ended or time was truncated due to end of follow up time. If a person received a transfer payment that did not fit any of the four states (i.e. education) the time was censored but the person was allowed back into the model if he afterwards received a transfer

payment fitting one of the four states. A transition was defined as a shift between any of the four states illustrated in Figure 1. Permanently censoring was used when a person reached the age limit of 63 years, emigrated or died.

Beside the covariates concerning gender, age, etc. each record included three variables that was processed during follow up and was both time and state dependent. Each of the processed time and state dependent covariates did hold the present number of times the person had experienced work, sick-listing or unemployment counted from start of follow up.

A multi-state model was used for analysing the transitions between the four states <sup>28</sup>. Each transition was analysed separately using the Cox proportional hazards model in SAS (The PHREG procedure, SAS version 9.2). The model included both time dependent covariates like gender and time, and independent covariates like number of unemployment periods during the follow up. The duration of weeks a person spended at each state was used as time scale. Because the baseline hazard for each state was allowed to vary freely, the covariate relied on the assumption of proportionality

## 3. Results

Table 1 shows the baseline characteristics for all patients stratified on those excluded (N=27.227) and the study population (N=4343). The latter was diagnosed with a less severe disease and had a higher SES at time of inclusion than the excluded.

One year after 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.

Table 3 and 4 shows the Hazard Ratio (HR) for transitions between work and sickness absence and reverse. The occupational history was significantly associated with returning to work and sickness absence. Previous periods of sickness absence and unemployment reduced the rate of

#### **BMJ Open**

returning to work with 7% and 12% per episode, whereas previous episodes of work increased the rate 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 (1.03-1.32)) 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 permanently withdrawal from the labor market one year after 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 not only related to the disease but also to SEP. Manual work and increasing disposal income reduces the risk for retirement after an episode of sickness absence and work, respectively. Compared to patients in work, the HR for retirement was 5.89 (3.46-10.03) among unemployed survivors.

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

#### 4. 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 one year after operation.

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

The observed rate of return to work is in accordance with previous studies on colorectal cancer survivors, where return to full time employment was reported in 60%-89% dependent on time from 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 one year after operation, based on a notion that it is not clinical relevant to study full return to work before the end of a one-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>29</sup>. This could be caused by the fact that there is a lack of consensus regarding definition and measurement of return to work. Thus, in some studies return to work is simply the number of persons working at time of follow-up divided by the number working at baseline <sup>10;30</sup>. In other studies return to work is measured among those persons, who are part of the workforce at time of follow-up, and in still other studies working is self-reported and covers from one week to permanently re-employed <sup>29</sup>

The lack of a clear definition can result in misinterpretation of factors related to the disease and SEP since the underlying mechanisms in the transition from sickness absence back to work or to disability pension seems to follow different pathways. Leaving the workforce for any type of pension is an irreversible process and is assigned when work demands exceeds health and mental

#### **BMJ Open**

resources and is thus dependent on both health and work related factors. On the other hand, unemployment and sickness absence both include conditions with an expectation of resuming work and is more related to either SEP or health, respectively.

The exclusion of persons who take disability pension the first year and the lower social one-year survival after colorectal cancer among socially deprived (23) might explain our finding of no effect of SEP on work and sickness absence one year after 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 one year after operation was primarily associated with factors related to the cancer disease. The risk for transition from work to sickness absence was 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 resuming of work after a cancer diagnosis including colorectal cancer has been observed in other studies where tumor stage <sup>13;31</sup>, treatment <sup>4;31</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 significant increased risk for sickness absence and retirement possibly due to the fact that this patient group in contrast to colon cancer patients more often will have to learn to take care of an ostomy or suffer from abnormal bowl and urinary function years after the operation <sup>32</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 the affiliation to the labour market are administrative data collected prospectively why recall-bias is eliminated.

This study has, however, some limitations. First of all we were not able to include complementary treatment 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;31</sup>. We defined return to work as not receiving any transfer payments for six 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.

#### Conclusion

This nationwide study of colorectal cancer patients who have survived one year shows that stage of disease, general health state of the individual, 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 early detection of colorectal cancer, and the importance of avoidance of post-operative complications. In addition, special attention should be on the more vulnerable persons who have a history of work related problems with episodes outside the working market.

#### Acknowledgment

# **BMJ Open**

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).

# **Author contribution:**

- Study conception and design: All authors
- Acquisition of data: Merete Osler and Kathrine Carlsen
- Analysis of data: Kathrine Carlsen
- Interpretation of data: All authors
- Writing manuscript: All authors

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



Figure 2: Flowchart 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 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.

Table 1: Characteristics of the colorectal cancer patients diagnosed in Denmark, 2001-2009 (N=31.570). The total population is divided into three groups: A) Excluded due to age, retirement before diagnosis and missing values (N=25.538), B) excluded during the first year due to retirement or death (N=1689) and C) the included persons (N=4343).

	Excluded population	Excluded during the first $N(G)$	Included after the first year	Р
Education	N (%)	year N (%)	N (%)	< 0001
Primary school	11 470 (45)	584 (35)	1244 (29)	<.0001
Vocational and short education	7576 (30)	781 (46)	2037 (47)	
Medium and long education	2520 (10)	324 (19)	1062 (24)	
Unknown	3972 (15)	0(0)	0(0)	
Disposal income (DKr.)	0,12(10)		0 (0)	<.0001
Mean	136 134	192 206	210 807	
Job type				<.0001
Management and knowledge work	311 (1)	190 (11)	740 (17)	
Office and sale (non-manual)	722 (3)	401 (24)	1414 (33)	
Manual	21 399 (84)	893 (53)	1661 (38)	
Other	3106 (12)	205 (12)	528 (12)	
Gender				<.0001
Women	12 380 (48)	691 (41)	1913 (44)	
Men	13 158 (52)	998 (59)	2430 (56)	
Age				<.0001
Mean	74.8	56.6	53.8	
Country of birth				<.0001
Denmark	24 648 (97)	1637 (97)	4150 (96)	
Other	890 (3)	52 (3)	193 (4)	
Marital status				<.0001
Married / cohabiting	12 146 (48)	1042 (62)	3162 (73)	
Single	11 655 (46)	494 (29)	1154 (26)	
Unknown	1737 (7)	153 (9)	27 (1)	
Year of operation	1006 (7)	101 (0)	200 (7)	0.36
2001	1896 (7)	104 (6)	309 (7)	
2002	2794 (11)	178 (10)	458 (10)	
2003	2754 (11)	176 (10)	439 (10)	
2004	2883 (11)	213 (13)	494 (11)	
2005	2968 (12)	210 (12)	486 (11)	
2006	3004(12)	199(12)	508 (13)	
2007	2980 (12)	107(12)	545 (15)	
2008	3057 (12)	197(12) 201(12)	514 (12)	
Z009	3037 (12)	201 (12)	514 (12)	< 0001
Colonic	16 776 (66)	1063 (63)	2464 (57)	<.0001
Rectal	8546 (34)	626 (37)	1879 (43)	
Stage	0540 (54)	020 (57)	1077 (43)	< 0001
I	8082 (32)	306 (18)	1535 (35)	2.0001
П	1052 (4)	43 (3)	146 (3)	
III	6058 (24)	351 (21)	1411 (32)	
IV	6984 (27)	858 (51)	760 (18)	
Unknown	3362 (13)	131 (8)	491 (11)	
Comorbidity	· · ·			<.0001
No	19 834 (78)	1447 (86)	4018 (93)	
Yes	5704 (22)	224 (14)	325 (7)	
ASA				<.0001
I	3444 (13)	484 (29)	2168 (50)	
П	12 012 (47)	771 (46)	1731 (40)	
->III	7488 (29)	240 (14)	172 (4)	
Unknown	2594 (10)	194 (11)	272 (6)	
Curative operation	15,000 ((0))		2220 (25)	<.0001
Yes	15 932 (62)	677 (40)	3278 (75)	
INO Umbra autor	1952 (31)	884 (52)	80/(20)	
Unknown	1034 (0)	128 (8)	198 (3)	. 0001
Type of operation	2925 (11)	228 (14)	206 (5)	<.0001
Rectal resection	2633 (11) 4650 (18)	228 (14)	200 (5)	
Explorative laparetery or formation of	4030 (18)	500 (18)	1552 (51)	
explorative taparotomy or formation of	0576 (38)	537 (32)	1445 (33)	
Local procedures	5820 (23)	367 (32)	1443 (33)	
Unknown	2657 (10)	251 (15)	143 (3)	
Post-operative complications	2037 (10)	251 (15)	173 (3)	-0.70
No	21 793 (85)	1448 (86)	3689 (85)	-0.70
Yes	3745 (15)	241 (14)	654 (15)	
				1

# 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 to 2009 and part of the workforce at time of follow-up.

Mean time in weeks from one year after operation and first change in employmental state (% of population)	To work	To sickness absence	To unemploy- ment	To retirement	To censoring due to age, dead, 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%)

<u>- 57 (31%) 63 (10%) 75 (1%)</u> <u>16 (34%) - 29 (9%) 30 (28%)</u> <u>- 19 (N=258/6%) 22 (47%) 28 (17%) - 63 (13%)</u>

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 to 2009, and part of the work force at time of follow-up.

diagnosed with colorectar cancer in the year	s 2001 to 2009, and pai	t of the work loree at t	line of follow-up.	
	HR – unadjusted	HR - ajusted for	HR - adjusted for	HR - adjusted for SES,
SICKNESS ABSENCE $\rightarrow$ WORK	(events: 2125)	SES	SES and	confounders and
	` ´		confounders*	clinical variables
Education			comounders	ennieur variaeres
Driment ash asl	1	1	1	1
Primary school				
Vocational and short education	0.87 (0.76-0.98)	0.91 (0.79-1.05)	0.91 (0.78-1.04)	0.92 (0.79-1.06)
Medium and long education	1.01 (0.91-1.13)	1.09 (0.96-1.24)	1.08 (0.95-1.23)	1.06 (0.93-1.21)
Disposal income #				
Lowest quartile	1	1	1	1
Second lowest quartile	1 11 (0.97-1.26)	1.03(0.90.1.17)	1.01(0.88-1.15)	1.07(0.94-1.22)
Second lowest quartile	1.11(0.771.20)	1.05(0.90-1.17)	1.01(0.08-1.13)	1.07(0.94-1.22) 1.15(1.00,1.21)
Second nignest quartile	$1.27(1.12-1.44)^{*}$	1.14 (1.00-1.29)	1.12 (0.98-1.27)	1.15 (1.00-1.51)
Highest quartile	1.25 (1.10-1.42)*	1.15 (1.00-1.33)	1.14 (0.99-1.3 2)	1.16 (1.00-1.34)
Job type				
Management and knowledge work	1.18 (0.95-1.22)	1.10 (0.90-1.28)	1.10 (0.94-1.28)	1.11 (0.95-1.30)
Office and sale (non-manual)	1.07(0.97-1.17)	1.07 (0.97-1.19)	1.09 (0.98-1.22)	1.10 (0.99-1.23)
Manual	1	1	1	1
Other	071(058-087)	0.71 (0.57-0.86)*	1 17 (0.50 2.20)	0.88(0.37-1.73)
	0.71 (0.38-0.87)	0.71 (0.57-0.80)*	1.17 (0.30-2.29)	0.88 (0.57-1.75)
Previous periodsof work				
	1.01 (1.01-1.02)*	1.13 (1.11-1.16)**	1.13 (1.11-1.16)**	1.13 (1.11-1.16)**
Previous periods of sickness absence				
-	1.05 (1.04-1.05)**	0.94 (0.92-0.96)**	0.94 (0.92-0.96)**	0.93 (0.91-0.95)**
Previous periods of unemployment		X	X	```´
revious perious or unemproyment	0.08 (0.08 0.00)*	0.80 (0.87 0.01)**	0.80 (0.87 0.01)**	0.88 (0.87 0.00)**
The fille	0.98 (0.98-0.99)*	0.89 (0.87-0.91)**	0.89 (0.87-0.91)	0.88 (0.87-0.90)**
Type of cancer				
Colonic	1			1
Rectal	1.01 (0.93-1.10)			0.96 (0.84-1.08)
Stage				
I	1			1
II	0.73 (0.56-0.94)*			0.82(0.62-1.06)
11	0.75(0.50-0.94)			0.32(0.62-1.00)
	0.76 (0.69-0.84)			$0.74(0.06-0.82)^{0.04}$
IV	0.36 (0.31-0.41)**			0.53 (0.41-0.68)**
Unknown	1.14 (1.00-1.30)			1.15 (0.96-1.39)
Comorbidity				
No	1			1
Vec	0.81 (0.73-0.89)*			0.90(0.82-1.00)
103	0.01 (0.75-0.07)			0.90 (0.82-1.00)
AJA	1			1
1	1			1
11	0.84 (0.77-0.92)*			0.93 (0.85-1.03)
>III	0.67 (0.52-0.84)*			0.85 (0.65-1.07)
Unknown	0.89 (0.73-1.06)			1.07 (0.79-1.41)
Curative Loneration				
Vac	1			1
les				
INO	0.45 (0.58-0.49)**			0.09 (0.05-0.86)*
Unknown	0.83 (0.68-1.02)			0.90 (0.62-1.26)
Type of operation				
Rectal resection	1			1
Colonic resection	0.95 (0.85-1.05)			0.95 (0.83-1.09)
Explorative laparotomy or formation of				
en esterre	0.00 (0.90 1.10)			1.06 (0.01.1.22)
an ostomy	0.99 (0.89-1.10)			1.00 (0.91-1.23)
Local procedures	0.65 (0.50-0.83)*			0.76 (0.57-1.00)*
Unknown	0.33 (0.22-0.48)**			0.48 (0.30-0.75)*
Post-operative complications				
No	1			1
Yes	0 84 (0 74-0 94)*			0.82 (0.72-0.92)*
100	()			0.02 (0.12-0.72)

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

# Depending on year the highest disposal income ranged from 175.500 DKr in 2001 to 299.717 DKr in 2009

Table 4: HR (95% CI) for sickness absence after an episode of work in relation to socioeconomic and clinical factors among 4343 patients aged 18-6.
diagnosed with colorectal cancer in the years 2001 to 2009, and part of the work force at time of follow-up.

9	IID 1' ( 1		UD 1' 16 OFO	
WORK $\rightarrow$ SICKNESS ABSENCE	(events: 2296)	HR - ajusted for SES	and confounders*	HR - adjusted for SES, confounders* and clinical variables
Education				ennieur variables
Drimory ashaal	1	1	1	1
Visiting School	1	1	1	1
vocational and short education	1.25 (1.11-1.41)*	1.10 (0.96-1.27)	1.10 (0.96-1.27)	1.07 (0.93-1.23)
Medium and long education	1.40 (1.26-1.56)**	1.22 (1.08-1.38)*	1.21 (1.07-1.37)*	1.18 (1.04-1.34)*
Disposal income #				
Lowest quartile	1	1	1	1
Second lowest quartile	1.18 (1.04-1.33)	1.18 (1.05-1.34)*	1.17 (1.03-1.33)	1.13 (0.99-1.28)
Second highest quartile	1.02 (0.91-1.16)	1.04 (0.92-1.18)	1.02 (0.90-1.16)	1.00 (0.88-1.14)
Highest quartile	0.82 (0.73-0.94)*	0.99(0.87-1.14)	0.99(0.86-1.14)	0.96(0.84-1.11)
Job type				0120 (010 1 1111)
Monogement and knowledge	0.60 (0.61 0.78)**	0.06 (0.83, 1, 12)	0.07 (0.84 1.14)	0.05 (0.82 1.11)
Management and knowledge	0.09 (0.01-0.78)	1.00 (0.01 1.10)	0.97 (0.04-1.14)	0.95 (0.82-1.11)
work	0.89 (0.82-0.98)	1.00 (0.91-1.10)	1.00 (0.91-1.12)	1.00 (0.90-1.11)
Office and sale (non-manual)	1	1	1	1
Manual	0.67 (0.54-0.83)*	0.84 (0.67-1.04)	1.00 (0.48-1.82)	1.06 (0.51-1.93)
Other				
Previous episodes of work				
-	1.03 (1.03-1.03)**	1.02 (1.01-1.04)*	1.02 (1.01-1.04)*	1.03 (1.01-1.04)*
Previous episodes of sickness			· · · · · ·	
absence	1 10 (1 09-1 11)**	1 08 (1 06-1 09)**	1 08 (1 06-1 09)**	1 08 (1 06-1 09)**
Previous enisodes of		1100 (1100 110))	1100 (1100 110))	100 (100 10))
unemployment	1.01 (1.01.1.02)*	0.08 (0.07 0.00)*	0.08 (0.07 0.00)*	0.08 (0.07 0.00)*
Tune of concer	1.01 (1.01-1.02)	0.98 (0.97-0.99)	0.98 (0.97-0.99)	0.98 (0.97-0.99)
Type of cancer				1
Colonic				1
Rectal	1.10 (1.01-1.19)			1.17 (1.03-1.32)*
Stage				
1	1			1
II	0.97(0.74-1.25)			0.99(0.75-1.28)
III	1.29 (1.16-1.41)*			1.24 (1.11-1.37)*
IV	1.63 (1.40-1.88)**			1.52 (1.21-1.91)*
Unknown	1.11 (0.98-1.25)			1.08 (0.91-1.29)
Co-morbidity				
No	1			1
Vac	1 0 00 (0 00 1 08)			1 05 (0.96 1.16)
165	0.33 (0.30-1.08)			1.03 (0.90-1.10)
ASA	1			
1	1			1
II	1.09 (1.00-1.19)			1.09 (0.99-1.20)
->III	1.42 (1.12-1.75)*			1.33 (1.05-1.67)*
Unknown	1.02 (0.85-1.21)			0.92 (0.70-1.19)
Curative operation				
Yes	1			1
No	1.43 (1.26-1.61)**			1.35 (1.11-1.63)*
Unknown	1 05 (0 87-1 29)			1 07 (0 77-1 45)
Type of operation	100 (0007 1127)			1107 (0177 1110)
Postal respection	1			1
Culturi resection	1			1
Colonic resection	1.0 (0.91-1.11)			1.10 (0.97-1.23)
Explorative laparotomy or				
formation of an ostomy	0.91 (0.82-1.01)			1.05 (0.91-1.22)
Local procedures	0.72 (0.56-0.91)*			0.78 (0.60-1.01)
Unknown	0.93 (0.66-1.26)			0.81 (0.53-1.20)
Post-operative complications				
No	1			1
Yes	1.18 (1.05-1.31)*			1.25 (1.11-1.41)*
	,			

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

# Depending on year the highest disposal income ranged from 175.500 DKr in 2001 to 299.717 DKr in 2009

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 time of follow-up.

cancer in the years 2001 to 2009, and pa	art of the work force at time	of follow-up.
Mutually adjusted and controlled for	HR for transition from	HR for transition from
confounders*	sickness absence ->	work / unemployed ->
	retirement (number of	retirement (number of
	events:569)	events: 109)
Status		
Working		1
Unemployed		5.89 (3.46-10.03)**
Education		
Primary school	1	1
Vocational and short education	1.13 (0.85-1.51)	1.29 (0.65-2.69)
Medium and long education	1.06 (0.81-1.41)	1.24 (0.64-2.53)
Disposal income #		
Lowest quartile	1	1
Second lowest quartile	0.95 (0.76-1.19)	0.49 (0.27-0.85)*
Second highest quartile	0.77 (0.60-0.98)*	0.47 (0.25-0.83)*
Highest quartile	0.79 (0.60-1.04)	0.29 (0.14-0.57)*
Job type		
Management and knowledge work	0.59 (0.42-0.82)*	0.93 (0.85-1.03)
Office and sale (non-manual)	0.72 (0.580.89)*	0.96 (0.86-1.06)
Manual	1	1
Other	1.05 (0.06-4.85)	0.38 (0.12-1.37)
Previous episodes of work		
	0.98 (0.95-1.00)	0.93 (0.85-1.03)
Previous episodes of sickness absence		
	1.00 (0.97-1.02)	0.96 (0.86-1.06)
Previous episodes of unemployment		
	1.03 (1.00-1.05)*	1.02 (0.94-1.11)
Type of cancer		
Colonic	1	1
Rectal	1.32 (1.04-1.67)*	1.33 (0.75-2.34)
Stage		
Ι	1	1
II	0.85 (0.46-1.46)	1.70 (0.49-4.51)
III	1.13 (0.89-1.44)	1.91 (1.15-3.21)*
IV	1.58 (1.04-2.42)*	2.30 (0.88-6.14)
Unknown	1.01 (0.68-1.50)	1.72 (0.82-3.59)
Comorbidity		
No	1	1
Yes	1.03 (0.85-1.24)	1.17 (0.76-1.77)
ASA		
I	1	
II	1.31 (1.08-1.58)*	1.56 (1.00-2.44)*
III	2.16 (1.49-3.06)*	2.57 (1.03-5.75)*
Unknown	1.29 (0.76-2.09)	1.64 (0.50-4.24)
Curative operation		
Yes	1	1
No	1.30 (0.89-1.86)	1.80 (0.77-3.84)
Unknown	1.41 (0.75-2.51)	1.05 (0.19-4.01)
Type of operation		
Rectal resection	1	1
Colonic resection	1.42 (1.11-1.81)*	1.36 (0.74-2.51)
Explorative laparotomy or	, ,	
formation of an ostomy	1.06 (0.78-1.43)	1.23 (0.55-2.32)
Local procedures	1.01 (0.53-1.84)	0.39 (0.08-1.26)
Unknown	1.45 (0.93-2.18)	0.84 (0.16-3.13)
Post-operative complications		
No	1	1
Yes	1.23 (1.00-1.51)*	0.86 (0.47-1.46)

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

# Depending on year the highest disposal income ranged from 175.500 DKr in 2001 to 299.717 DKr in 2009

# **BMJ Open**

# Reference List

- (1) Ferlay J, Parkin DM, Steliarova-Foucher E. Estimates of cancer incidence and mortality in Europe in 2008. *Eur J Cancer* 2010; 46(4):765-781.
- (2) Coleman MP, Forman D, Bryant H, Butler J, Rachet B, Maringe C et al. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. *Lancet* 2011; 377(9760):127-138.
- (3) Brenner H, Bouvier AM, Foschi R, Hackl M, Larsen IK, Lemmens V et al. Progress in colorectal cancer survival in Europe from the late 1980s to the early 21st century: The EUROCARE study. *Int J Cancer* 2011.
- (4) Gordon L, Lynch BM, Newman B. Transitions in work participation after a diagnosis of colorectal cancer. *Aust N Z J Public Health* 2008; 32(6):569-574.
- (5) van den Brink M, van den Hout WB, Kievit J, Marijnen CA, Putter H, van de Velde CJ et al. The impact of diagnosis and treatment of rectal cancer on paid and unpaid labor. *Dis Colon Rectum* 2005; 48(10):1875-1882.
- (6) Frederiksen BL, Osler M, Harling H, Ladelund S, Jorgensen T. The impact of socioeconomic factors on 30-day mortality following elective colorectal cancer surgery: a nationwide study. *Eur J Cancer* 2009; 45(7):1248-1256.
- (7) Cavalli-Bjorkman N, Lambe M, Eaker S, Sandin F, Glimelius B. Differences according to educational level in the management and survival of colorectal cancer in Sweden. *Eur J Cancer* 2011; 47(9):1398-1406.
- (8) Egeberg R, Halkjaer J, Rottmann N, Hansen L, Holten I. Social inequality and incidence of and survival from cancers of the colon and rectum in a population-based study in Denmark, 1994-2003. *Eur J Cancer* 2008; 44(14):1978-1988.
- (9) Aarts MJ, Lemmens VEPP, Louwman MWJ, Kunst AE, Coebergh JW. Socioeconomic status and changing inequalities in colorectal cancer? A review of the associations with risk, treatment and outcome. *European Journal of Cancer* 2010; 46(15):2681-2695.
- (10) Drolet M, Maunsell E, Brisson J, Brisson C, Masse B, Deschenes L. Not Working 3 Years After Breast Cancer: Predictors in a Population-Based Study. *J Clin Oncol* 2005; 23(33):8305-8312.
- (11) Steiner JF, Cavender TA, Nowels CT, Beaty BL, Bradley CJ, Fairclough DL et al. The impact of physical and psychosocial factors on work characteristics after cancer. *Psychooncology* 2008; 17(2):138-147.
- (12) Paraponaris A, Teyssier LS, Ventelou B. Job tenure and self-reported workplace discrimination for cancer survivors 2 years after diagnosis: does employment legislation matter? *Health Policy* 2010; 98(2-3):144-155.

- (13) Earle CC, Chretien Y, Morris C, Ayanian JZ, Keating NL, Polgreen LA et al. Employment among survivors of lung cancer and colorectal cancer. *J Clin Oncol* 2010; 28(10):1700-1705.
- (14) Spelten ER, Sprangers MA, Verbeek JH. Factors reported to influence the return to work of cancer survivors: a literature review
- 1. Psychooncology 2002; 11(2):124-131.
  - (15) Short PF, Vasey JJ, Tunceli K. Employment pathways in a large cohort of adult cancer survivors. *Cancer* 2005; 103(6):1292-1301.
  - (16) Mehnert A. Employment and work-related issues in cancer survivors. *Crit Rev Oncol Hematol* 2011; 77(2):109-130.
  - (17) Dalton SO, Steding-Jessen M, Gislum M, Frederiksen K, Engholm G, Schüz J. Social inequality and incidence and survival of cancer in a population based study in Denmark, 1994-2003: Aims, background and methods. *Eur J Cancer* 2008; x:xx.
  - (18) Amir Z, Moran T, Walsh L, Iddenden R, Luker K. Return to paid work after cancer: a British experience. *J Cancer Surviv* 2007; 1(2):129-136.
  - (19) Carlsen K, Dalton SO, Frederiksen K, Diderichsen F, Johansen C. Cancer and the risk for taking early retirement pension:

A Danish cohort study. Scandinavian Journal of Public Health 2008; 36(2):117-125.

- (20) Mols F, Thong MS, Vissers P, Nijsten T, van de Poll-Franse LV. Socio-economic implications of cancer survivorship: Results from the PROFILES registry. *Eur J Cancer* 2011.
- (21) Sjovall K, Attner B, Englund M, Lithman T, Noreen D, Gunnars B et al. Sickness absence among cancer patients in the pre-diagnostic and the post-diagnostic phases of five common forms of cancer. *Support Care Cancer* 2012; 20(4):741-747.
- (22) Syse A, Tretli S, Kravdal O. Cancer's impact on employment and earnings--a populationbased study from Norway. *J Cancer Surviv* 2008; 2(3):149-158.
- (23) Frederiksen BL, Osler M, Harling H, Ladelund S, Jorgensen T. Do patient characteristics, disease, or treatment explain social inequality in survival from colorectal cancer? *Soc Sci Med* 2009; 69(7):1107-1115.
- (24) Statistics Denmark. IDA an integrated data base for labour market research. Main report, 1991 . 2006.

Ref Type: Generic

- (25) Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. *Scand J Public Health* 2011; 39(7 Suppl):30-33.
- (26) Kildemoes HW, Sorensen HT, Hallas J. The Danish National Prescription Registry. *Scand J Public Health* 2011; 39(7 Suppl):38-41.

- (27) Hjollund NH, Larsen FB, Andersen JH. Register-based follow-up of social benefits and other transfer payments: accuracy and degree of completeness in a Danish interdepartmental administrative database compared with a population-based survey. *Scand J Public Health* 2007; 35(5):497-502.
- (28) Pedersen J, Bjorner JB, Burr H, Christensen KB. Transitions between sickness absence, work, unemployment, and disability in Denmark 2004-2008. *Scand J Work Environ Health* 2012.
- (29) Sanchez KM, Richardson JL, Mason HR. The return to work experiences of colorectal cancer survivors. *AAOHN J* 2004; 52(12):500-510.
- (30) Taskila T, Martikainen R, Hietanen P, Lindbohm ML. Comparative study of work ability between cancer survivors and their referents. *Eur J Cancer* 2007; 43(5):914-920.
- (31) Mols F, Thong MS, Vreugdenhil G, van de Poll-Franse LV. Long-term cancer survivors experience work changes after diagnosis: results of a population-based study. *Psychooncology* 2009; 18(12):1252-1260.
- (32) Rodriguez-Bigas MA, Chang GJ, Skibber JM. Barriers to rehabilitation of colorectal cancer patients. *J Surg Oncol* 2007; 95(5):400-408.





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

Journal:	BMJ Open
Manuscript ID:	bmjopen-2012-002259.R1
Article Type:	Research
Date Submitted by the Author:	20-Dec-2012
Complete List of Authors:	Carlsen, Kathrine; Glostrup University Hospital, Research Centre for Prevention and Health Harling, Henrik; Bispebjerg University Hospital, Department of Surgery Pedersen, Jacob; National Research Centre for the Working Environment, Christensen, Karl; University of Copenhagen, Department of Biostatistics Osler, Merete; Glostrup University Hospital, Research Centre for Prevention and Health
<b>Primary Subject Heading</b> :	Oncology
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, Gastrointestinal tumours < ONCOLOGY, SOCIAL MEDICINE



# BMJ Open

2			
4	1	The transition between work, sickness absence and pension in a cohort of Danish colorectal cancer	
5 6	2	survivors.	
7 8	3		
9	4	BY	
10 11	5	Kathrine Carlsen, MSc, MPH, PhD*1	
12 13	6	Henrik Harling, MD, Clinical Doctor <sup>2</sup>	
14	7	Jacob Pedersen, MSc, Statistician <sup>3</sup>	
15 16	8	Karl Bang Christensen, Statistician <sup>4</sup>	
17 18	9	Merete Osler, MD, Professor <sup>5</sup>	
19	10		
20 21	11		
22 23	12		
24	13		
25 26	14		
27 28	15	E-mail addresses and affiliations:	
29	16	* Corresponding author; kathrine.carlsen@regionh.dk, phone: +45 38633384, Fax: +45 38633977	
30 31 32 33	17	1: kathrine.carlsen@regionh.dk. Research Centre for Prevention and Health, Glostrup University	
	18	Hospital, 2600 Glostrup, Denmark	
34 35	19	2: hhar0002@bbh.regionh.dk. Department of Surgery, Bispebjerg University Hospital, 2400	
36	20	Copenhagen, Denmark	
37 38	21	3: jpe@nrcwe.dk. National Research Centre for the Working Environment, 2100 Copenhagen,	
39 40	22	Denmark	
40	23	4: kach@sund.ku.dk. Department of Biostatistics, University of Copenhagen, 1014 Copenhagen K,	
42 43	24	Denmark	
44 45	25	5: merete.osler@regionh.dk. Research Centre for Prevention and Health, Glostrup University	
46	26	Hospital, 2600 Glostrup, Denmark	
47 48	27		
49 50	28	Number of words: 3291	
51	29	Abstract: 300 words	
52 53	30	Number of references: 37	
54 55	31	Number of figures: 2	
56	32	Number of tables: 5	
57 58	33		
59 60			

Objectives: The aim of this study was to evaluate the impact of socioeconomic and clinical factors

2
2
3
4
5
6
7
1
8
9
10
11
10
12
13
14
15
16
10
17
18
19
20
21
21
22
23
24
25
20
26
27
28
29
20
30
31
32
33
34
04
35
36
37
38
20
39
40
41
42
43
11
44
45
46
47
10
40
49
50
51
52
52
03
54
55
56
57
51
วช
59
60

1

1

2

Abstract

# 3 on the transitions between work, sickness absence and retirement in a cohort of Danish colorectal 4 cancer survivors. 5 Design: Register based cohort study with up to 10 years of follow-up. 6 Setting: Population based study with use of administrative health related and socioeconomic 7 registers. 8 Participants: All persons (N=4343) diagnosed with colorectal cancer in Denmark in the years 2001-9 2009 while they were in their working age (18-63 years) and who were part of the labor force one 10 year post diagnosis. 11 Primary and secondary outcome measures: By use of multi-state models in Cox proportional 12 hazards models we analyzed the hazard ratio for re-employment, sickness absence and retirement in 13 models including clinical as well as health related variables. <u>Results:</u> One year after diagnosis 62% were working and 58% continued until end of follow-up. 14 15 Socioeconomic factors were found to be associated with retirement but not with sickness absence 16 and return to work. The risk for transition from work to sickness absence was increased if the 17 disease was diagnosed at a later stage (stage III) 1.52 (95% CI: 1.21-1.91), not operated curatively 18 1.35 (95% CI: 1.11-1.63) and with occurrence of post-operative complications 1.25 (95% CI: 1.11-19 1.41). The opposite was found for the transition from sickness absence back to work. 20 Conclusion: This nationwide study of colorectal cancer patients who have survived one year shows 21 that stage of disease, general health state of the individual, post-operative complications and the 22 history of sickness absence and unemployment have an impact on the transition between work, 23 sickness absence and disability pension. This leads to an increased focus on the rehabilitation 24 process for the more vulnerable persons who have a combination of severe disease and a history of 25 work related problems with episodes outside the working market.

Page 3 o	of 51	BMJ Open
1		
2 3 4	1	
5	י ר ר	Article summery
7 8	2	
9 10	3	<u>Article focus:</u>
11 12	4	• How many colorectal cancer survivors return to work, stay at sickness absence, get unemployed
13 14	5	or become pensioners in the years following diagnosis?
15 16	6	• Does socioeconomic position or clinical factors predict re-employment, sickness absence,
17 18	7	unemployment or pension in this cohort?
19 20	8	Key messages:
21 22 23	9	• First study to differentiate between re-employment, sickness absence, unemployment and
24 25	10	retirement in a cohort of colorectal cancer survivors.
26 27	11	• One year after diagnosis 62% had resumed work.
28 29	12	• Socioeconomic factors were associated with early retirement whereas clinical factors were
30 31 22	13	found to be associated with sickness absence and re-employment.
32 33 34	14	Strengths and limitations:
35 36	15	• This is a longitudinal nationwide population based study including more than 4000 persons
37 38	16	diagnosed with colorectal cancer.
39 40	17	• The study identifies an association between socioeconomic position / clinical factors and re-
41 42 43	18	employment / sickness absence / pension but is not able to identify mechanisms behind.
44 45	19	
46 47	20	What is new in this paper:
48 49	21	Very few studies have analyzed the impact colorectal cancer has on the affiliation to the labor
50 51 52	22	market. In this study we are able to identify clinical and socioeconomic risk factors for sickness
52 53 54	23	absence, work resumption and retirement.
55 56		
57 58		
59 60		

## 

# **1. Introduction**

In 2008 nearly 500.000 persons in Europe were diagnosed with colorectal cancer 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 to 2002 from 50% to 60% among persons aged 15 to 59 years<sup>3</sup>.

7 Throughout Europe life expectancy has increased leading to higher age at pension and longer time 8 in the workforce. As the risk of colorectal cancer increases with age, it can be expected that still 9 more persons will be diagnosed with colorectal cancer while they are an active part of the

10 workforce.

Few studies have analyzed the impact of colorectal cancer on work participation in the years following diagnosis and treatment. The existing studies reported that 2/3 of those working at time of diagnosis resume work in the years after treatment. Risk factors for work cessation were high age; radiation therapy and co-morbidity <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 has 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 13;18-22 

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, i.e.

# BMJ Open

2		
3 4 5	1	unemployment, sickness absence or disability pension and the transition from a cancer diagnosis to
6 7	2	one of these outcomes could very well differ according to different risk factors.
8 9	3	These transitions between different states (e.g. from sickness absence to work, or from sickness
10 11	4	absence to disability) can be modeled by using multi-state models <sup>23</sup> . Multi-state models are well-
12 13	5	known statistical models used for event history analysis, e.g. the study of survival. The application
14 15	6	of statistical models for survival analysis in the analysis of sickness absence is relatively new <sup>24;25</sup>
16 17 19	7	and the use of multi-state models is mainly due to Lie et al <sup>26</sup> , but multi-state models have also been
19 20	8	applied by other researchers <sup>27;28</sup> .
20 21 22	9	By use of detailed, nationwide, population based registers the aim of this study is to evaluate the
23 24	10	impact of both socioeconomic and clinical factors on the transitions between work, sickness
25 26	11	absence and retirement in a cohort of colorectal cancer survivors and to test for interaction between
27 28	12	clinical and socioeconomic factors
29 30	12	childen and socioeconomic factors.
31 32	15	
33 34	14	2. Materials and methods
35 36	15	This study is based on Danish population based registers linked together with the unique personal
37 38	16	identification code given to all Danish residents.
39 40	17	
41 42	18	Danish Colorectal Cancer Group (DCCG)
43 44	19	The study population was derived from the national database of DCCG which includes around 93%
45 46	20	of patients in Denmark with a first-time adenocarcinoma of the rectum (ICD-10: C20) or colon
47 48 40	21	(ICD-C18). This database comprises prospectively collected data registered by surgeons. The
49 50 51	22	database has previously been used in epidemiological studies and is described in details elsewhere
52 53	23	$^{29}$ . From the database we obtained clinical data with relevance for the probability of returning to
54 55	24	work after treatment. Entry into the study was equal to date of surgery and was used to calculate the
56 57	27	work after reachent. Entry into the study was equal to date of surgery and was used to calculate the

follow-up time. Variables describing the disease were cancer type and tumor stage classified according to the International Union Against Cancer (UICC). Information about surgical procedure was included as 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 time of surgery was measured by ASA score (according to the American Society of Anesthesiologists) where patients are categorized into five subgroups by preoperative physical fitness reaching from I - A completely healthy patient to V - A moribund patient who is not expected to live 24 hours with or without surgery. ASA score 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, intra-abdominal 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 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 length of study (primary school 9-12 years of education, vocational and short education 13-15 years, medium and long education more than 16 years and unknown). Job type was classified as management and knowledge work (e.g. leaders, doctors and teachers at high school), office and sale (e.g. secretary, police and nurses) and manual work (e.g. farmers, craftsmen and social and health care assistants). In order to obtain information on disposal income for the family we also identified partners and

## **BMJ Open**

2		
3 4	1	their income Disposal income was calculated as the average of the family income three years
5	1	then meetine. Disposal meetine was calculated as the average of the failing meetine three years
6 7	2	before the year of diagnosis and was deflated according to the 2000 value of the Danish kroner.
8 9	3	Education, job type and disposal income were combined under the heading socioeconomic status
10 11	4	(SES).
12 13	5	
14 15 16	6	The Danish National Patient Registry (NPR)
17 18	7	This register holds information on all hospitalizations and outpatient visits in Denmark since 1978.
19 20	8	In this study we used information of date of admission and discharge and diagnosis coded according
21 22	9	to the International Classifications of Diseases (ICD-10) <sup>31</sup> .
23 24	10	
25	10	
26 27	11	The Register of Medical Product Statistics (RMPS)
28 29	12	Since 1995 every medical product sold on prescription by Danish pharmacies has been registered.
30 31 32	13	From this register we had information on date for redemption of the prescription and substance
32 33 34	14	classified according to the anatomical-therapeutic-chemical (ATC) system <sup>32</sup> .
35 36	15	
37 38	16	Co-morbidity preceding five years before the year of diagnosis was obtained from NPR and RMPS.
39 40	17	As comorbidity we included cardiovascular disease, chronic obstructive pulmonary disease,
41 42 42	18	diabetes and liver, kidney or connective tissue diseases – diseases which are all part of the Charlson
43 44 45	19	index. Comorbidity was stated if one or more of these diseases were present at time of diagnosis.
46 47	20	
48 49	21	Register based Evaluation of Marginalization (DREAM)
50 51	22	The Danish labor market is characterized as a flexicurity system with a high degree of economic
52 53 54	23	compensation in case of unemployment or reduced work ability (security) but also with a high
55 56 57	24	turnover rate (flexible). Unemployed persons are warranted economic compensation if they are
58		

actively seeking job. During the study period it was possible to receive a maximum of four years of unemployment benefit. After the end of these four years or if a person is not qualified for unemployment benefit (i.e. 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 two years or 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. 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 in 2001 until week 13 in 2011. In work was defined as not receiving any social transfer payments for six 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 withdraw from the workforce not caused by disability.

*Study population* 

In the years 2001 to 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 consists of 4.343 persons aged 18-63 years, who were part of the workforce and survived the first postoperative year (fig. 2). The follow-up period of this population was between 65 weeks (for persons diagnosed in the last week of 2009) to 535 week (for persons diagnosed in the first week of 2009) to 535 week (for persons diagnosed in the first week of 2009) to 535 week (for persons diagnosed in the first week of 2009) to 535 week (for persons diagnosed in the first week of 2001) leading to 12.569 person years.

### **BMJ Open**

2				
3				
4 5	1			
6 7	2	Outcome data		
8 9	3	For every person in the study population labour market status was recorded on a weekly basis until		
10 11	4	the person reached the age limit of 63 years, emigrated, died, or until the end of follow-up		
12 13	5	whichever came first. Labour market status was categorized in four different 'states': work,		
14 15 16	6	sickness absence, unemployment, and disability. The multi-state model is a model for the nine		
17 18	7	possible transitions between these four states (Figure 1).		
19 20	8			
21 22	9	Statistical analysis		
23 24 25	10	Descriptive analysis by use of chi <sup>2</sup> and t-tests was conducted in order to examine the characteristics		
26 27	11	of the sample. The outcome data was recoded and for each person time spent in one of the four		
28 29	12	states was registered. Furthermore it was registered if a transition to another state occurred at the		
30 31 22	13	end of the persons stay in the state, and, if so, what state the person shifted to. The time spent in the		
32 33 34	14	state was censored if the person died, emigrated, or shifted to a social transfer payment that did not		
35 36	15	fit any of the four states.		
37 38	16			
39 40 41	17	Each of the nine possible transitions shown in Figure 1 was analysed using the Cox proportional		
41 42 43	18	hazards model in SAS (The PHREG procedure, SAS version 9.2). The time scale used was duration		
44 45	19	of stay in current state.		
46 47	20	The variables education, disposal income, job type, type of cancer, cancer stage, comorbidity, ASA		
48 49	21	score, curative operation, type of operation, post-operative complications were included as time		
50 51 52	22	constant covariates. Three time dependent covariates were also included: number of times the		
53 54 55	23	person been employed, had been sick-listed, or unemployment since the start of follow up.		
56 57 58 59				

	BMJ Open
1	Because the baseline hazard for each state was allowed to vary freely, the covariate relied on the
2	assumption of proportionality.
3	
4	3. Results
5	Table 1 shows the baseline characteristics for all patients stratified on those excluded during the
6	first year after diagnosis (N=1689) and the study population (N=4343). Compared to the excluded
7	population the study population was diagnosed with significantly less severe disease and higher
8	SES at time of inclusion.
9	One year after operation 62% of the study population were in work while 32% were sick listed and
10	6% were unemployed (Table 2). Of those who were working, 58% continued working for an
11	average of 136 weeks.
12	Table 3 and 4 shows the Hazard Ratio (HR) for transitions between work and sickness absence and
13	reverse. Previous periods of sickness absence and unemployment reduced the rate of returning to
14	work with 7% and 12% per episode, whereas previous episodes of work increased the rate of both
15	work and sickness absence. In addition, we found that increasing levels of education increased the
16	rate of transition from work back to sickness absence.
17	Return to work after a period of sickness absence (Table 3) was less common among cancer
18	survivors who were operated in an advanced stage of disease, who did not have curative surgery
19	and who suffered postoperative complications.
20	Sickness absence following a period of work was primarily associated with disease related factors
21	(Table 4). In contrast to return to work, patients diagnosed with rectal cancer had an increased risk
22	for sickness absence (HR=1.17 (1.03-1.32)) compared to those operated for colonic cancer.
23	Furthermore we found that an ASA score on III increased the risk for sickness absence with almost
24	40%.

1	
י י	
2	
3	
4	
5	
6	
7	
8	
0	
9	
10	
11	
12	
13	
14	
15	
10	
10	
17	
18	
19	
20	
21	
22	
22	
23	
24	
25	
26	
27	
28	
29	
30	
21	
20	
32	
33	
34	
35	
36	
37	
38	
20	
39	
40	
41	
42	
43	
44	
45	
46	
47	
10	
40	
49	
50	
51	
52	
53	
54	
55	
56	
50	
5/	
58	
59	

60

1	The risk factors associated with permanently withdrawal from the labor market one year after
2	operation are shown in Table 5. Since the transition from work and unemployment to retirement
3	follows the same pathways, these groups were joined in order to gain more power. The risk for
4	retirement was not only related to the disease but also to SES. Manual work and increasing disposal
5	income reduces the risk for retirement after an episode of sickness absence and work, respectively.
6	Compared to patients in work, the HR for retirement was 5.89 (3.46-10.03) among unemployed
7	survivors.
8	Advanced stage at diagnosis and high ASA score increased the risk for retirement among both
9	groups.
10	Finally, we analyzed for effect modification by adding an interaction in the logistic model between
11	disposal income as the strongest socioeconomic predictor and type of cancer, stage of disease, type
12	of operation and post-operative complications. We did not find any significant effect modification
13	between socioeconomic factors and disease related factors (Data not shown).
14	
15	4. Discussion and conclusion
16	In this cohort study including 4343 Danish colorectal cancer patients, who were part of the
17	workforce after the first postoperative year, we found that 62% were working one year after
18	operation.
19	One year after operation previous episodes of sickness absence and unemployment, cancer stage at
20	diagnosis, curative operation and post-operative complications were associated with labor market
21	affiliation during follow-up whereas SES was only weakly associated with the transition between
22	the different occupational states.
Page 12 of 51

2
3
4
4
5
6
7
0
0
9
10
11
12
12
13
14
15
16
17
17
18
19
20
21
21
22
23
24
25
20
20
27
28
29
20
30
31
32
33
3/
25
35
36
37
38
20
39
40
41
42
12
44
45
46
47
-т <i>і</i> ЛО
40 40
49
50
51
52
52
53
54
55
56
50
5/
58
59
60

1

The observed rate of return to work is in accordance with previous studies on colorectal cancer
 survivors, where return to full time employment was reported in 60%-89% dependent on time from
 diagnosis, definition of return to work and severity of the disease.

4 In this study we decided only to include survivors, who were still part of the workforce one year 5 after operation, based on a notion that it is not clinical relevant to study full return to work before 6 the end of a one-year survival period. In this selected group of patients the observed resumption of 7 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 8 9 consensus regarding definition and measurement of return to work. Thus, in some studies return to 10 work is simply the number of persons working at 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 11 12 the workforce at time of follow-up, and in still other studies working is self-reported and covers from one week to permanently re-employed <sup>34</sup> 13

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 seems to follow different pathways. Leaving the workforce for any type of pension is an irreversible process and is assigned when work demands exceeds health and mental resources and is thus dependent on both health and work related factors. On the other hand, unemployment and sickness absence both include conditions with an expectation of resuming work and is more related to either SES or health, respectively.

21 The exclusion of persons who take disability pension the first year and the lower social one-year
22 survival after colorectal cancer among socially deprived might explain our finding of no effect of
23 SES on work and sickness absence one year after diagnosis of colorectal cancer. It seems as a

Page 13 of 51

1 2

#### **BMJ Open**

3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32 ეე	
აა ე⊿	
34 25	
38 22	
30 37	
38 38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53 54	
54 57	
25 56	
00 57	
57 50	
50 50	
-	

60

1 'healthy worker effect' where the most affluent survive the first year without leaving the workforce2 for disability pension.

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

5 The risk for transition from work to sickness absence was increased if the disease was diagnosed at 6 a later stage, not operated curatively and with occurrence of post-operative complications. The

7 opposite was found for the transition from sickness absence back to work. The association between

8 disease related factors and resuming of work after a cancer diagnosis including colorectal cancer

9 has been observed in other studies where tumor stage  $^{13;36}$ , treatment  $^{4;36}$ , physical symptoms  $^{16}$  and

10 ASA-score were reported to be negatively associated with return to work.

11 We found that persons diagnosed with rectal cancer had a significant increased risk for sickness

12 absence and retirement possibly due to the fact that this patient group in contrast to colon cancer

patients more often will have to learn to take care of an ostomy or suffer from abnormal bowl and

14 urinary function years after the operation <sup>37</sup>. Unfortunately, we could not account for these factors in

15 our analysis.

16

17 Strengths and limitations

18 The present study is based on data from a well-defined clinical database of all Danish colorectal

19 cancer patients. The database has a high completeness and data validity and missing values are

20 random and not associated with the outcome under study whereby selection-bias is removed.

21 Variables regarding socioeconomic position and the affiliation to the labour market are

22 administrative data collected prospectively why recall-bias is eliminated.

23 This study has, however, some limitations. First of all we were not able to include complementary

treatment 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 six 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 expenditures to social protection in the Nordic countries including Denmark is higher compared to the rest of the European Union and countries as US and Canada they 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.

16 Conclusion

This nationwide study of colorectal cancer patients who have survived one year shows that 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 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 complications and stage of disease has on the work ability in order to reduce the risk for sickness absence and retirement years after operation.

1		
2		
3	1	
4 5	1	
6 7	2	Acknowledgment
8 9	3	This work is funded by The Danish Cancer Society and The Novo Nordisk Foundation and is part
10 11 12	4	of The Centre for Integrated Rehabilitation of Cancer Patients (CIRE).
12 13 14	5	
15 16	6	Ethics approval: The study based solely on national and administrative registers and did not
17 18	7	require any approval from the ethics committee according to national regulations.
19 20 21	8	
22	9	Author contribution:
23 24	10	Study conception and design: All authors
25	11	Acquisition of data: Merete Osler and Kathrine Carlsen
26 27	12	Analysis of data: Kathrine Carlsen
28 29	13	Interpretation of data: All authors
30 31	14	Writing manuscript: All authors
32	15	
33 34	16	Funding
35 26	17	Funded by The Danish Cancer Society and The Novo Nordisk Foundation.
37	18	
38 39	19	Competing Interests
40 41	20	None
42	21	
43 44	22	Data Sharing
45 46 47 48 49 50 51 52 52	23	No additional data
53 54 55 56 57 58 59		

Figure Legends : Figure 1: Transition states between labor market outcomes in Denmark. Work, 

- sickness absence and unemployment covers persons in the workforce while retirement independent
- of reason (disability or age) are an irreversible state, where persons are considered to leave the workforce forever.
- population\*.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

#### **BMJ Open**

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). Divided into those who were excluded during the first year due to retirement or
death (N=1689) and the included persons (N=4343).

	Evaluaded during the first	Included often the first ween	D
	Excluded during the first	Included after the first year	Р
	year N (%)	N (%)	0004
Education			<.0001
Primary school	584 (35)	1244 (29)	
Vocational and short education	781 (46)	2037 (47)	
Medium and long education	324 (19)	1062 (24)	
Unknown	0 (0)	0 (0)	
Disposal income (DKr.)			<.0001
Mean	192 206	210 807	
Job type			<.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)	
Conder	205 (12)	526 (12)	0.02
Waman	601 (41)	1012 (44)	0.05
Women	091 (41)	1913 (44)	
Men	998 (59)	2430 (56)	1 0001
Age		52.0	<.0001
Mean	56.6	53.8	
Country of birth			0.02
Denmark	1637 (97)	4150 (96)	
Other	52 (3)	193 (4)	
Marital status			<.0001
Married / cohabiting	1042 (62)	3162 (73)	
Single	494 (29)	1154 (26)	
Unknown	153 (9)	27 (1)	
Vear of operation			0.55
2001	104 (6)	309 (7)	0.55
2001	178 (10)	509 (7) 458 (10)	
2002	178 (10)	438 (10)	
2003	1/6 (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			<.0001
Colonic	1063 (63)	2464 (57)	
Rectal	626 (37)	1879 (43)	
Stage			<.0001
I	306 (18)	1535 (35)	
П	43 (3)	146 (3)	
ш	351 (21)	1411 (32)	
IV	858 (51)	760 (18)	
Unknown	131 (8)	491 (11)	
Comorbidity	131 (0)	7/1 (11)	< 0001
Comorbialty			<.0001
N	1447 (0()	4010 (02)	
No	1447 (86)	4018 (93)	
No Yes	1447 (86) 224 (14)	4018 (93) 325 (7)	
No Yes ASA	1447 (86) 224 (14)	4018 (93) 325 (7)	<.0001
No Yes ASA I	1447 (86) 224 (14) 484 (29)	4018 (93) 325 (7) 2168 (50)	<.0001
No Yes ASA I II	1447 (86) 224 (14) 484 (29) 771 (46)	4018 (93)           325 (7)           2168 (50)           1731 (40)	<.0001
No Yes ASA I II ->III	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14)	4018 (93) 325 (7) 2168 (50) 1731 (40) 172 (4)	<.0001
No Yes ASA I II ->III Unknown	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11)	4018 (93) 325 (7) 2168 (50) 1731 (40) 172 (4) 272 (6)	<.0001
No Yes ASA I II ->III Unknown Curative operation	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)	<.0001
No Yes ASA I II ->III Unknown Curative operation Yes	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40)	4018 (93) 325 (7) 2168 (50) 1731 (40) 172 (4) 272 (6) 3278 (75)	<.0001
No Yes ASA I II ->III Unknown Curative operation Yes No	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52)	4018 (93) 325 (7) 2168 (50) 1731 (40) 172 (4) 272 (6) 3278 (75) 867 (20)	<.0001
No Yes ASA I II ->III Unknown Curative operation Yes No Unknown	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8)	4018 (93) 325 (7) 2168 (50) 1731 (40) 172 (4) 272 (6) 3278 (75) 867 (20) 198 (5)	<.0001
No Yes ASA I II ->III Unknown Curative operation Yes No Unknown Type of operation	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)	<.0001
No Yes ASA I II ->III Unknown Curative operation Yes No Unknown Type of operation Rectal resection	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8) 228 (14)	4018 (93) 325 (7) 2168 (50) 1731 (40) 172 (4) 272 (6) 3278 (75) 867 (20) 198 (5) 206 (5)	<.0001 <.0001 <.0001
No Yes ASA I I ->III Unknown Curative operation Yes No Unknown Type of operation Rectal resection Rectal resection	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8) 228 (14) 306 (18)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)         206 (5)         1352 (31)	<.0001 <.0001 <.0001
No Yes ASA I I Unknown Curative operation Yes No Unknown Type of operation Rectal resection Colonic resection	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8) 228 (14) 306 (18)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)         206 (5)         1352 (31)	<.0001 <.0001 <.0001
No Yes ASA I I Unknown Curative operation Yes No Unknown Type of operation Rectal resection Colonic resection Explorative laparotomy or formation of an ostomy	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8) 228 (14) 306 (18) 527 (22)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)         206 (5)         1352 (31)         1445 (32)	<.0001 <.0001 <.0001
No Yes ASA I I Unknown Curative operation Yes No Unknown Type of operation Rectal resection Colonic resection Explorative laparotomy or formation of an ostomy Local procedures	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8) 228 (14) 306 (18) 537 (32) 537 (32)	4018 (93) 325 (7) 2168 (50) 1731 (40) 172 (4) 272 (6) 3278 (75) 867 (20) 198 (5) 206 (5) 1352 (31) 1445 (33)	<.0001 <.0001 <.0001
No Yes ASA I I J ->III Unknown Curative operation Yes No Unknown Type of operation Rectal resection Colonic resection Colonic resection Explorative laparotomy or formation of an ostomy Local procedures Unknown	1447 (86) 224 (14) 484 (29) 771 (46) 240 (14) 194 (11) 677 (40) 884 (52) 128 (8) 228 (14) 306 (18) 537 (32) 367 (22)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)         206 (5)         1352 (31)         1445 (33)         1197 (28)	<.0001 <.0001 <.0001
No Yes ASA I I ->III Unknown Curative operation Yes No Unknown Type of operation Rectal resection Colonic resection Explorative laparotomy or formation of an ostomy Local procedures Unknown	1447 (86)         224 (14)         484 (29)         771 (46)         240 (14)         194 (11)         677 (40)         884 (52)         128 (8)         228 (14)         306 (18)         537 (32)         367 (22)         251 (15)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)         206 (5)         1352 (31)         1445 (33)         1197 (28)         143 (3)	<.0001 <.0001 <.0001
No Yes ASA I I Unknown Curative operation Yes No Unknown Type of operation Rectal resection Colonic resection Explorative laparotomy or formation of an ostomy Local procedures Unknown Post-operative complications	1447 (86)         224 (14)         484 (29)         771 (46)         240 (14)         194 (11)         677 (40)         884 (52)         128 (8)         228 (14)         306 (18)         537 (32)         367 (22)         251 (15)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)         206 (5)         1352 (31)         1445 (33)         1197 (28)         143 (3)	<.0001 <.0001 <.0001
No Yes ASA I I Unknown Curative operation Yes No Unknown Type of operation Rectal resection Colonic resection Explorative laparotomy or formation of an ostomy Local procedures Unknown	1447 (86)         224 (14)         484 (29)         771 (46)         240 (14)         194 (11)         677 (40)         884 (52)         128 (8)         228 (14)         306 (18)         537 (32)         367 (22)         251 (15)         1448 (86)	4018 (93)         325 (7)         2168 (50)         1731 (40)         172 (4)         272 (6)         3278 (75)         867 (20)         198 (5)         206 (5)         1352 (31)         1445 (33)         1197 (28)         143 (3)         3689 (85)	<.0001 <.0001 <.0001 0.44

- 1 Table 2
- 2 Mean number of weeks from one state of employment to the next among 4343 patients aged 18-63
- 3 years diagnosed with colorectal cancer in the years 2001 to 2009 and part of the workforce at time 4 of follow-up

of follow-up.					
Mean time in weeks from one year	To work	To sickness	То	То	To censoring
after operation and first change in		absence	unemploy-	retirement	due to age,
employmental state (% of population	)		ment		dead,
	·				migration or
					end of
					follow-up
From work (N=2679 / 62%)		57 (31%)	63 (10%)	75 (1%)	136 (58%)
From sickness absence (N=1406 /	16 (249/)		20 (0%)	20 (200/)	26 (20%)
32%)	16 (34%)		29 (9%)	30 (28%)	36 (30%)
From unemployment (N=258/ 6%)	22 (47%)	28 (17%)		63 (13%)	77 (23%)

1

2
3
1
4
5
6
7
6
8
9
10
11
11
12
13
14
45
15
16
17
18
10
19
20
21
20
22
23
24
25
20
26
27
28
20
29
30
31
22
32
33
34
35
200
30
37
38
20
59
40
41
42
12
43
44
45
16
40
47
48
49
E0
50
51
52
53
55 E 4
54
55
56
57
57
БQ

59 60

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 to 2009, and part of the work force at time of follow-up.

0	IID	IID	IID - Lord IC	IID - Located for
GIOWIEGG ADGENIGE NUCERY	HK – unadjusted	HK - ajusted for	HK - adjusted for	HK - adjusted for
SICKNESS ABSENCE $\rightarrow$ WORK	(events: 2125)	SES§	SES§ and	SES§, confounders and
			confounders*	clinical variables
Education				
Primary school	1	1	1	1
Vocational and short education	0.87 (0.76-0.98)	0.91 (0.79-1.05)	0.91 (0.78-1.04)	0.92 (0.79-1.06)
Medium and long education	1.01 (0.91-1.13)	1.09 (0.96-1.24)	1.08 (0.95-1.23)	1.06 (0.93-1.21)
Disposal income #				
Lowest quartile	1	1	1	1
Second lowest quartile	1.11 (0.97-1.26)	1.03 (0.90-1.17)	1.01 (0.88-1.15)	1.07 (0.94-1.22)
Second highest quartile	1.27 (1.12-1.44)¤	1.14 (1.00-1.29)	1.12 (0.98-1.27)	1.15 (1.00-1.31)
Highest quartile	1.25 (1.10-1.42)¤	1.15 (1.00-1.33)	1.14 (0.99-1.3'2)	1.16 (1.00-1.34)
Job type				
Management and knowledge work	1.18 (0.95-1.22)	1.10 (0.90-1.28)	1.10 (0.94-1.28)	1.11 (0.95-1.30)
Office and sale (non-manual)	1.07 (0.97-1.17)	1.07 (0.97-1.19)	1.09 (0.98-1.22)	1.10 (0.99-1.23)
Manual	1	1	1	1
Other	0.71 (0.58-0.87)	0.71 (0.57-0.86)¤	1.17 (0.50-2.29)	0.88 (0.37-1.73)
Previous periodsof work				· · · · · · · · · · · · · · · · · · ·
	1.01 (1.01-1.02)¤	1.13 (1.11-1.16)¤¤	1.13 (1.11-1.16)aa	1.13 (1.11-1.16)¤¤
Previous periods of sickness absence				· · · · · · · · · · · · · · · · · · ·
1	1.05 (1.04-1.05)aa	0.94 (0.92-0.96)¤¤	0.94 (0.92-0.96)¤¤	0.93 (0.91-0.95)¤¤
Previous periods of unemployment				· · · · · · · · · · · · · · · · · · ·
·····	0.98 (0.98-0.99)¤	0.89 (0.87-0.91)aa	0.89 (0.87-0.91)aa	0.88 (0.87-0.90)¤¤
Type of cancer				
Colonic	1			1
Rectal	1.01 (0.93-1.10)			0.96 (0.84-1.08)
Stage				· · · · · · · · · · · · · · · · · · ·
Ĩ	1			1
II	0.73 (0.56-0.94)¤			0.82 (0.62-1.06)
III	0.76 (0.69-0.84)aa			0.74 (0.66-0.82)¤¤
IV	0.36 (0.31-0.41)aa			0.53 (0.41-0.68) aa
Unknown	1.14 (1.00-1.30)			1.15 (0.96-1.39)
Comorbidity				· · · · · · · · · · · · · · · · · · ·
No	1			1
Yes	0.81 (0.73-0.89)¤			0.90 (0.82-1.00)
ASA				
I	1			1
Г П	0.84 (0.77-0.92)¤			0.93 (0.85-1.03)
>111	0.67 (0.52-0.84)¤			0.85 (0.65-1.07)
Unknown	0.89(0.73-1.06)			1.07(0.79-1.41)
Curative Loneration				
Yes	1			1
No	0 43 (0 38-0 49)gg			0.69 (0.55-0.86)¤
Unknown	0.83(0.68-1.02)			0.90(0.62 - 1.26)
Type of operation				
Rectal resection	1			1
Colonic resection	0.95 (0.85-1.05)			-
Explorative lanarotomy or formation of	0.95 (0.05-1.05)			0.75 (0.05-1.07)
an ostomy	0.99 (0.89-1.10)			1.06 (0.91-1.23)
L ocal procedures	0.65 (0.50-0.83)			0.76(0.57-1.00)
Unknown	$0.03(0.30-0.03)^{\circ}$ 0.33(0.22-0.48)00			0.48 (0.30-0.75)m
Post_onerative complications	0.55 (0.22-0.40)202			0.10 (0.50-0.15)~
No	1			1
Vec	1 0 84 (0 74-0 94)¤			0 82 (0 72-0 92)m
100	0.07 (0.7 <b>-</b> 0.7 <b>-</b> ) <sup>Q</sup>		1	0.02 (0.12-0.12)

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

34567

¤¤ Significant at a <.0001 level

1 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 to 2009, and part of the work force at time of follow-up.

**BMJ Open** 

diagnosed with colorectar cancer in	tile years 2001 to 2009, and	balt of the work force at time	of follow-up.	
	HR - unadjusted	HR - ajusted for SES§	HR - adjusted for SES§	HR - adjusted for SES§,
WORK $\rightarrow$ SICKNESS ABSENCE	(events: 2296)		and confounders*	confounders* and
				clinical variables
Education				
Primary school	1	1	1	1
Vocational and short education	1 25 (1 11-1 41)¤	1 10 (0 96-1 27)	1 10 (0 96-1 27)	1.07(0.93-1.23)
Medium and long education	1.40 (1.26-1.56)00	1.22(1.08-1.38)	1.10(0.901.27)	1.18 (1.04-1.34)
	1.40 (1.20-1.50)	1.22 (1.00-1.50)~	1.21 (1.07-1.57)~	1.18 (1.04-1.54)~
Disposal income #				
Lowest quartile	1	1	1	1
Second lowest quartile	1.18 (1.04-1.33)	1.18 (1.05-1.34)¤	1.17 (1.03-1.33)	1.13 (0.99-1.28)
Second highest quartile	1.02 (0.91-1.16)	1.04 (0.92-1.18)	1.02 (0.90-1.16)	1.00 (0.88-1.14)
Highest quartile	0.82 (0.73-0.94)¤	0.99 (0.87-1.14)	0.99 (0.86-1.14)	0.96 (0.84-1.11)
Job type				
Management and knowledge	0.69 (0.61-0.78)¤¤	0.96 (0.83-1.12)	0.97 (0.84-1.14)	0.95 (0.82-1.11)
work	0.89 (0.82-0.98)	1.00(0.91-1.10)	1.00(0.91-1.12)	1.00(0.90-1.11)
Office and sale (non-manual)	1	1	1	1
Manual	0.67 (0.54-0.83)	0.84 (0.67 - 1.04)	1 00 (0.48 - 1.82)	1.06(0.51-1.93)
Other	0.07 (0.54-0.85)≈	0.04 (0.07-1.04)	1.00 (0.46-1.62)	1.00 (0.51-1.75)
Previous episodes of work				
	1.03 (1.03-1.03)aa	1.02 (1.01-1.04)¤	1.02 (1.01-1.04)¤	1.03 (1.01-1.04)¤
Previous episodes of sickness				
absence	1.10 (1.09-1.11)¤¤	1.08 (1.06-1.09)¤¤	1.08 (1.06-1.09)¤¤	1.08 (1.06-1.09)¤¤
Previous episodes of				
unemployment	1.01 (1.01-1.02)¤	0.98 (0.97-0.99)¤	0.98 (0.97-0.99)¤	0.98 (0.97-0.99)¤
Type of cancer				
Colonic	1			1
Rectal	1 10 (1 01-1 19)			1 17 (1 03-1 32)¤
Stage				
I	1			1
I II	1 0 07(0 74 1 25)			$1 \\ 0.00(0.75, 1.28)$
	1.20(1.1(.1.41))			0.99(0.73-1.26)
	1.29 (1.16-1.41) <sup>Q</sup>			1.24 (1.11-1.37) <sup>Q</sup>
IV	1.63 (1.40-1.88) <sup>aa</sup>			1.52 (1.21-1.91)¤
Unknown	1.11 (0.98-1.25)			1.08 (0.91-1.29)
Co-morbidity				
No	1			1
Yes	0.99 (0.90-1.08)			1.05 (0.96-1.16)
ASA				
I	1			1
П	1 09 (1 00-1 19)			1 09 (0 99-1 20)
	1 42 (1 12-1 75)g			1 33 (1 05-1 67) <sup>T</sup>
Unknown	$1.02(0.85-1.75)^{\sim}$			0.92 (0.70-1.19)
Curative operation	1.02 (0.03-1.21)			0.92 (0.70-1.19)
Vac	1			1
ies				1
NO	1.43 (1.26-1.61)00			1.35 (1.11-1.63) <sup>Q</sup>
Unknown	1.05 (0.87-1.29)		-	1.0/(0.//-1.45)
Type of operation				
Rectal resection	1			1
Colonic resection	1.0 (0.91-1.11)			1.10 (0.97-1.25)
Explorative laparotomy or				
formation of an ostomy	0.91 (0.82-1.01)			1.05 (0.91-1.22)
Local procedures	0.72 (0.56-0.91)¤			0.78 (0.60-1.01)
Unknown	0.93 (0.66-1.26)			0.81 (0.53-1.20)
Post-operative complications				
No	1			1
Vec	1 18 (1.05 1.21)			1 25 (1 11 1 41)0
105	1.10 (1.05-1.51)			1.20 (1.11-1.41)

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

§ SES (Socioeconomic status): education, disposal income and job type

¤ Significant at a 0.05 level

¤¤ Significant at a <.0001 level

2 Table 5: HR (95% CI) for retirement in relation to socioeconomic and clinical factors among 4343 patients aged 18-63 diagnosed with colorectal

sickness absence	work / unemployed >
sickness absence ->	work / unemployed ->
events:560)	events: 109)
Cronts.507	events. 107)
	1
	5.89 (3.46-10.03)¤¤
1	1
1.13 (0.85-1.51)	1.29 (0.65-2.69)
1.06 (0.81-1.41)	1.24 (0.64-2.53)
1	1
0.95 (0.76-1.19)	0.49 (0.27-0.85)¤
0.77 (0.60-0.98)¤	0.47 (0.25-0.83)¤
0.79 (0.60-1.04)	0.29 (0.14-0.57)¤
0.50 (0.40.0.00)	0.00 (0.05.1.00)
0.59 (0.42-0.82)¤	0.93 (0.85-1.03)
0.72 (0.580.89) <sup>Q</sup>	0.90 (0.80-1.06)
1 05 (0.06-4.85)	$1 \\ 0.38 (0.12 - 1.37)$
1.03 (0.00-4.03)	0.50 (0.12-1.57)
0.98 (0.95-1.00)	0.93 (0.85-1.03)
0.50 (0.55-1.00)	0.75 (0.05-1.05)
1 00 (0 97-1 02)	0.96 (0.86-1.06)
1.00 (0.97 1.02)	0.50 (0.00 1.00)
1.03 (1.00-1.05)¤	1.02 (0.94-1.11)
1	1
1.32 (1.04-1.67)¤	1.33 (0.75-2.34)
1	1
0.85 (0.46-1.46)	1.70 (0.49-4.51)
1.13 (0.89-1.44)	1.91 (1.15-3.21)¤
1.58 (1.04-2.42)¤	2.30 (0.88-6.14)
1.01 (0.68-1.50)	1.72 (0.82-3.59)
1	
1 1.02 (0.85 1.24)	I 1 17 (0 76 1 77)
1.03 (0.83-1.24)	1.17 (0.76-1.77)
1	
1 31 (1 08-1 58)¤	$1 1 56 (1 00-2 44) \sigma$
2.16 (1.49-3.06)¤	2.57 (1.03-5.75)¤
1.29 (0.76-2.09)	1.64 (0.50-4.24)
1	1
1.30 (0.89-1.86)	1.80 (0.77-3.84)
1.41 (0.75-2.51)	1.05 (0.19-4.01)
1	1
1.42 (1.11-1.81)¤	1.36 (0.74-2.51)
1.06 (0.78-1.43)	1.23 (0.55-2.32)
1.01 (0.53-1.84)	0.39 (0.08-1.26)
1.45 (0.93-2.18)	0.84 (0.16-3.13)
1	
1 1.23 (1.00-1.51)¤	1 0.86 (0.47-1.46)
	HR for transition from sickness absence -> retirement (number of events:569)            1         1.13 (0.85-1.51)         1.06 (0.81-1.41)         1         0.95 (0.76-1.19)         0.77 (0.60-0.98) $\square$ 0.79 (0.60-1.04)         0.59 (0.42-0.82) $\square$ 0.79 (0.60-1.04)         0.59 (0.42-0.82) $\square$ 0.79 (0.60-1.04)         0.59 (0.42-0.82) $\square$ 0.72 (0.580.89) $\square$ 1         1.05 (0.06-4.85)         0.98 (0.95-1.00)         1.00 (0.97-1.02)         1.03 (1.00-1.05) $\square$ 1         1.32 (1.04-1.67) $\square$ 1         1.33 (0.85-1.24)         1         1.31 (1.08-1.58) $\square$ 2.16 (1.49-3.06) $\square$ 1.29 (0.76-2.09)         1         1.30 (0.89-1.86)         1.41 (0.75-2.51)         1         1.42 (1.11-1.81) $\square$ 1.06 (0.78-1.43)         1.01 (0.53-1.84)         1.45 (0.93-2.18)

2			
3			
4	1		
5			
6	2		Reference List
7	3		
8	4	(1)	Ferlay I Parkin DM Steliarova-Foucher E Estimates of cancer incidence and mortality in
9	5	(1)	Europe in 2008 Eur L Cancer 2010: $46(4)$ :765-781
10	5		Europe in 2000. Euro Cancer 2010, 10(1).705 701.
11	6	(2)	Coleman MP Forman D Bryant H et al Cancer survival in Australia Canada Denmark
12	0 7	(2)	Norway Sweden and the UK 1005 2007 (the International Cancer Benchmarking
13	/ 0		Derthership): on analysis of nonvestion based concer registry data. <i>Langet</i> 2011:
14	0		
15	9		577(9760):127-138.
10	10	(2)	Deserves II Deserves AM Esselie Destal Deserves in selected serves survival in Essen
10	10	(3)	Brenner H, Bouvier AM, Foschi K, et al. Progress in colorectal cancer survival in Europe
10	11		from the late 1980s to the early 21st century: the EUROCARE study. Int J Cancer 2012;
20	12		131(7):1649-1658.
20			
27	13	(4)	Gordon L, Lynch BM, Newman B. Transitions in work participation after a diagnosis of
22	14		colorectal cancer. Aust NZJ Public Health 2008; 32(6):569-574.
24			
25	15	(5)	van den Brink M, van den Hout WB, Kievit J, et al. The impact of diagnosis and treatment
26	16		of rectal cancer on paid and unpaid labor. <i>Dis Colon Rectum</i> 2005; 48(10):1875-1882.
27			
28	17	(6)	Frederiksen BL, Osler M, Harling H, et al. The impact of socioeconomic factors on 30-day
29	18		mortality following elective colorectal cancer surgery: a nationwide study. Eur J Cancer
30	19		2009; 45(7):1248-1256.
31			
32	20	(7)	Cavalli-Bjorkman N, Lambe M, Eaker S, et al. Differences according to educational level in
33	21		the management and survival of colorectal cancer in Sweden Eur J Cancer 2011
34	22		47(9):1398-1406
35	22		
36	23	(8)	Egeberg R Halkiaer I Rottmann N et al Social inequality and incidence of and survival
37	22	(0)	from cancers of the colon and rectum in a nonulation-based study in Denmark 1994-2003
38	24		Fur L Cancer 2008: $M(1A)$ :1078-1088
39	25		Eur J Cuncer 2008, 44(14).1978-1988.
40	26	(9)	Aarts ML Lemmens VEPP Louwman MWL et al Socioeconomic status and changing
41	20	$(\mathcal{I})$	inequalities in colorectal concer? A review of the associations with risk treatment and
42	27		autoomo, Europorn Journal of Crinocu 2010: 46(15):2691-2605
43	28		outcome. European Journal of Cancer 2010, 40(15).2081-2095.
44	20	(10)	Drolet M. Mourgell F. Driggen I. et al. Net Working 2 Years After Droot Concern Drodictors
40	29	(10)	Diolet M, Maunsell E, Brisson J, et al. Not working 5 Years After Breast Cancer. Predictors
40	30		in a Population-Based Study. J Clin Oncol 2005; 23(33):8305-8312.
47 78	21	(11)	
40 70	31	(11)	Steiner JF, Cavender IA, Nowels CI, et al. The impact of physical and psychosocial factors
49 50	32		on work characteristics after cancer. <i>Psychooncology</i> 2008; 17(2):138-147.
51	22	/ 1 <b>-</b> 1	
52	33	(12)	Paraponaris A, Teyssier LS, Ventelou B. Job tenure and self-reported workplace
53	34		discrimination for cancer survivors 2 years after diagnosis: does employment legislation
54	35		matter? <i>Health Policy</i> 2010; 98(2-3):144-155.
55			
56	36	(13)	Earle CC, Chretien Y, Morris C, et al. Employment among survivors of lung cancer and
57	37		colorectal cancer. J Clin Oncol 2010; 28(10):1700-1705.
58			
59			
60			

1 2 2			
5 4 5 6	1 2 3	(14)	Spelten ER, Sprangers MA, Verbeek JH. Factors reported to influence the return to work of cancer survivors: a literature review. <i>Psychooncology</i> 2002; 11(2):124-131.
7 8 9	4 5	(15)	Short PF, Vasey JJ, Tunceli K. Employment pathways in a large cohort of adult cancer survivors. <i>Cancer</i> 2005; 103(6):1292-1301.
10 11 12	6 7	(16)	Mehnert A. Employment and work-related issues in cancer survivors. <i>Crit Rev Oncol Hematol</i> 2011; 77(2):109-130.
13 14 15 16	8 9 10	(17)	Dalton SO, Steding-Jessen M, Gislum M, et al. Social inequality and incidence of and survival from cancer in a population-based study in Denmark, 1994-2003: Background, aims, material and methods. <i>Eur J Cancer</i> 2008; 44(14):1938-1949.
17 18 19 20	11 12	(18)	Amir Z, Moran T, Walsh L, et al. Return to paid work after cancer: a British experience. <i>J Cancer Surviv</i> 2007; 1(2):129-136.
21 22 23 24	13 14 15	(19)	Carlsen K, Dalton SO, Frederiksen K, et al. Cancer and the risk for taking early retirement pension: A Danish cohort study. <i>Scandinavian Journal of Public Health</i> 2008; 36(2):117-125.
25 26 27 28	16 17 18 19	(20)	Sjovall K, Attner B, Englund M, et al. Sickness absence among cancer patients in the pre- diagnostic and the post-diagnostic phases of five common forms of cancer. <i>Support Care</i> <i>Cancer</i> 2012; 20(4):741-747.
29 30 31 32	20 21	(21)	Syse A, Tretli S, Kravdal O. Cancer's impact on employment and earningsa population- based study from Norway. <i>J Cancer Surviv</i> 2008; 2(3):149-158.
33 34 35	22 23	(22)	Mols F, Thong MS, Vissers P, et al. Socio-economic implications of cancer survivorship: results from the PROFILES registry. <i>Eur J Cancer</i> 2012; 48(13):2037-2042.
36 37 38	24 25	(23)	Andersen PK, Keiding N. Multi-state models for event history analysis. <i>Stat Methods Med Res</i> 2002; 11(2):91-115.
39 40 41	26 27	(24)	Christensen KB, Andersen PK, Smith-Hansen L, et al. Analyzing sickness absence with statistical models for survival data. <i>Scand J Work Environ Health</i> 2007; 33(3):233-239.
42 43 44 45	28 29 30	(25)	Gjesdal S, Ringdal PR, Haug K, et al. Long-term sickness absence and disability pension with psychiatric diagnoses: a population-based cohort study. <i>Nord J Psychiatry</i> 2008; 62(4):294-301.
40 47 48 49 50	31 32 33	(26)	Lie SA, Eriksen HR, Ursin H, et al. A multi-state model for sick-leave data applied to a randomized control trial study of low back pain. <i>Scand J Public Health</i> 2008; 36(3):279-283.
51 52 53 54	34 35 36	(27)	Pedersen J, Bjorner JB, Burr H, et al. Transitions between sickness absence, work, unemployment, and disability in Denmark 2004-2008. <i>Scand J Work Environ Health</i> 2012; 38(6):516-526.
55 56 57 58 59 60	37 38	(28)	Oyeflaten I, Lie SA, Ihlebaek CM, Eriksen HR et al. Multiple transitions in sick leave, disability benefits, and return to work A 4-year follow-up of patients participating in a

2			
3	1		work related rehabilitation are aroun DMC Dublic Harleh 2012, 12,749
4 5	1		work-related reliabilitation program. <i>BMC Fublic Health</i> 2012, 12.746.
6	2	(29)	Frederiksen BL Osler M Harling H et al. Do natient characteristics disease or treatment
7	$\frac{1}{3}$	(_>)	explain social inequality in survival from colorectal cancer? Soc Sci Med 2009: 69(7):1107-
8	4		1115
9	•		
10	5	(30)	IDA - an integrated data base for labour market research. Main report, 1991. 2006.
11	6		Statistics Denmark. Ref Type: Report
12	7		
13	8	(31)	Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. Scand J Public
15	9		Health 2011; 39(7 Suppl):30-33.
16			
17	10	(32)	Kildemoes HW, Sorensen HT, Hallas J. The Danish National Prescription Registry. Scand J
18	11		Public Health 2011; 39(7 Suppl):38-41.
19			
20	12	(33)	Hjollund NH, Larsen FB, Andersen JH. Register-based follow-up of social benefits and
21	13		other transfer payments: accuracy and degree of completeness in a Danish interdepartmental
23	14		administrative database compared with a population-based survey. Scand J Public Health
24	15		2007; 35(5):497-502.
25	16	(2.4)	
26	16	(34)	Sanchez KM, Richardson JL, Mason HR. The return to work experiences of colorectal
27	1/		cancer survivors. AAOHN J 2004; $52(12)$ :500-510.
28	10	(25)	Taskila T. Martikainan P. Histonan P. at al. Comparative study of work shility between
29	10	(33)	concer survivors and their referents. Fur I Cancer 2007: 43(5):014,020
30	19		cancer survivors and their references. Eur 5 Cancer 2007, $+5(5).51+-520$ .
32	20	(36)	Mols F Thong MS Vreugdenhil G et al Long-term cancer survivors experience work
33	21	(50)	changes after diagnosis: results of a population-based study <i>Psychooncology</i> 2009.
34	22		18(12):1252-1260
35			
36	23	(37)	Rodriguez-Bigas MA, Chang GJ, Skibber JM. Barriers to rehabilitation of colorectal cancer
37	24		patients. J Surg Oncol 2007; 95(5):400-408.
38	25		
39	26		
40			
42			
43			
44			
45			
46 47			
47 48			
49			
50			
51			
52			
53			
54 55			
55 56			
57			
58			
59			
60			

#### **BMJ Open**

2		
3 4	1	The transition between work, sickness absence and pension in a cohort of Danish colorectal cancer
5 6	2	survivors.
7 8	3	
9	4	BY
10 11	5	Kathrine Carlsen, MSc, MPH, PhD* <sup>1</sup>
12 13	6	Henrik Harling, MD, Clinical Doctor <sup>2</sup>
14	7	Jacob Pedersen, MSc, Statistician <sup>3</sup>
15 16	8	Karl Bang Christensen, Statistician <sup>4</sup>
17 18	9	Merete Osler, MD, Professor <sup>5</sup>
19	10	
20 21	11	
22 23	12	
24	13	
25 26	14	
27 28	15	E-mail addresses and affiliations:
29	16	* Corresponding author; kathrine.carlsen@regionh.dk, phone: +45 38633384, Fax: +45 38633977
30 31	17	1: kathrine.carlsen@regionh.dk. Research Centre for Prevention and Health, Glostrup University
32 33	18	Hospital, 2600 Glostrup, Denmark
34	19	2: hhar0002@bbh.regionh.dk. Department of Surgery, Bispebjerg University Hospital, 2400
36	20	Copenhagen, Denmark
37 38	21	3: jpe@nrcwe.dk. National Research Centre for the Working Environment, 2100 Copenhagen,
39 40	22	Denmark
40 41	23	4: kach@sund.ku.dk. Department of Biostatistics, University of Copenhagen, 1014 Copenhagen K,
42 43	24	Denmark
44 45	25	5: merete.osler@regionh.dk. Research Centre for Prevention and Health, Glostrup University
46	26	Hospital, 2600 Glostrup, Denmark
47 48	27	
49 50	28	Number of words: 3291
51	29	Abstract: 300 words
52 53	30	Number of references: 37
54 55	31	Number of figures: 2
56	32	Number of tables: 5
ว7 58	33	
59 60		
-		

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

Setting: Population based study with use of administrative health related and socioeconomic

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

2

- -
2
3
4
5
6
0
1
8
9
10
10
11
12
13
14
17
15
16
17
18
10
19
20
21
22
23
20
24
25
26
27
20
28
29
30
31
22
32
33
34
35
36
30
37
38
39
10
40
41
42
43
44
15
40
46
47
48
10
+3
50
51
52
53
55
54
55
56
57
50
00
59
60

1

1

2

3

4

5

6

7

8

Abstract

registers.

cancer survivors.

# Participants: All persons (N=4343) diagnosed with colorectal cancer in Denmark in the years 2001-9 2009 while they were in their working age (18-63 years) and who were part of the labor force one 10 year post diagnosis. 11 Primary and secondary outcome measures: By use of multi-state models in Cox proportional 12 hazards models we analyzed the hazard ratio for re-employment, sickness absence and retirement in 13 models including clinical as well as health related variables. <u>Results:</u> One year after diagnosis 62% were working and 58% continued until end of follow-up. 14 15 Socioeconomic factors were found to be associated with retirement but not with sickness absence 16 and return to work. The risk for transition from work to sickness absence was increased if the 17 disease was diagnosed at a later stage (stage III) 1.52 (95% CI: 1.21-1.91), not operated curatively 18 1.35 (95% CI: 1.11-1.63) and with occurrence of post-operative complications 1.25 (95% CI: 1.11-19 1.41). The opposite was found for the transition from sickness absence back to work. 20 Conclusion: This nationwide study of colorectal cancer patients who have survived one year shows 21 that stage of disease, general health state of the individual, post-operative complications and the 22 history of sickness absence and unemployment have an impact on the transition between work, 23 sickness absence and disability pension. This leads to an increased focus on the rehabilitation 24 process for the more vulnerable persons who have a combination of severe disease and a history of 25 work related problems with episodes outside the working market. For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

#### **BMJ Open**

1		
3		
4	1	
5		
6 7	2	Article summary
7 8	_	
9	3	<u>Article focus:</u>
10		
11	4	• How many colorectal cancer survivors return to work, stay at sickness absence, get unemployed
12	E	
13	5	or become pensioners in the years following diagnosis?
15	6	Dess segisses nomin position or alinical factors predict re-ampleument sickness absence
16	0	• Does socioeconomic position of chinear factors predict re-employment, sickness absence,
17	7	unemployment or pension in this cohort?
18	/	unemproyment of pension in this conort:
19 20	8	Key messages:
21	-	
22	9	• First study to differentiate between re-employment, sickness absence, unemployment and
23		
24	10	retirement in a cohort of colorectal cancer survivors.
25 26		
27	11	<ul> <li>One year after diagnosis 62% had resumed work.</li> </ul>
28		
29	12	Socioeconomic factors were associated with early retirement whereas clinical factors were
30	10	
31	13	found to be associated with sickness absence and re-employment.
33	14	Strengths and limitations:
34	14	<u>Strengths and minitations.</u>
35	15	• This is a longitudinal nationwide population based study including more than 4000 persons
36	15	• This is a tongitudinal nation whee population based study meruding more than 4000 persons
<i>31</i> २८	16	diagnosed with colorectal cancer.
39	10	
40	17	• The study identifies an association between socioeconomic position / clinical factors and re-
41		
42	18	employment / sickness absence / pension but is not able to identify mechanisms behind.
43 44		
45	19	
46		
47	20	What is new in this paper:
48	21	Var for at the base and the impact of energy has an the efficiency to the labor
49 50	21	very lew studies have analyzed the impact colorectal cancer has on the attituation to the labor
51	22	market. In this study we are able to identify clinical and socioeconomic risk factors for sickness
52		market. In this study we are able to identify ennical and sociocononine fisk factors for sickless
53	23	absence, work resumption and retirement.
54 55		, r.
55 56		
57		
58		
59		

#### 

#### **1. Introduction**

In 2008 nearly 500.000 persons in Europe were diagnosed with colorectal cancer 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 to 2002 from 50% to 60% among persons aged 15 to 59 years<sup>3</sup>.

7 Throughout Europe life expectancy has increased leading to higher age at pension and longer time 8 in the workforce. As the risk of colorectal cancer increases with age, it can be expected that still 9 more persons will be diagnosed with colorectal cancer while they are an active part of the

10 workforce.

Few studies have analyzed the impact of colorectal cancer on work participation in the years following diagnosis and treatment. The existing studies reported that 2/3 of those working at time of diagnosis resume work in the years after treatment. Risk factors for work cessation were high age; radiation therapy and co-morbidity <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 has 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 13;18-22 

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, i.e.

#### **BMJ Open**

1	unemployment, sickness absence or disability pension and the transition from a cancer diagnosis to
2	one of these outcomes could very well differ according to different risk factors.
3	These transitions between different states (e.g. from sickness absence to work, or from sickness
4	absence to disability) can be modeled by using multi-state models <sup>23</sup> . Multi-state models are well-
5	known statistical models used for event history analysis, e.g. the study of survival. The application
6	of statistical models for survival analysis in the analysis of sickness absence is relatively new <sup>24;25</sup>
7	and the use of multi-state models is mainly due to Lie et al <sup>26</sup> , but multi-state models have also been
8	applied by other researchers <sup>27;28</sup> .
9	By use of detailed, nationwide, population based registers the aim of this study is to evaluate the
10	impact of both socioeconomic and clinical factors on the transitions between work, sickness
11	absence and retirement in a cohort of colorectal cancer survivors and to test for interaction between
12	clinical and socioeconomic factors.
13	
14	2. Materials and methods
14 15	<ul><li>2. Materials and methods</li><li>This study is based on Danish population based registers linked together with the unique personal</li></ul>
14 15 16	<ul><li>2. Materials and methods</li><li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li></ul>
14 15 16 17	<ul><li>2. Materials and methods</li><li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li></ul>
14 15 16 17 18	2. Materials and methods         This study is based on Danish population based registers linked together with the unique personal         identification code given to all Danish residents.         Danish Colorectal Cancer Group (DCCG)
14 15 16 17 18 19	<ul> <li>2. Materials and methods</li> <li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li> <li>Danish Colorectal Cancer Group (DCCG)</li> <li>The study population was derived from the national database of DCCG which includes around 93%</li> </ul>
14 15 16 17 18 19 20	<ul> <li>2. Materials and methods</li> <li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li> <li>Danish Colorectal Cancer Group (DCCG)</li> <li>The study population was derived from the national database of DCCG which includes around 93% of patients in Denmark with a first-time adenocarcinoma of the rectum (ICD-10: C20) or colon</li> </ul>
14 15 16 17 18 19 20 21	<ul> <li>2. Materials and methods</li> <li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li> <li>Danish Colorectal Cancer Group (DCCG)</li> <li>The study population was derived from the national database of DCCG which includes around 93%</li> <li>of patients in Denmark with a first-time adenocarcinoma of the rectum (ICD-10: C20) or colon</li> <li>(ICD-C18). This database comprises prospectively collected data registered by surgeons. The</li> </ul>
14 15 16 17 18 19 20 21 21 22	<ul> <li>2. Materials and methods</li> <li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li> <li>Danish Colorectal Cancer Group (DCCG)</li> <li>The study population was derived from the national database of DCCG which includes around 93% of patients in Denmark with a first-time adenocarcinoma of the rectum (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 details elsewhere</li> </ul>
14 15 16 17 18 19 20 21 22 23	<ul> <li>2. Materials and methods</li> <li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li> <li>Danish Colorectal Cancer Group (DCCG)</li> <li>The study population was derived from the national database of DCCG which includes around 93% of patients in Denmark with a first-time adenocarcinoma of the rectum (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 details elsewhere</li> <li><sup>29</sup>. From the database we obtained clinical data with relevance for the probability of returning to</li> </ul>
14 15 16 17 18 19 20 21 22 23 24	<ul> <li>2. Materials and methods</li> <li>This study is based on Danish population based registers linked together with the unique personal identification code given to all Danish residents.</li> <li>Danish Colorectal Cancer Group (DCCG)</li> <li>The study population was derived from the national database of DCCG which includes around 93% of patients in Denmark with a first-time adenocarcinoma of the rectum (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 details elsewhere</li> <li><sup>29</sup>. From the database we obtained clinical data with relevance for the probability of returning to work after treatment. Entry into the study was equal to date of surgery and was used to calculate the</li> </ul>

1
2
3
4
5
6
7
2 2
0
9 10
10
10
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
20
20
21
20
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
<u>10</u>
50
50
01 50
52 50
53
54
55
56
57
58
59
60

1	follow-up time. Variables describing the disease were cancer type and tumor stage classified
2	according to the International Union Against Cancer (UICC). Information about surgical procedure
3	was included as curative operation (yes/no) and type of operation (1=rectal resection, 2=colonic
4	resection, 3=explorative laparotomy or formation of an ostomy, 4=local procedures). Health status
5	at time of surgery was measured by ASA score (according to the American Society of
6	Anesthesiologists) where patients are categorized into five subgroups by preoperative physical
7	fitness reaching from I - A completely healthy patient to V - A moribund patient who is not expected
8	to live 24 hours with or without surgery. ASA score III-V was collapsed into one group of patients
9	with severe systemic diseases. Postoperative complications were grouped as no complications or
10	one or more complications. The latter group included postoperative bleeding, problems with the
11	ostomy, intra-abdominal infections or infections in the wound, lack of passage through the intestine,
12	leak from the intestine or postoperative rupture of the wound.
13	
13 14	Statistics Denmark
13 14 15	Statistics Denmark Information on a number of demographic and socioeconomic characteristics was obtained from the
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> </ol>	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
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> </ol>	<i>Statistics Denmark</i> 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 country of
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> </ol>	<i>Statistics Denmark</i> 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 country of origin (grouped as born in Denmark or born outside Denmark) and marital status (married or
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> </ol>	<i>Statistics Denmark</i> 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 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 length of
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> </ol>	<i>Statistics Denmark</i> 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 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 length of study (primary school 9-12 years of education, yocational and short education 13-15 years, medium
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> <li>21</li> </ol>	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 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 length of study (primary school 9-12 years of education, vocational and short education 13-15 years, medium and long education more than 16 years and unknown). Job type was classified as management and
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> <li>21</li> <li>22</li> </ol>	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 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 length of study (primary school 9-12 years of education, vocational and short education 13-15 years, medium and long education more than 16 years and unknown). Job type was classified as management and knowledge work (e.g. leaders, doctors and teachers at high school) office and sale (e.g. secretary
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> <li>21</li> <li>22</li> <li>23</li> </ol>	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 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 length of study (primary school 9-12 years of education, vocational and short education 13-15 years, medium and long education more than 16 years and unknown). Job type was classified as management and knowledge work (e.g. leaders, doctors and teachers at high school), office and sale (e.g. secretary, police and nurses) and manual work (e.g. farmers, craftsmen and social and health care assistents)
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> <li>21</li> <li>22</li> <li>23</li> <li>24</li> </ol>	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 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 length of study (primary school 9-12 years of education, vocational and short education 13-15 years, medium and long education more than 16 years and unknown). Job type was classified as management and knowledge work (e.g. leaders, doctors and teachers at high school), office and sale (e.g. secretary, police and nurses) and manual work (e.g. farmers, craftsmen and social and health care assistants).

#### **BMJ Open**

- 3 4	1	their income. Disposal income was calculated as the average of the family income three years
5 6	2	before the year of diagnosis and was deflated according to the 2000 value of the Danish kroner
7 8	2	server the year of diagnosis and was defined according to the 2000 value of the Damsh Riohel.
9	3	Education, job type and disposal income were combined under the heading socioeconomic status
10 11	4	(SES).
12 13	5	
14 15 16	6	The Danish National Patient Registry (NPR)
17 18	7	This register holds information on all hospitalizations and outpatient visits in Denmark since 1978.
19 20	8	In this study we used information of date of admission and discharge and diagnosis coded according
21 22	9	to the International Classifications of Diseases (ICD-10) <sup>31</sup> .
23 24 25	10	
26 27	11	The Register of Medical Product Statistics (RMPS)
28 29	12	Since 1995 every medical product sold on prescription by Danish pharmacies has been registered.
30 31 22	13	From this register we had information on date for redemption of the prescription and substance
32 33 34	14	classified according to the <i>anatomical-therapeutic-chemical</i> (ATC) system <sup>32</sup> .
35 36	15	
37 38	16	Co-morbidity preceding five years before the year of diagnosis was obtained from NPR and RMPS.
39 40	17	As comorbidity we included cardiovascular disease, chronic obstructive pulmonary disease,
41 42	18	diabetes and liver, kidney or connective tissue diseases - diseases which are all part of the Charlson
43 44 45	19	index. Comorbidity was stated if one or more of these diseases were present at time of diagnosis.
46 47	20	
48 49	21	Register based Evaluation of Marginalization (DREAM)
50 51	22	The Danish labor market is characterized as a flexicurity system with a high degree of economic
52 53 54	23	compensation in case of unemployment or reduced work ability (security) but also with a high
55 56 57 58 59	24	turnover rate (flexible). Unemployed persons are warranted economic compensation if they are

3 4	1	actively seeking job. During the study period it was possible to receive a maximum of four years of
5 6	2	unemployment benefit After the end of these four years or if a person is not qualified for
7 8	-	anomptoymont bonont. Enter the ond of these four yours of it a person is not quantica for
9	3	unemployment benefit (i.e. not member of a union) it is possible to receive social income. If a
10 11 12	4	person is unable to work due to illness or disability it is possible to receive sickness benefit for a
13 14	5	maximum of 52 weeks during a period of two years or apply for early retirement if the work ability
15 16	6	is reduced to a level where it is not possible to hold a job. This holds for all Danish citizens
17 18	7	independent of job type. During the study period the retirement age was 64 years of age.
19 20	8	The outcome of the study was receipt of social transfer payments or in work. Information about
21 22 23	9	social transfer payments was obtained from the Danish population based administrative register
24 25	10	DREAM. DREAM covers all residents in Denmark who have received social transfer payments
26 27	11	from the state <sup>33</sup> in any given week since 1991. In the present study we included data from DREAM
28 29	12	from week 1 in 2001 until week 13 in 2011. In work was defined as not receiving any social transfer
30 31 22	13	payments for six consecutive weeks. Transfer income obtained from DREAM was divided into
32 33 34	14	sickness benefit, unemployment benefit and permanent withdrawal from the workforce due to early
35 36	15	retirement pension or post-employment benefit, which is an optional withdraw from the workforce
37 38	16	not caused by disability.
39 40	17	
41 42 43	18	Study population
43 44 45	19	In the years 2001 to 2009 31.570 persons were diagnosed with colorectal cancer in Denmark. The
46 47	20	majority of these persons were diagnosed after the age of retirement and the study population
48 49	21	consists of 4.343 persons aged 18-63 years, who were part of the workforce and survived the first
50 51 52	22	postoperative year (fig. 2). The follow-up period of this population was between 65 weeks (for
52 53 54	23	persons diagnosed in the last week of 2009) to 535 week (for persons diagnosed in the first week of
55 56	24	2001) leading to 12.569 person years.
57 58		

**BMJ Open** 

2		
3		
4	1	
5		
0 7	2	Outcome data
/ 0		
0	3	For every person in the study population labour market status was recorded on a weekly basis until
9 10		
10	4	the person reached the age limit of 63 years, emigrated, died, or until the end of follow-up
12		
13	5	whichever came first Labour market status was categorized in four different 'states' work
14	-	······································
15	6	sickness absence, unemployment, and disability. The multi-state model is a model for the nine
16	0	stekness ussence, unemployment, and disubility. The mater state model is a model for the mile
17	7	possible transitions between these four states (Figure 1)
18	/	possible transitions between these four states (1 igure 1).
19	0	
20	0	
21	0	Statistical and the state
22	9	Statistical analysis
23	1.0	
24	10	Descriptive analysis by use of chi <sup>2</sup> and t-tests was conducted in order to examine the characteristics
20		
20	11	of the sample. The outcome data was recoded and for each person time spent in one of the four
28		
29	12	states was registered. Furthermore it was registered if a transition to another state occurred at the
30		
31	13	end of the persons stay in the state, and, if so, what state the person shifted to. The time spent in the
32		
33	14	state was censored if the person died, emigrated, or shifted to a social transfer payment that did not
34		
35	15	fit any of the four states.
36		
3/	16	
30 30		
39 40	17	Each of the nine possible transitions shown in Figure 1 was analysed using the Cox proportional
40		
42	18	hazards model in SAS (The PHREG procedure, SAS version 9.2). The time scale used was duration
43		
44	19	of stay in current state.
45		
46	20	The variables education, disposal income, job type, type of cancer, cancer stage, comorbidity, ASA
47		
48	21	score curative operation type of operation post-operative complications were included as time
49		
50 E1	22	constant covariates. Three time dependent covariates were also included: number of times the
51 52		consume covariates. These time appendent covariates were also meradoa, name er er antes the
52	23	person been employed had been sick-listed or unemployment since the start of follow up
54	20	person over employed, had over siek insted, of anomproyment since the start of follow up.
55		
56		
57		
58		
59		
60		

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

Table 1 shows the baseline characteristics for all patients stratified on those excluded during the

population the study population was diagnosed with significantly less severe disease and higher

first year after diagnosis (N=1689) and the study population (N=4343). Compared to the excluded

One year after operation 62% of the study population were in work while 32% were sick listed and

Table 3 and 4 shows the Hazard Ratio (HR) 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% and 12% per episode, whereas previous episodes of work increased the rate of both

work and sickness absence. In addition, we found that increasing levels of education increased the

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

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

Furthermore we found that an ASA score on III increased the risk for sickness absence with almost

for sickness absence (HR=1.17 (1.03-1.32)) compared to those operated for colonic cancer.

6% were unemployed (Table 2). Of those who were working, 58% continued working for an

ว	
2	
3	
4	
5	
6	
0	
7	
8	
9	
10	
10	
11	
12	
13	
14	
14	
15	
16	
17	
18	
10	
19	
20	
21	
22	
~~	
23	
24	
25	
26	
20	
21	
28	
29	
30	
24	
31	
32	
33	
34	
25	
35	
36	
37	
38	
20	
39	
40	
41	
42	
12	
43	
44	
45	
46	
17	
47	
48	
49	
50	
51	
51	
52	
53	
54	
55	
55	
56	
57	
58	
50	
79	

1

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

60

40%.

3. Results

assumption of proportionality.

SES at time of inclusion.

average of 136 weeks.

rate of transition from work back to sickness absence.

and who suffered postoperative complications.

#### **BMJ Open**

1	The risk factors associated with permanently withdrawal from the labor market one year after
2	operation are shown in Table 5. Since the transition from work and unemployment to retirement
3	follows the same pathways, these groups were joined in order to gain more power. The risk for
4	retirement was not only related to the disease but also to SES. Manual work and increasing disposal
5	income reduces the risk for retirement after an episode of sickness absence and work, respectively.
6	Compared to patients in work, the HR for retirement was 5.89 (3.46-10.03) among unemployed
7	survivors.
8	Advanced stage at diagnosis and high ASA score increased the risk for retirement among both
9	groups.
10	Finally, we analyzed for effect modification by adding an interaction in the logistic model between
11	disposal income as the strongest socioeconomic predictor and type of cancer, stage of disease, type
12	of operation and post-operative complications. We did not find any significant effect modification
13	between socioeconomic factors and disease related factors (Data not shown).
14	
15	4. Discussion and conclusion
16	In this cohort study including 4343 Danish colorectal cancer patients, who were part of the
17	workforce after the first postoperative year, we found that 62% were working one year after
18	operation.
19	One year after operation previous episodes of sickness absence and unemployment, cancer stage at
20	diagnosis, curative operation and post-operative complications were associated with labor market
21	affiliation during follow-up whereas SES was only weakly associated with the transition between
22	the different occupational states.

Page 36 of 51

The observed rate of return to work is in accordance with previous studies on colorectal cancer survivors, where return to full time employment was reported in 60%-89% dependent on time from 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 one year after operation, based on a notion that it is not clinical relevant to study full return to work before the end of a one-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 definition and measurement of return to work. Thus, in some studies return to work is simply the number of persons working at 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 time of follow-up, and in still other studies working is self-reported and covers from one week to permanently re-employed <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 seems to follow different pathways. Leaving the workforce for any type of pension is an irreversible process and is assigned when work demands exceeds health and mental resources and is thus dependent on both health and work related factors. On the other hand, unemployment and sickness absence both include conditions with an expectation of resuming work and is more related to either SES or health, respectively. The exclusion of persons who take disability pension the first year and the lower social one-year survival after colorectal cancer among socially deprived might explain our finding of no effect of SES on work and sickness absence one year after diagnosis of colorectal cancer. It seems as a

Page 37 of 51

1 2

#### **BMJ Open**

3	
4	
5	
6	
7	
8	
9	
10	)
11	
12	
13	
14	
15	;
16	;
17	
18	
19	)
20	)
21	
22	
23	
24	
25	;
26	;
27	,
28	
29	)
30	)
31	
32	
33	
34	
35	,
36	;
37	
38	
39	)
40	)
41	
42	
43	
44	•
45	,
46	;
47	•
48	
49	
50	)
51	
52	
53	
54	
55	,
56	;
57	•
58	
59	)

60

1 'healthy worker effect' where the most affluent survive the first year without leaving the workforce2 for disability pension.

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

5 The risk for transition from work to sickness absence was increased if the disease was diagnosed at 6 a later stage, not operated curatively and with occurrence of post-operative complications. The

7 opposite was found for the transition from sickness absence back to work. The association between

8 disease related factors and resuming of work after a cancer diagnosis including colorectal cancer

9 has been observed in other studies where tumor stage  $^{13;36}$ , treatment  $^{4;36}$ , physical symptoms  $^{16}$  and

10 ASA-score were reported to be negatively associated with return to work.

11 We found that persons diagnosed with rectal cancer had a significant increased risk for sickness

12 absence and retirement possibly due to the fact that this patient group in contrast to colon cancer

13 patients more often will have to learn to take care of an ostomy or suffer from abnormal bowl and

14 urinary function years after the operation <sup>37</sup>. Unfortunately, we could not account for these factors in

15 our analysis.

16

17 Strengths and limitations

18 The present study is based on data from a well-defined clinical database of all Danish colorectal

19 cancer patients. The database has a high completeness and data validity and missing values are

20 random and not associated with the outcome under study whereby selection-bias is removed.

21 Variables regarding socioeconomic position and the affiliation to the labour market are

22 administrative data collected prospectively why recall-bias is eliminated.

23 This study has, however, some limitations. First of all we were not able to include complementary

treatment as chemotherapy and radiation, reduced working hours or job changes in our analysis.

1	
2	
3	
4	
5	
6	
7	
8	
0	
9 10	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
20	
20	
20	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
77 15	
40	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	
00	

1	Complementary cancer treatment can have a negative effect on the physical and psychological work
2	ability and has been shown to be associated with reductions in work hours and reassignment to
3	other work tasks <sup>11;16;36</sup> . We defined return to work as not receiving any transfer payments for six
4	consecutive weeks. This can lead to misclassification of persons leaving the workforce without
5	receiving economic compensation from the state. This is, however, very seldom in Denmark and
6	can be ignored in this study.
7	The present study is conducted in a Nordic welfare system with high turnover rates on the labour
8	market, high rates of participation and high degrees of social security. Despite the fact that the
9	expenditures to social protection in the Nordic countries including Denmark is higher compared to
10	the rest of the European Union and countries as US and Canada they all have some degree of social
11	welfare systems and universal health care. The size of economic compensation and duration of
12	sickness absence might have an impact on the consequence of a chronic disease but the risk factors
13	and reasons for being on sickness absence or return to work is not influenced by the political
13 14	and reasons for being on sickness absence or return to work is not influenced by the political context.
13 14 15	and reasons for being on sickness absence or return to work is not influenced by the political context.
13 14 15 16	and reasons for being on sickness absence or return to work is not influenced by the political context.
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> </ol>	and reasons for being on sickness absence or return to work is not influenced by the political context. <i>Conclusion</i> This nationwide study of colorectal cancer patients who have survived one year shows that stage of
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> </ol>	and reasons for being on sickness absence or return to work is not influenced by the political context. <i>Conclusion</i> This nationwide study of colorectal cancer patients who have survived one year shows that stage of disease, general health state of the individual (ASA score), post-operative complications and the
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> </ol>	and reasons for being on sickness absence or return to work is not influenced by the political context. <i>Conclusion</i> This nationwide study of colorectal cancer patients who have survived one year shows that 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,
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> </ol>	and reasons for being on sickness absence or return to work is not influenced by the political context. <i>Conclusion</i> This nationwide study of colorectal cancer patients who have survived one year shows that 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 rehabilitation
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> <li>21</li> </ol>	and reasons for being on sickness absence or return to work is not influenced by the political context. <i>Conclusion</i> This nationwide study of colorectal cancer patients who have survived one year shows that 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 rehabilitation process for the more vulnerable persons who have a history of work related problems with episodes
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> <li>21</li> <li>22</li> </ol>	and reasons for being on sickness absence or return to work is not influenced by the political context. <i>Conclusion</i> This nationwide study of colorectal cancer patients who have survived one year shows that 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 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 complications
<ol> <li>13</li> <li>14</li> <li>15</li> <li>16</li> <li>17</li> <li>18</li> <li>19</li> <li>20</li> <li>21</li> <li>22</li> <li>23</li> </ol>	and reasons for being on sickness absence or return to work is not influenced by the political context. <i>Conclusion</i> This nationwide study of colorectal cancer patients who have survived one year shows that 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 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 complications and stage of disease has on the work ability in order to reduce the risk for sickness absence and

1 2		
3 4	1	
5 6 7	2	Acknowledgment
7 8 9	3	This work is funded by The Danish Cancer Society and The Novo Nordisk Foundation and is part
10 11	4	of The Centre for Integrated Rehabilitation of Cancer Patients (CIRE).
12 13	5	
14 15	6	Ethics approval: The study based solely on national and administrative registers and did not
16 17 18	7	require any approval from the ethics committee according to national regulations.
19 20	8	
21 22	9	Author contribution:
23	10	Study conception and design: All authors
24 25	11	Acquisition of data: Merete Osler and Kathrine Carlsen
26 27	12	Analysis of data: Kathrine Carlsen
28	12	Interpretation of data: All authors
29 30 31	14	Writing manuscript: All authors
32		
34		
35 36		
37		
38 39		
40 41		
42		
43		
44 45		
46		
47		
40 49		
50		
51		
52 53		
54		
55		
56 57		
ว <i>า</i> 58		
59		

Figure 1: Transition states between labor market outcomes in Denmark. Work, sickness absence and
 unemployment covers persons in the workforce while retirement independent of reason (disability

3 or age) are an irreversible state, where persons are considered to leave the workforce forever.





1 Table 1: Characteristics of the colorectal cancer patients diagnosed in Denmark while in their working age and part of 2 the work force, 2001-2009 (N=6032). Divided into those who were excluded during the first year due to retirement or 3 death (N=1689) and the included persons (N=4343).

Education year (V6)         Include after the first year was (V6)         Include after the first year (V6)         V           Education Merinary school Merinary	death (11-1007) and the mended persons (11-	-+5+5		D
Vert N (%)         N (%)         N (%)           Primary school         S84 (35)         1244 (29)         2000           Weational and short education         324 (19)         1062 (24)         000           Dinknown         0 (0)         0 (0)         0 (0)         0 (0)           Mean         192 206         210 807         200001           Job type         190 (11)         740 (17)         401 (23)         4144 (33)           Office and lac (non-mannal)         893 (53)         1661 (28)         0000           Other         205 (12)         528 (12)         0000           Mean         983 (53)         1661 (28)         0000           Mean         983 (59)         2430 (56)         0000           Age         56.6         53.8         60001           Maried / colubiting         1042 (62)         3162 (73)         \$0001           Maried / colubiting         1042 (62)         3162 (73)         \$0001           2001         104 (6)         309 (7)         153 (69)         27 (1)           2002         178 (10)         453 (10)         154 (65)         164 (13)           2003         178 (10)         458 (11)         250 (12)         26001     <		Excluded during the first	Included after the first year	Р
Falsetion         584 (3) (2000)         1244 (29) (2001)         50000 (2001)           Primary school         983 (35) (2001)         124 (29) (2001)         120 (27) (2001)         500001           Job type         192 206         210 807         500001         500001         500001           Management and knowledge work. Other         190 (11)         1414 (33) (2001)         1414 (49) (2011)         1414 (49) (2011)         1414 (49) (411)		year N (%)	N (%)	1 0001
Primary school         384 (3)         1.244 (29)           Weational alshort education         324 (19)         1062 (24)           Dinknown         0 (0)         0 (0)         0 (0)           Bryssal income (DKr.)         192 206         210 807         \$20001           Management and knowledge work         190 (11)         440 (17)         440 (17)         \$20001           Management and knowledge work         401 (23)         1414 (23)         1414 (23)         0.02           Other         205 (12)         528 (12)         0.02         0.02           Other         98 (59)         2430 (56)         \$0001           Mean         98 (59)         2430 (56)         \$0002           Age         \$56.6         \$3.8         \$0001           Mariad colubing         1042 (62)         3162 (73)         \$0001           Mariad colubing         1042 (62)         3162 (73)         \$0001           Mariad colubing         1044 (29)         1154 (26)         \$0001           Single         104 (6)         399 (7)         \$001         \$0001           2001         166 (6)         399 (7)         \$001         \$0001           2002         178 (10)         458 (10)         \$0001<	Education	594 (25)	1244 (20)	<.0001
Vector         131 (46)         243 (47)         105 (24)           Disposi Income (DKr.)         192 206         210 807         20001           Madium and long education         192 206         210 807         20001           Job Type         192 206         210 807         20001           Main and long education         190 (11)         740 (17)         40021           Job Type         Management and knowledge work         190 (11)         740 (17)         2001           Office and set (non-manual)         393 (33)         1661 (38)         20001           Women         601 (41)         1913 (44)         200 (20)           Mean         998 (59)         2430 (56)         2002           Mean         56.6         53.8         20002           Obter         22 (3)         193 (4)         2001           Matin status         1042 (62)         1162 (73)         2002           Obter         193 (4)         1154 (20)         1154 (20)         200           Unknown         194 (6)         309 (7)         2001         200         2002         2001         200         2001         2001         2001         2001         2001         2001         2001         2001	Primary school	584 (35)	1244 (29)	
Medium and long education         234 (19)         100 (24)           Unkkown         0 (0)         0 (0)           Bispeal income (DK:)         10         740 (17)         50001           Management and knowledge work         190 (11)         740 (17)         60001           Management and knowledge work         190 (11)         1414 (13)         1661 (13)         1661 (13)           Management and knowledge work         00 (11)         1913 (44) (13)         1661 (13)         1661 (13)           Other         205 (12)         528 (12)         528 (12)         1661 (13)         1661 (13)           Gender         666         53.8         50001         1661 (13)         160 (13)         1	Vocational and short education	/81 (46)	2037 (47)	
Instrum         0 (0)         0 (0)         0 (0)         0 (0)           Mean         192 206         210 807         30001           Management and knowledge work         190 (11)         740 (17)         40001           Office and ske (non-manual)         893 (53)         1661 (38)         50001           Management and knowledge work         190 (11)         740 (17)         528 (12)         60001           Gender         205 (12)         528 (12)         60001         60001         60001           Women         691 (41)         1913 (44)         6003         60001         60001           Mean         556         53.8         60001         6001 <td>Medium and long education</td> <td>324 (19)</td> <td>1062 (24)</td> <td></td>	Medium and long education	324 (19)	1062 (24)	
Disposel income (DK:)         100         10.0 807         50000           Job type         10.0 807         210.807         20000           Management and knowledge work         190 (11)         740 (17)         740 (17)           Office and sale (non-manual)         401 (24)         1414 (33)         1661 (38)           Other         205 (12)         528 (12)         528 (12)           Other         020 (12)         528 (12)         1001           Mana         56.6         53.8         50001           Mana         56.6         53.8         50001           Other         52 (3)         193 (4)         102           Demmark         1637 (97)         4150 (96)         102           Other         52 (3)         193 (4)         102           Warried / cohabiting         1042 (62)         3162 (73)         50001           Single         494 (29)         27 (1)         50001         102           2001         104 (6)         309 (7)         55         102         103         103         103         103         103         103         104         101         102         102         103 (41)         101         102         103 (41)         102<	Unknown	0(0)	0(0)	
Mean         192 206         210 807         40000           Management and knowledge work         190 (11)         740 (17)         50001           Office and sice (non-manul)         401 (24)         1414 (33)         60001           Management and knowledge work         190 (11)         740 (17)         528 (12)         60001           Other         205 (12)         528 (12)         6003         6003           Mean         998 (59)         2430 (56)         6001         6001           Mean         556         53.8         60001         6001           Other         52 (3)         193 (4)         60021         60021           Martial status         1042 (62)         3162 (73)         50001         60021           Other         52 (3)         193 (4)         700         7001	Disposal income (DKr.)			<.0001
Job type         740 (17)         50000           Management and knowledge work         190 (11)         740 (17)         1414 (33)           Office and sube (non-manual)         401 (24)         1414 (33)         161 (38)           Other         205 (12)         528 (12)         528 (12)         1661 (38)           Other         205 (12)         528 (12)         528 (12)         161 (38)           Mana         667 (97)         2430 (56)         160         002           Men         998 (59)         2430 (56)         160         002           Men         56.6         53.8         50001         161 (18)	Mean	192 206	210 807	
Management and knowledge work         190 (11)         740 (7)         740 (7)           Office and sel (non-manual)         401 (24)         1414 (33)         161 (38)           Other         205 (12)         528 (12)         0.03           Gender         600         528 (12)         0.03           Women         691 (41)         1913 (44)         0.03           Mean         56.6         53.8         60001           Country of birth         0.02         193 (4)         0.02           Other         52 (3)         193 (4)         0.02           Marriel / colabiting         1042 (62)         3162 (73)         80000           Single         494 (29)         27 (1)         104 (6)         390 (7)           2001         104 (6)         390 (7)         155 (9)         27 (1)           2002         178 (10)         458 (10)         205         203 (12)         205 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)         568 (13)         200 (12)	Job type			<.0001
Office and sale (non-manual) Manual         401 (24)         1414 (33)           Other         205 (12)         528 (12)           Other         205 (12)         528 (12)           Women         691 (41)         1913 (44)           Manual         56 6         53.8           Country of birth         56 6         53.8           Denmark         1637 (97)         4150 (96)           Other         52 (3)         193 (4)           Married / cohabiting         1042 (62)         3162 (27)           Married / cohabiting         1042 (62)         3162 (27)           Other         153 (9)         27 (1)         55           2001         1044 (62)         3162 (27)         55           2001         1044 (29)         1154 (20)         55           2001         1044 (61)         309 (7)         55           2002         178 (10)         458 (10)         55           2003         210 (12)         546 (13)         50           2004         213 (13)         494 (11)         50           2005         210 (12)         546 (13)         50           2006         199 (12)         556 (13)         50           2	Management and knowledge work	190 (11)	740 (17)	
Manual         \$93 (53)         1661 (38)           Other         205 (12)         528 (12)           Gender         998 (59)         2430 (56)           Women         691 (41)         1913 (44)           Mean         56.6         53.8         50001           Courtry of birth         1637 (97)         4150 (96)         102           Other         52 (3)         193 (4)         50001           Married / cohabiting         1042 (62)         3152 (73)         \$0001           Married / cohabiting         1042 (62)         3152 (73)         \$0001           Year of operation         1153 (9)         277 (1)         555           2001         104 (61)         309 (7)         155           2002         178 (10)         438 (10)         55           2003         176 (10)         439 (10)         55           2005         210 (12)         546 (13)         50           2006         199 (12)         546 (13)         50           2007         211 (12)         546 (13)         50           2008         197 (12)         530 (12)         50           2009         201 (12)         546 (13)         50	Office and sale (non-manual)	401 (24)	1414 (33)	
Other         205 (12)         528 (12)         003           Women         691 (41)         1913 (44)         003           Men         998 (59)         2430 (56)         50001           Maren         56.6         53.8         50001           Oberrard         1637 (97)         4150 (96)         502           Other         52 (3)         193 (4)         502           Married / cohabiting         1042 (62)         3162 (73)         50001           Married / cohabiting         1042 (62)         3162 (73)         50001           Single         494 (29)         1154 (26)         71           2001         104 (6)         309 (7)         205           2002         178 (10)         458 (10)         201           2003         176 (10)         458 (13)         201           2004         213 (13)         494 (11)         201           2005         210 (12)         546 (13)         200           2006         199 (12)         546 (13)         200           2008         197 (12)         530 (12)         200           2009         201 (12)         546 (13)         200           2009         200 (12)	Manual	893 (53)	1661 (38)	
Gender Women         691 (41) 98 (59)         1913 (44) 240 (50)         003           Age	Other	205 (12)	528 (12)	
Waten         691 (41)         1913 (44)           Mem         998 (59)         2430 (56)           Age         5001           Marrial Value         56.6         53.8         002           Outney of birth         56.6         53.8         002           Demmark         56.6         53.8         002           Other         52 (3)         193 (4)         002           Marrial value         1042 (62)         3162 (73)         60001           Marrial value         1042 (62)         3162 (73)         60001           Marrial value         105 (9)         27 (1)         2001         104 (6)         309 (7)         2001         2001         104 (6)         309 (7)         2001         2001         104 (6)         309 (7)         2001         2001         2001 (2)         546 (1)         2001         2001         2001 (2)         546 (1)         2001         2001         2001 (2)         546 (1)         2001         2001         2001 (2)         546 (1)         2001         2001         2001         2001 (2)         546 (1)         2001         2001         2001         2001         2001         2001         2001         2001 (2)         546 (1)         2001         20	Gender			0.03
Men         998 (59)         2430 (56)           Mean         56.6         53.8         50001           Ountry of birth         1637 (97)         4150 (96)         002           Other         52 (3)         193 (4)         50001           Marital status         1637 (97)         4150 (96)         001           Marital status         1042 (62)         3162 (73)         50001           Vear of operation         103 (4)         50001         52 (3)         103 (4)           2001         104 (6)         309 (7)         53 (9)         27 (1)         55 (7)           2002         178 (10)         438 (10)         200 (1)	Women	691 (41)	1913 (44)	
Age Mean         56.6         53.8         60001           Ountry of birth Denmark         1637 (97)         4150 (96)         0.02           Other         52 (3)         193 (4)         0.02           Married / cohabiting         1042 (62)         3162 (73)         50001           Single         193 (4)         0.02         0.02           Warried / cohabiting         1042 (62)         3162 (73)         50001           Single         193 (4)         0.02         0.02           Unknown         153 (9)         27 (1)         0.05           Year of operation         1044 (6)         309 (7)         0.05           2002         178 (10)         438 (10)         20         201 (12)         548 (13)           2005         210 (12)         548 (13)         2007         211 (12)         545 (13)           2006         199 (12)         548 (13)         2001         20         2001         214 (12)           2008         197 (12)         538 (13)         140 (12)         141 (12)         141 (12)           100 (16)         135 (21)         141 (13)         141 (13)         141 (13)         141 (13)           2009         224 (14)         325 (7)	Men	998 (59)	2430 (56)	
Mean         56.6         53.8           Country of birth Denmark         1637 (97)         4150 (96)         002           Other         52 (3)         193 (4)         002           Marital status         1042 (62)         3162 (73)         50001           Marital status         1042 (62)         3162 (73)         50001           Unknown         153 (9)         27 (1)         9           Year of operation         004 (53)         399 (7)         9           2001         104 (6)         309 (7)         9         55           2001         178 (10)         438 (10)         9         16           2005         210 (12)         486 (11)         16         16           2006         199 (12)         568 (13)         20         9         16           2007         211 (12)         539 (12)         16         <	Age			<.0001
Country of birth Demark Other         1637 (97) 52 (3)         1150 (96) 193 (4)         002           Marical status         1042 (62) 3162 (73) 494 (29)         1154 (26) 1154 (26)         3162 (73) 1154 (26)           Marical status         1042 (66) 396 (29)         3162 (73) 1154 (26)         50001           2001         104 (6) 2002         309 (7) 2003         105 (10) 498 (10)         458 (10) 498 (11)           2001         104 (6) 2003         178 (10) 498 (11)         458 (10) 498 (11)         515           2004         213 (13) 2005         210 (12) 548 (13) 2006         548 (13) 2007         514 (12)           2006         199 (12) 2006         548 (13) 2007         514 (12)         50001           2007         211 (12) 2009         514 (12)         50001         514 (12)           2008         197 (12) 2009         513 (12)         2001         514 (12)           2008         197 (12) 2009         513 (12)         141 (32)         17           Rectal         306 (18) 11         1535 (35)         50001         50001           Ves         513 (21)         1411 (32)         17         50001           Ves         224 (14)         325 (7)         50001         50001           Ves         526 (23)	Mean	56.6	53.8	
Drimark Other         1637 (97)         4150 (96)         -           Marital status         193 (4)         -         -           Married / cohabiting Single         1042 (62)         3162 (73)         -         -           Ver of operation         153 (9)         27 (1)         -         -         -           2001         104 (6)         309 (7)         0.55         -         -         0.55           2002         178 (10)         458 (10)         -         -         0.55           2003         176 (10)         439 (10)         -         -         -           2004         213 (13)         494 (11)         -	Country of birth			0.02
Other         52 (3)         193 (4)           Marital status         1042 (62)         3162 (73)         50001           Marital status         494 (29)         1154 (26)         3162 (73)           Unknown         153 (9)         27 (1)         0           Year of operation         104 (6)         309 (7)         0.55           2001         104 (6)         309 (7)         0.55           2002         178 (10)         458 (10)         203           2004         213 (13)         494 (11)         200           2005         210 (12)         568 (13)         200           2006         199 (12)         545 (13)         300 (12)           2007         201 (12)         543 (13)         200           2008         207 (12)         514 (12)         500 (12)           2009         201 (12)         514 (12)         500 (12)           2009         201 (12)         514 (12)         500 (12)           Stage         1063 (63)         2464 (57)         60001           Rectal         626 (37)         1879 (43)         50001           1         11         43 (3)         146 (3)         11           10         430 (	Denmark	1637 (97)	4150 (96)	
Married / cohabiting         1042 (62)         31 62 (73)         50001           Single         494 (29)         1154 (26)         1154 (26)         1154 (26)           Unknown         153 (9)         27 (1)         0.55         0.55           2001         104 (6)         309 (7)         0.55           2002         178 (10)         438 (10)         0.55           2003         210 (12)         446 (11)         200           2004         213 (13)         494 (11)         200           2005         210 (12)         568 (13)         200           2006         199 (12)         568 (13)         200           2007         211 (12)         530 (12)         200           2008         197 (12)         531 (12)         200           2009         201 (12)         530 (12)         200           10         306 (18)         1535 (35)         10           I         306 (18)         1535 (35)         100           II         318 (8)         491 (11)         20           VN         858 (51)         760 (18)         100           Ves         224 (14)         325 (7)         2000           No	Other	52 (3)	193 (4)	
Married / cohabiting Single         1042 (62) 494 (29)         3162 (73) 1154 (26)           Unknown         153 (0)         27 (1)         0           2001         104 (6)         309 (7)         0.55           2001         178 (10)         458 (10)         439 (10)           2003         176 (10)         439 (10)         439 (10)           2004         213 (13)         494 (11)         439 (10)           2005         210 (12)         486 (11)         568 (13)           2006         199 (12)         545 (13)         50001           2008         197 (12)         533 (12)         70001           2009         201 (12)         514 (12)         70001           2009         201 (12)         514 (13)         70001           Rectal         626 (37)         1879 (43)         7001           Stage         1         43 (3)         146 (3)         111           11         43 (3)         146 (3)         7001         7001           No         13 (8)         491 (11)         7001         858 (51)         7001         8101           11         43 (3)         146 (3)         7001         8101         7001         8101         70	Marital status			<.0001
Single         194 (29)         1154 (26)           Unknown         153 (9)         27 (1)         0.55           2001         104 (6)         309 (7)         0.55           2002         178 (10)         435 (10)         439 (10)           2003         176 (10)         439 (10)         439 (10)           2004         213 (13)         444 (11)         439 (10)           2005         210 (12)         568 (13)         500 (12)           2006         199 (12)         568 (13)         500 (12)           2007         211 (12)         530 (12)         500 (12)           2008         197 (12)         530 (12)         500 (12)           2009         201 (12)         514 (12)         500 (12)           2009         201 (12)         514 (12)         500 (12)           2009         201 (12)         5135 (35)         1           Stage         1         1063 (63)         246 (43)         1           11         43 (3)         146 (3)         1         1           11         43 (3)         146 (3)         1         1           11         434 (29)         2168 (50)         1           No <td< td=""><td>Married / cohabiting</td><td>1042 (62)</td><td>3162 (73)</td><td></td></td<>	Married / cohabiting	1042 (62)	3162 (73)	
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         201 (12)         545 (13)           2009         201 (12)         514 (12)           2009         201 (12)         514 (12)           2009         201 (12)         514 (13)           2009         201 (12)         514 (13)           201         306 (18)         1535 (35)           1         306 (18)         141 (32)           1         306 (18)         141 (32)           1         13 (8)         491 (11)           1         43 (3)         146 (30)           1         13 (8)         491 (11)           1         434 (29)         2168 (50)           1         771 (46)         327 (75)           No         24	Single	494 (29)	1154 (26)	
Vear of operation         D100         D101         D155           2001         104 (6)         309 (7)         0.55           2002         178 (10)         458 (10)         458 (10)           2003         176 (10)         439 (10)         439 (10)           2004         213 (13)         449 (11)         439 (10)           2005         210 (12)         545 (13)         545 (13)           2006         199 (12)         568 (13)         545 (13)           2008         197 (12)         530 (12)         500 (12)           2009         201 (12)         545 (13)         500 (12)           2008         197 (12)         530 (12)         500 (12)           2009         201 (12)         545 (13)         500 (12)           2008         197 (12)         530 (12)         500 (12)           2009         201 (12)         545 (13)         500 (12)           Stage         2464 (57)         620 (37)         1879 (43)           I         306 (18)         1555 (35)         60001           Ves         255 (13)         760 (18)         146 (3)           III         31 (8)         491 (11)         200 (14)         127 (14) <tr< td=""><td>Unknown</td><td>153 (9)</td><td>27 (1)</td><td></td></tr<>	Unknown	153 (9)	27 (1)	
Not open nom         Mass         Mass         Mass         Mass           2001         178 (10)         458 (10)         458 (10)           2003         176 (10)         439 (10)         458 (10)           2004         213 (13)         494 (11)         494 (11)           2005         210 (12)         486 (11)         568 (13)           2006         199 (12)         568 (13)         500 (12)           2009         201 (12)         514 (12)         545 (13)           2009         201 (12)         514 (12)         514 (12)           7000         2006 (18)         1535 (35)         1           1         306 (18)         1535 (35)         1           11         43 (3)         146 (3)         1           11         43 (3)         146 (3)         1           11         43 (3)         146 (3)         1           11         43 (3)         146 (3)         1           11         43 (2)         1411 (32)         1           12         44 (14)         305 (7)         2           ASA         1         484 (29)         2168 (50)           11         484 (29)         2168 (50) <td< td=""><td>Vear of operation</td><td>100 (3)</td><td>27(1)</td><td>0.55</td></td<>	Vear of operation	100 (3)	27(1)	0.55
2001         109 (0)         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)           2009         201 (12)         514 (12)           2009         201 (12)         514 (12)           2009         201 (12)         514 (12)           2009         201 (12)         514 (12)           2009         201 (12)         514 (12)           2009         201 (12)         514 (12)           2009         201 (12)         514 (12)           2010         141 (12)         513 (13)           11         306 (18)         1535 (35)           11         31 (8)         491 (11)           11         31 (8)         491 (11)           11         71 (46)         1731 (40)           2001         11         71 (46)         1731 (40)           2011         202 (14)         206 (5)	2001	104 (6)	309 (7)	0.55
2002         176 (10)         439 (10)         439 (10)           2004         213 (13)         494 (11)         439 (10)           2005         210 (12)         568 (13)         200           2006         199 (12)         568 (13)         200           2008         217 (12)         530 (12)         2000           2009         201 (12)         514 (12)         530 (12)           2009         201 (12)         514 (12)         530 (12)           2009         201 (12)         514 (12)         530 (12)           Rectal         626 (37)         1879 (43)         50001           Stage         1         1063 (63)         2464 (57)         60001           II         306 (18)         1535 (35)         1         1           Vit         858 (51)         760 (18)         1         1           Unknown         11 (8)         491 (11)         1         1         1           No         1447 (86)         40018 (93)         2         60001           Yes         224 (14)         325 (7)         1         1         1           No         1447 (86)         401 (1)         172 (4)         1 <t< td=""><td>2001</td><td>178 (10)</td><td>458 (10)</td><td></td></t<>	2001	178 (10)	458 (10)	
2004         213 (13)         494 (11)           2005         210 (12)         486 (11)           2006         197 (12)         568 (13)           2007         211 (12)         545 (13)           2008         197 (12)         530 (12)           2009         201 (12)         514 (12)           Type of cancer         523 (12)         50001           Colonic         1063 (63)         2464 (57)         60001           Stage         535 (12)         1879 (43)         50001           I         306 (18)         1535 (35)         11           103 (12)         1411 (32)         7         60001           Ves         224 (14)         325 (7)         7         60001           No         1447 (86)         216 (50)         7         60001           No         1447 (86)         224 (14)         325 (7)         7         60001           ASA         1         771 (46)         1731 (40)         7         6         7           Yes         884 (52)         867 (20)         6         7         6         7           No         128 (8)         198 (5)         7         7         8         7	2002	176 (10)	438 (10)	
2004         210 (12)         486 (11)           2006         199 (12)         568 (13)           2007         211 (12)         545 (13)           2008         197 (12)         530 (12)           2009         201 (12)         514 (12)           7ype of cancer         206 (12)         514 (12)           Colonic         Rectal         626 (37)         1879 (43)           Stage         2000 (18)         1535 (35)         146 (3)           I         306 (18)         1535 (35)         146 (3)           III         43 (3)         146 (3)         1446 (3)           IV         858 (51)         760 (18)         2007           Unknown         131 (8)         491 (11)         2007           Ves         224 (14)         325 (7)         320 (7)           ASA         1         771 (46)         173 (40)           -1II         771 (46)         173 (40)         272 (6)           Unknown         194 (11)         272 (6)         20001           Ves         884 (52)         867 (20)         100 (14)           Unknown         128 (8)         198 (5)         20001           Ves         60001         3278 (75)<	2003	213(13)	439 (10)	
2005 $199 (12)$ $568 (13)$ 2007       211 (12) $545 (13)$ 2008       197 (12) $545 (13)$ 2009       201 (12) $514 (12)$ 2009       201 (12) $514 (12)$ 2009       201 (12) $514 (12)$ 2009       201 (12) $514 (12)$ 2009       201 (12) $514 (12)$ 2009       201 (12) $514 (12)$ 2009       201 (12) $514 (12)$ 2000       1879 (43) $535 (35)$ Stage       206 (18) $1535 (35)$ I       43 (3)       146 (3)         II       43 (3)       146 (3)         IV       858 (51)       760 (18)         Unknown       131 (8)       491 (11)         Comorbidity       484 (29)       2168 (50)         No       1447 (86)       225 (7)         ASA       714 (46)       1731 (40)         ->III       714 (46)       1731 (40)         ->III       714 (46)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation       28 (81)       198 (5)	2004	213 (13)	494 (11)	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	2003	210(12) 100(12)	400 (11) 568 (12)	
2007       211 (12)       543 (13)         2009       201 (12)       514 (12)         2009       201 (12)       514 (12)         2009       201 (12)       514 (12)         2009       201 (12)       514 (12)         2000       626 (37)       1879 (43)         Stage       \$0001       \$0001         I       306 (18)       1535 (35)         III       43 (3)       146 (3)         III       351 (21)       1411 (32)         IVV       858 (51)       760 (18)         Unknown       131 (8)       491 (11)         Comorbidity       \$224 (14)       325 (7)         No       1447 (86)       4018 (93)         Yes       224 (14)       325 (7)         ASA       \$224 (14)       325 (7)         II       484 (29)       2168 (50)         II       771 (46)       1731 (40)         >III       240 (14)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation       \$28 (14)       206 (5)         Yes       677 (40)       3278 (75)         No       \$28 (14)       206 (5)         Colonic re	2000	211 (12)	545 (13)	
2009         201 (12)         530 (12)           Type of cancer         2464 (57)         <0001	2007	211 (12)	545 (13)	
2009         201 (12)         314 (12)         30001           Type of cancer Colonic         1063 (63)         2464 (57)         \$0001           Rectal         626 (37)         1879 (43)         \$0001           Stage         266 (57)         1879 (43)         \$0001           I         306 (18)         1535 (35)         \$0001           II         306 (18)         146 (3)         \$0001           IV         858 (51)         760 (18)         \$0001           Unknown         131 (8)         491 (11)         \$0001           Comorbidity         \$0001         \$0001         \$0001           No         1447 (86)         2168 (50)         \$0001           I         771 (46)         1731 (40)         \$0001           Yes         224 (14)         325 (7)         \$0001           Ves         677 (40)         3278 (75)         \$0001           Yes         677 (40)         3278 (75)         \$0001           No         884 (52)         867 (20)         \$0001           Unknown         128 (8)         198 (5)         \$0001           Yes         228 (14)         206 (5)         \$0001           Stof (22)         1197 (28)<	2008	197 (12)	530 (12)	
Type of calleer       1063 (63)       2464 (57)       80001         Rectal       626 (37)       1879 (43)       60001         Stage       306 (18)       1535 (35)       60001         I       306 (18)       1535 (35)       60001         II       306 (18)       146 (3)       60001         II       351 (21)       1411 (32)       60001         V       858 (51)       760 (18)       60001         Unknown       131 (8)       491 (11)       60001         No       1447 (86)       4018 (93)       60001         Yes       224 (14)       325 (7)       60001         ASA       50001       771 (46)       1731 (40)       60001         ->III       771 (46)       1731 (40)       60001       60001         ->III       240 (14)       172 (4)       60001       60001         Yes       677 (40)       3278 (75)       60001       60001         No       128 (8)       198 (5)       60001       60001         Curative operation       228 (14)       206 (5)       60001       60001         Rectal resection       228 (14)       206 (5)       60001       60001         C	2009	201 (12)	514 (12)	< 0001
Colume         1005 (05)         2404 (57)           Rectal         626 (37)         1879 (43)           Stage         306 (18)         1535 (35)           I         306 (18)         1535 (35)           II         31 (3)         146 (3)           IV         858 (51)         760 (18)           Unknown         131 (8)         491 (1)           Comorbidity         4018 (93)         4018 (93)           Yes         224 (14)         325 (7)           ASA         11         484 (29)         2168 (50)           II         771 (46)         1731 (40)         4014 (93)           ->III         240 (14)         172 (4)         400           Unknown         194 (11)         272 (6)         4000           Ves         224 (14)         3278 (75)         \$0001           Yes         677 (40)         3278 (75)         \$0001           Yes         884 (52)         867 (20)         \$0001           Unknown         128 (8)         198 (5)         \$0001           Explorative aparotomy or formation of an ostomy         \$37 (32)         1445 (33)         \$0001           Local procedures         367 (22)         197 (28)         \$251	Type of cancer	1063 (63)	2464 (57)	<.0001
Kectal         0.00 (37)         1677 (43)         \$0001           Stage         306 (18)         1535 (35)         \$0001           I         43 (3)         146 (3)         144 (3)           III         351 (21)         1411 (32)         760 (18)           Unknown         131 (8)         491 (11)         \$0001           Comorbidity         4018 (93)         \$0001           No         1447 (86)         4018 (93)         \$0001           I         484 (29)         2168 (50)         \$0001           I         771 (46)         1731 (40)         \$0001           ->III         771 (46)         1731 (40)         \$0001           ->III         240 (14)         172 (4)         \$0001           Ves         677 (40)         3278 (75)         \$0001           Yes         677 (40)         3278 (75)         \$0001           No         884 (52)         867 (20)         \$0001           Unknown         128 (8)         198 (5)         \$0001           Type of operation         \$28 (14)         206 (5)         \$0001           Colonic resection         228 (14)         206 (5)         \$0001           Colonic resection         306 (1	Pactal	626 (27)	1870(43)	
Stage         306 (18)         1535 (35)         10001           I         43 (3)         146 (3)         146 (3)           II         351 (21)         1411 (32)         146 (3)           IV         858 (51)         760 (18)         491 (11)           Comorbidity         491 (11)         491 (11)         4018 (93)         491 (11)           No         1447 (86)         4018 (93)         40001         40001           Yes         224 (14)         325 (7)         40001         40001           I         484 (29)         2168 (50)         4001         40	Stage	020 (37)	1877 (45)	< 0001
I       43 (3)       146 (3)         III       43 (3)       144 (3)         III       351 (21)       1411 (32)         IV       858 (51)       760 (18)         Unknown       131 (8)       491 (11)         Comorbidity         No       1447 (86)       4018 (93)         Yes       224 (14)       325 (7)         ASA	J	306 (18)	1535 (35)	~.0001
II       140 (3)       140 (3)         III       351 (21)       1411 (32)         IV       858 (51)       760 (18)         Unknown       131 (8)       491 (11)         Comorbidity       491 (11)          No       1447 (86)       4018 (93)         Yes       224 (14)       325 (7)         ASA       11       771 (46)       1731 (40)         ->III       771 (46)       1731 (40)         ->III       240 (14)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation       677 (40)       3278 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation       228 (14)       206 (5)         Colonic resection       206 (18)       1352 (31)         Explorative laparotomy or formation of an ostomy       537 (32)       1445 (33)         Unknown       367 (22)       1197 (28)         Unknown       367 (22)       1197 (28)         Unknown       367 (22)       1443 (3)         Post-operative complications       1448 (86)       3689 (85)         No       Yes       241 (14)		$\frac{300}{12}$	1355 (35)	
III       351 (21)       1411 (32)         IV       858 (51)       760 (18)         Unknown       131 (8)       491 (11)         Comorbidity       4018 (93)       325 (7)         No       1447 (86)       325 (7)         ASA       -       -         I       484 (29)       2168 (50)         II       771 (46)       1731 (40)         ->III       240 (14)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation       677 (40)       3278 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation       228 (14)       206 (5)         Rectal resection       228 (14)       206 (5)         Colonic resection       306 (18)       1352 (31)         Explorative laparotomy or formation of an ostomy       1445 (33)       1445 (33)         Unknown       367 (22)       1197 (28)       143 (3)         Obst-operative complications       537 (32)       1445 (33)       1448 (86)         No       1448 (86)       3689 (85)       644 (15)		45 (5)	140(3)	
IV       038 (31)       700 (13)       -         Unknown       131 (8)       491 (11) <td></td> <td>551 (21) 959 (51)</td> <td>760(18)</td> <td></td>		551 (21) 959 (51)	760(18)	
Onknown         151 (6)         491 (11) <td>Iv Unknown</td> <td>121 (8)</td> <td>401 (11)</td> <td></td>	Iv Unknown	121 (8)	401 (11)	
Comorbidity No         1447 (86)         4018 (93)         325 (7)           ASA         224 (14)         325 (7)            ASA         11         484 (29)         2168 (50) <t< td=""><td></td><td>131 (8)</td><td>491 (11)</td><td>&lt; 0001</td></t<>		131 (8)	491 (11)	< 0001
No       144 / (86)       4018 (93)         Yes       224 (14)       325 (7)         ASA       224 (14)       325 (7)         I       484 (29)       2168 (50)         II       771 (46)       1731 (40)         ->III       240 (14)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation       677 (40)       3278 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation       228 (14)       206 (5)         Colonic resection       228 (14)       206 (5)         Colonic resection       237 (32)       1445 (33)         Unknown       367 (22)       1197 (28)         Local procedures       537 (32)       1445 (33)         Unknown       251 (15)       143 (3)         Post-operative complications       251 (15)       3689 (85)         No       1448 (86)       3689 (85)         Yes       241 (14)       654 (15)		1447 (96)	4018 (02)	<.0001
ICS       224 (14)       325 (7)         ASA       484 (29)       2168 (50)         I       771 (46)       1731 (40)         ->III       240 (14)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation       677 (40)       3278 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation       228 (14)       206 (5)         Colonic resection       228 (14)       206 (5)         Colonic resection       306 (18)       1352 (31)         Explorative laparotomy or formation of an ostomy       537 (32)       1445 (33)         Unknown       251 (15)       143 (3)         Post-operative complications       251 (15)       143 (3)         No       1448 (86)       3689 (85)         Yes       241 (14)       654 (15)	INO Voc	$\frac{144}{(80)}$	4018 (93)	1
ASA       484 (29)       2168 (50)          I       771 (46)       1731 (40)          ->III       240 (14)       172 (4)          Unknown       194 (11)       272 (6)           Curative operation       677 (40)       3278 (75)             Yes       677 (40)       3278 (75)	ies	224 (14)	323 (7)	1 0001
I       484 (29)       2168 (50)         II       771 (46)       1731 (40)         ->III       240 (14)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation         Yes       677 (40)       3278 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation         Rectal resection       228 (14)       206 (5)         Colonic resection       228 (14)       206 (5)         Colonic resection       306 (18)       1352 (31)         Explorative laparotomy or formation of an ostomy       4537 (32)       1445 (33)         Unknown       251 (15)       143 (3)	ASA	484 (20)	21(2)(50)	<.0001
II       //1 (46)       1/31 (40)         ->III       240 (14)       1/72 (4)         Unknown       194 (11)       272 (6)         Curative operation       272 (6)         Yes       677 (40)       3278 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation       228 (14)       206 (5)         Rectal resection       228 (14)       206 (5)         Colonic resection       306 (18)       1352 (31)         Explorative laparotomy or formation of an ostomy       123 (3)       445 (33)         Local procedures       537 (32)       1445 (33)       444 (33)         Post-operative complications       251 (15)       143 (3)       0.44         No       1448 (86)       3689 (85)       0.44		404 (29)	2108 (30)	
~111       240 (14)       172 (4)         Unknown       194 (11)       272 (6)         Curative operation       677 (40)       3278 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation       228 (14)       206 (5)         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       537 (22)       1197 (28)         Unknown       251 (15)       143 (3)         Post-operative complications       1448 (86)       3689 (85)         No       1448 (86)       3689 (85)         Yes       241 (14)       654 (15)		7/1 (40)	1731 (40)	
Unknown         194 (11)         2/2 (6)           Curative operation </td <td>-&gt;111 1.1</td> <td>240 (14)</td> <td>1/2 (4)</td> <td></td>	->111 1.1	240 (14)	1/2 (4)	
Curative operation          <         <         <         <         <         <         <         <          <         <          <         <          <         <         <         <         <         <         <         <         <         <         <         <         <         <          <         <          <         <            <           <         <          <             <	Unknown	194 (11)	272(0)	< 0001
res       67/ (40)       52/8 (75)         No       884 (52)       867 (20)         Unknown       128 (8)       198 (5)         Type of operation       228 (14)       206 (5)         Colonic resection       306 (18)       1352 (31)         Explorative laparotomy or formation of an ostomy       537 (32)       1445 (33)         Local procedures       537 (22)       1197 (28)         Unknown       251 (15)       143 (3)         Post-operative complications       1448 (86)       3689 (85)         No       1448 (86)       3689 (85)         Yes       241 (14)       654 (15)	Curative operation	(77 (40)	2278 (75)	<.0001
No         884 (52)         867 (20)           Unknown         128 (8)         198 (5)           Type of operation         28 (14)         206 (5)           Rectal resection         228 (14)         206 (5)           Colonic resection         306 (18)         1352 (31)           Explorative laparotomy or formation of an ostomy         537 (32)         1445 (33)           Unknown         367 (22)         1197 (28)           251 (15)         143 (3)	Yes	677 (40)	3278 (75)	
Unknown         128 (8)         198 (5)           Type of operation Rectal resection         228 (14)         206 (5)           Colonic resection         306 (18)         1352 (31)           Explorative laparotomy or formation of an ostomy Local procedures         537 (32)         1445 (33)           Unknown         367 (22)         1197 (28)           251 (15)         143 (3)           Post-operative complications No         1448 (86)         3689 (85)           Yes         241 (14)         654 (15)	No	884 (52)	867 (20)	
Type of operation         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <         <          <         <	Unknown	128 (8)	198 (5)	
Rectal resection         228 (14)         206 (5)           Colonic resection         306 (18)         1352 (31)           Explorative laparotomy or formation of an ostomy         -         -           Local procedures         537 (32)         1445 (33)           Unknown         367 (22)         1197 (28)           251 (15)         143 (3)         -           Post-operative complications         -         0.44           No         1448 (86)         3689 (85)           Yes         241 (14)         654 (15)	Type of operation			<.0001
Colonic resection       306 (18)       1352 (31)         Explorative laparotomy or formation of an ostomy       537 (32)       1445 (33)         Local procedures       537 (22)       1197 (28)         Unknown       251 (15)       143 (3)         Post-operative complications       1448 (86)       3689 (85)         No       1448 (86)       3689 (85)         Yes       241 (14)       654 (15)	Rectal resection	228 (14)	206 (5)	
Explorative laparotomy or formation of an ostomy       537 (32)       1445 (33)         Local procedures       537 (22)       1197 (28)         Unknown       251 (15)       143 (3)         Post-operative complications       1448 (86)       3689 (85)         No       1448 (86)       3689 (85)         Yes       241 (14)       654 (15)	Colonic resection	306 (18)	1352 (31)	
Local procedures         537 (32)         1445 (33)           Unknown         367 (22)         1197 (28)           251 (15)         143 (3)           Post-operative complications         0.44           No         1448 (86)         3689 (85)           Yes         241 (14)         654 (15)	Explorative laparotomy or formation of an ostomy			
Unknown         367 (22) 251 (15)         1197 (28) 143 (3)           Post-operative complications         0.44           No         1448 (86)         3689 (85)           Yes         241 (14)         654 (15)	Local procedures	537 (32)	1445 (33)	
251 (15)         143 (3)           Post-operative complications         0.44           No         1448 (86)         3689 (85)           Yes         241 (14)         654 (15)	Unknown	367 (22)	1197 (28)	
Post-operative complications         0.44           No         1448 (86)         3689 (85)           Yes         241 (14)         654 (15)		251 (15)	143 (3)	
No         1448 (86)         3689 (85)           Yes         241 (14)         654 (15)	Post-operative complications			0.44
Yes 241 (14) 654 (15)	No	1448 (86)	3689 (85)	
	Yes	241 (14)	654 (15)	

#### 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 to 2009 and part of the workforce at time
- of follow-up

Mean time in weeks from one year after operation and first change in employmental state (% of population)	To work	To sickness absence	To unemploy- ment	To retirement	To censoring due to age, dead, 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%)

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 year	s 2001 to 2009, and par	t of the work force at t	ime of follow-up.	
	HR – unadjusted	HR - ajusted for	HR - adjusted for	HR - adjusted for
SICKNESS ABSENCE $\rightarrow$ WORK	(events: 2125)	SES8	SES8 and	SES8 confounders and
biele (Ebb / Ebb / Ebb / Cel / Woldt	(0,0110,2120)	5253	confounders*	clinical variables
Education			comounders	chilical variables
Duinement	1	1	1	1
Primary school				
Vocational and short education	0.87 (0.76-0.98)	0.91 (0.79-1.05)	0.91 (0.78-1.04)	0.92 (0.79-1.06)
Medium and long education	1.01 (0.91-1.13)	1.09 (0.96-1.24)	1.08 (0.95-1.23)	1.06 (0.93-1.21)
Disposal income #				
Lowest quartile	1	1	1	1
Second lowest quartile	1 11 (0 97-1 26)	1 03 (0 90-1 17)	1 01 (0 88-1 15)	1 07 (0 94-1 22)
Second highest quartile	1.27(1.12-1.44)m	1.03(0.90(1.17)) 1.14(1.00-1.29)	1.12(0.98-1.27)	1.15(1.00-1.31)
Highest quartile	$1.27(1.12-1.44) \approx$	1.14(1.00-1.2)) 1.15(1.00, 1.23)	1.12(0.96-1.27) 1.14(0.00, 1.27)	1.15(1.00-1.51) 1.16(1.00,1.24)
	1.25 (1.10-1.42) <sup>\alpha</sup>	1.15 (1.00-1.55)	1.14 (0.33-1.3 2)	1.10 (1.00-1.54)
Job type				
Management and knowledge work	1.18 (0.95-1.22)	1.10 (0.90-1.28)	1.10 (0.94-1.28)	1.11 (0.95-1.30)
Office and sale (non-manual)	1.07 (0.97-1.17)	1.07 (0.97-1.19)	1.09 (0.98-1.22)	1.10 (0.99-1.23)
Manual	1	1	1	1
Other	0.71 (0.58-0.87)	0.71 (0.57-0.86)¤	1.17 (0.50-2.29)	0.88 (0.37-1.73)
Previous periodsof work				· · · · · · · · · · · · · · · · · · ·
Periodo in an	1 01 (1 01-1 02)o	1 13 (1 11-1 16)00	1 13 (1 11-1 16)00	1 13 (1 11-1 16)00
Durations noticely of sight one about a	1.01 (1.01-1.02)~	1.15 (1.11-1.10)	1.15 (1.11-1.10)	1.15 (1.11-1.10)
Previous periods of sickness absence	1.05 (1.04.1.05)	0.04(0.00.0.00)==	0.04 (0.02.0.00)	0.02 (0.01.0.05)==
	1.05 (1.04-1.05)00	0.94 (0.92-0.96)00	0.94 (0.92-0.96)00	0.93 (0.91-0.95)
Previous periods of unemployment				
	0.98 (0.98-0.99)¤	0.89 (0.87-0.91)¤¤	0.89 (0.87-0.91)00	0.88 (0.87-0.90)¤¤
Type of cancer				
Colonic	1			1
Rectal	1 01 (0 93-1 10)			0.96 (0.84-1.08)
Stago	1.01 (0.55 1.10)			0.50 (0.01 1.00)
J	1			1
	1 0.72 (0.5( 0.04) $\pi$			
	0.73 (0.56-0.94)			0.82 (0.62-1.06)
111	0.76 (0.69-0.84)			0.74 (0.66-0.82)
IV	0.36 (0.31-0.41)aa			0.53 (0.41-0.68)¤¤
Unknown	1.14 (1.00-1.30)			1.15 (0.96-1.39)
Comorbidity				
No	1			1
Ves	0.81 (0.73-0.89)¤			0.90(0.82-1.00)
A C A	0.01 (0.75 0.07)-			0.90 (0.02 1.00)
I	1			1
	1 0.94 (0.77.0.02)			1
	0.84 (0.77-0.92) <sup>Q</sup>			0.95 (0.85-1.05)
>111	0.67 (0.52-0.84)¤			0.85 (0.65-1.07)
Unknown	0.89 (0.73-1.06)			1.07 (0.79-1.41)
Curative l operation				
Yes	1			1
No	0.43 (0.38-0.49)00			0.69 (0.55-0.86)¤
Unknown	0.83 (0.68-1.02)			0.90 (0.62-1.26)
Type of operation				
Pastal resection	1			1
	1			1
Colonic resection	0.95 (0.85-1.05)			0.95 (0.83-1.09)
Explorative laparotomy or formation of				
an ostomy	0.99 (0.89-1.10)			1.06 (0.91-1.23)
Local procedures	0.65 (0.50-0.83)¤			0.76 (0.57-1.00)¤
Unknown	0.33 (0.22-0.48)aa			0.48 (0.30-0.75)¤
Post-operative complications				
No	1			1
Vec	0.84 (0.74.0.04)			0.82 (0.72-0.92)
103	0.0+ (0.7+-0.94) <sup>2</sup>			0.02 (0.72-0.92)

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

§ SES (Socioeconomic status): education, disposal income and job type

¤ Significant at a 0.05 level

DD Significant at a <.0001 level

# Depending on year the highest disposal income ranged from 175.500 DKr in 2001 to 299.717 DKr in 2009

  $\frac{1}{2}$ 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 to 2009, and part of the work force at time of follow-up.

WORK → SICKNESS ABSENCE	HR - unadjusted (events: 2296)	HR - ajusted for SES§	HR - adjusted for SES§ and confounders*	HR - adjusted for SES§, confounders* and
				clinical variables
Education	1	1	1	1
Vocational and short education	1 1 25 (1 11-1 41)0	1 1 10 (0.96 1.27)	1 1 10 (0.96-1.27)	1 1 07 (0.93 1 23)
Medium and long education	1.25 (1.11-1.41) <sup>\inflow</sup>	1.10(0.90-1.27) 1.22(1.08-1.38) $\sigma$	1.10(0.90-1.27) 1.21(1.07-1.37)	1.07 (0.95-1.25) 1.18 (1.04-1.34)o
Disposal income #	1.40 (1.20-1.50)	1.22 (1.00-1.50)~	1.21 (1.07-1.57)~	1.10 (1.04-1.54)~
Lowest quartile	1	1	1	1
Second lowest quartile	1.18 (1.04-1.33)	1.18 (1.05-1.34)¤	1.17 (1.03-1.33)	1.13 (0.99-1.28)
Second highest quartile	1.02 (0.91-1.16)	1.04 (0.92-1.18)	1.02 (0.90-1.16)	1.00 (0.88-1.14)
Highest quartile	0.82 (0.73-0.94)¤	0.99 (0.87-1.14)	0.99 (0.86-1.14)	0.96 (0.84-1.11)
Job type				
Management and knowledge	0.69 (0.61-0.78)¤¤	0.96 (0.83-1.12)	0.97 (0.84-1.14)	0.95 (0.82-1.11)
work	0.89 (0.82-0.98)	1.00 (0.91-1.10)	1.00 (0.91-1.12)	1.00 (0.90-1.11)
Office and sale (non-manual)	1	1	1	1
Manual	0.67 (0.54-0.83)¤	0.84 (0.67-1.04)	1.00 (0.48-1.82)	1.06 (0.51-1.93)
Other				
Previous episodes of work	1.02 (1.02.1.02)	1.02 (1.01.1.04)~	1.02 (1.01.1.04)~	1.02 (1.01.1.04)~
Durations onice des of sightees	1.03 (1.03-1.03)00	1.02 (1.01-1.04)¤	1.02 (1.01-1.04)¤	1.03 (1.01-1.04)¤
absence	1 10 (1 09-1 11)00	1 08 (1 06-1 09)00	1 08 (1 06-1 09)00	1.08 (1.06-1.09)00
Previous enisodes of	1.10 (1.0)-1.11)	1.00 (1.00-1.07)	1.00 (1.00-1.07)	1.00 (1.00-1.07)
unemployment	1.01 (1.01-1.02)¤	0.98 (0.97-0.99)¤	0.98 (0.97-0.99)¤	0.98 (0.97-0.99)¤
Type of cancer		, , , , , , , , , , , , , , , , , , ,		· · · · · · · · · · · · · · · · · · ·
Colonic	1			1
Rectal	1.10 (1.01-1.19)			1.17 (1.03-1.32)¤
Stage				
I				1
	0.9/(0.74-1.25)			0.99(0.75-1.28)
	1.29 (1.16-1.41) <sup>Q</sup>			1.24 (1.11-1.37) <sup>Q</sup>
IV Unknown	$1.03(1.40-1.88)^{\Box\Box}$			$1.52(1.21-1.91)^{\Omega}$
Co-morbidity	1.11 (0.98-1.23)			1.08 (0.91-1.29)
No	1			1
Yes	0.99(0.90-1.08)			105(0.96-1.16)
ASA	0.55 (0.50 1.00)			1.00 (0.90 1110)
I	1			1
II	1.09 (1.00-1.19)			1.09 (0.99-1.20)
->III	1.42 (1.12-1.75)¤			1.33 (1.05-1.67)¤
Unknown	1.02 (0.85-1.21)			0.92 (0.70-1.19)
Curative operation				
Yes	1			1
No	1.43 (1.26-1.61)00			1.35 (1.11-1.63)¤
Unknown	1.05 (0.87-1.29)			1.07 (0.77-1.45)
Type of operation	1			1
Colonia resection	1 10 (0.01 1 11)			1 1 10 (0.97 1.25)
Explorative laparotomy or	1.0 (0.71-1.11)			1.10 (0.77-1.23)
formation of an ostomy	0.91 (0.82 - 1.01)			1.05(0.91-1.22)
Local procedures	0.72 (0.56-0.91)¤			0.78 (0.60-1.01)
Unknown	0.93 (0.66-1.26)			0.81 (0.53-1.20)
Post-operative complications				, , , , , , , , , , , , , , , , , , ,
No	1			1
Yes	1.18 (1.05-1.31)¤			1.25 (1.11-1.41)¤

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

§ SES (Socioeconomic status): education, disposal income and job type

¤ Significant at a 0.05 level

DD Significant at a <.0001 level

1 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 time of follow-up.

cancer in the years 2001 to 2009, and pa	art of the work force at time of	of follow-up.
Mutually adjusted and controlled for	HR for transition from	HR for transition from
confounders*	sickness absence ->	work / unemployed ->
	retirement (number of	retirement (number of
	events:569)	events: 109)
Status		
Working		1
Unemployed		5 89 (3 46-10 03)pp
Education		0.03 (0.10 10.03)
Primary school	1	1
Vocational and short education	1 13(0.85, 1.51)	1 20 (0.65 2.60)
Medium and long education	1.15(0.85-1.51) 1.06(0.81,1.41)	1.29(0.03-2.09) 1.24(0.64, 2.53)
Dispessal in some #	1.00 (0.81-1.41)	1.24 (0.04-2.33)
Disposal income #	1	1
Lowest quartile	$1 \\ 0.05 (0.76 + 1.10)$	1
Second lowest quartile	0.93 (0.76-1.19)	0.49 (0.27-0.83)
Second nignest quartile	0.77 (0.60-0.98) <sup>Q</sup>	$0.47(0.25-0.83)^{\circ}$
Highest quartile	0.79 (0.60-1.04)	0.29 (0.14-0.57) <sup>\overlaphi</sup>
Job type	0.50 (0.40.0.00)	
Management and knowledge work	0.59 (0.42-0.82)¤	0.93 (0.85-1.03)
Office and sale (non-manual)	0.72 (0.580.89)¤	0.96 (0.86-1.06)
Manual	1	1
Other	1.05 (0.06-4.85)	0.38 (0.12-1.37)
Previous episodes of work		
	0.98 (0.95-1.00)	0.93 (0.85-1.03)
Previous episodes of sickness absence		
_	1.00 (0.97-1.02)	0.96 (0.86-1.06)
Previous episodes of unemployment		, , , , , , , , , , , , , , , , , , , ,
1 1 2	1.03 (1.00-1.05)¤	1.02 (0.94-1.11)
Type of cancer	, i i i i i i i i i i i i i i i i i i i	, , , , , , , , , , , , , , , , , , ,
Colonic	1	1
Rectal	1.32 (1.04-1.67)¤	1.33 (0.75-2.34)
Stage		
I	1	
II	0.85 (0.46-1.46)	1 70 (0 49-4 51)
III	1 13 (0.89 - 1.44)	191 (115-321)¤
IV	1.58 (1.04-2.42)g	2 30 (0 88-6 14)
Unknown	1.01 (0.68-1.50)	1.72(0.82-3.59)
Comorbidity	1.01 (0.00-1.50)	1.72 (0.02-5.57)
No	1	
Vec	$1 \\ 1 \\ 03 \\ (0 \\ 85 \\ 1 \\ 24)$	1 17 (0 76 1 77)
	1.05 (0.85-1.24)	1.17 (0.70-1.77)
ASA I	1	
	1 21 (1 02 1 52)	1 56 (1 00 2 44)5
	1.31 (1.08-1.38) <sup>Q</sup> 2.16 (1.40.2.06) <sup>m</sup>	$1.30(1.00-2.44)^{\Omega}$ 2.57(1.02.5.75)
	2.16 (1.49-3.06) <sup>Q</sup>	2.57 (1.03-5.75) <sup>Q</sup>
Unknown	1.29 (0.70-2.09)	1.04 (0.50-4.24)
Curative operation	1	1
Yes		
No	1.30 (0.89-1.86)	1.80 (0.77-3.84)
Unknown	1.41 (0.75-2.51)	1.05 (0.19-4.01)
Type of operation		
Rectal resection	1	1
Colonic resection	1.42 (1.11-1.81)¤	1.36 (0.74-2.51)
Explorative laparotomy or		
formation of an ostomy	1.06 (0.78-1.43)	1.23 (0.55-2.32)
Local procedures	1.01 (0.53-1.84)	0.39 (0.08-1.26)
Unknown	1.45 (0.93-2.18)	0.84 (0.16-3.13)
Post-operative complications		
No	1	1
**	1.22(1.00, 1.51)m	0.86 (0.47.1.46)

\*Confounders: Gender, age at time of diagnosis, country of birth, marital status and year of operation

¤ Significant at a 0.05 level

pp Significant at a <.0001 level

# Depending on year the highest disposal income ranged from 175.500 DKr in 2001 to 299.717 DKr in 2009

2			
3 4	1		
5	1		
6 7	2		Reference List
8 9 10	4 5	(1)	Ferlay J, Parkin DM, Steliarova-Foucher E. Estimates of cancer incidence and mortality in Europe in 2008. <i>Eur J Cancer</i> 2010; 46(4):765-781.
11 12 13 14 15 16	6 7 8 9	(2)	Coleman MP, Forman D, Bryant H, Butler J, Rachet B, Maringe C et al. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. <i>Lancet</i> 2011; 377(9760):127-138.
17 18 19 20	10 11 12	(3)	Brenner H, Bouvier AM, Foschi R, Hackl M, Larsen IK, Lemmens V et al. Progress in colorectal cancer survival in Europe from the late 1980s to the early 21st century: the EUROCARE study. <i>Int J Cancer</i> 2012; 131(7):1649-1658.
21 22 23	13 14	(4)	Gordon L, Lynch BM, Newman B. Transitions in work participation after a diagnosis of colorectal cancer. <i>Aust N Z J Public Health</i> 2008; 32(6):569-574.
24 25 26 27	15 16 17	(5)	van den Brink M, van den Hout WB, Kievit J, Marijnen CA, Putter H, van de Velde CJ et al. The impact of diagnosis and treatment of rectal cancer on paid and unpaid labor. <i>Dis Colon Rectum</i> 2005; 48(10):1875-1882.
28 29 30 31 32	18 19 20	(6)	Frederiksen BL, Osler M, Harling H, Ladelund S, Jorgensen T. The impact of socioeconomic factors on 30-day mortality following elective colorectal cancer surgery: a nationwide study. <i>Eur J Cancer</i> 2009; 45(7):1248-1256.
33 34 35 36	21 22 23	(7)	Cavalli-Bjorkman N, Lambe M, Eaker S, Sandin F, Glimelius B. Differences according to educational level in the management and survival of colorectal cancer in Sweden. <i>Eur J Cancer</i> 2011; 47(9):1398-1406.
37 38 39 40	24 25 26	(8)	Egeberg R, Halkjaer J, Rottmann N, Hansen L, Holten I. Social inequality and incidence of and survival from cancers of the colon and rectum in a population-based study in Denmark, 1994-2003. <i>Eur J Cancer</i> 2008; 44(14):1978-1988.
41 42 43 44 45	27 28 29	(9)	Aarts MJ, Lemmens VEPP, Louwman MWJ, Kunst AE, Coebergh JW. Socioeconomic status and changing inequalities in colorectal cancer? A review of the associations with risk, treatment and outcome. <i>European Journal of Cancer</i> 2010; 46(15):2681-2695.
43 46 47 48 49	30 31 32	(10)	Drolet M, Maunsell E, Brisson J, Brisson C, Masse B, Deschenes L. Not Working 3 Years After Breast Cancer: Predictors in a Population-Based Study. <i>J Clin Oncol</i> 2005; 23(33):8305-8312.
50 51 52 53	33 34 35	(11)	Steiner JF, Cavender TA, Nowels CT, Beaty BL, Bradley CJ, Fairclough DL et al. The impact of physical and psychosocial factors on work characteristics after cancer. <i>Psychooncology</i> 2008; 17(2):138-147.
54 55 56 57 58 59	36 37 38	(12)	Paraponaris A, Teyssier LS, Ventelou B. Job tenure and self-reported workplace discrimination for cancer survivors 2 years after diagnosis: does employment legislation matter? <i>Health Policy</i> 2010; 98(2-3):144-155.
## **BMJ Open**

3 4 5	1	(13)	Earle CC, Chretien Y, Morris C, Ayanian JZ, Keating NL, Polgreen LA et al. Employment
6 7	3		1705.
8 9 10	4 5 6	(14)	Spelten ER, Sprangers MA, Verbeek JH. Factors reported to influence the return to work of cancer survivors: a literature review. <i>Psychooncology</i> 2002; 11(2):124-131.
11 12 13 14	7 8	(15)	Short PF, Vasey JJ, Tunceli K. Employment pathways in a large cohort of adult cancer survivors. <i>Cancer</i> 2005; 103(6):1292-1301.
15 16 17	9 10	(16)	Mehnert A. Employment and work-related issues in cancer survivors. <i>Crit Rev Oncol Hematol</i> 2011; 77(2):109-130.
18 19 20 21 22	11 12 13 14	(17)	Dalton SO, Steding-Jessen M, Gislum M, Frederiksen K, Engholm G, Schuz J. Social inequality and incidence of and survival from cancer in a population-based study in Denmark, 1994-2003: Background, aims, material and methods. <i>Eur J Cancer</i> 2008; 44(14):1938-1949.
23 24 25	15 16	(18)	Amir Z, Moran T, Walsh L, Iddenden R, Luker K. Return to paid work after cancer: a British experience. <i>J Cancer Surviv</i> 2007; 1(2):129-136.
26 27 28 29 20	17 18 19 20	(19)	Carlsen K, Dalton SO, Frederiksen K, Diderichsen F, Johansen C. Cancer and the risk for taking early retirement pension: A Danish cohort study. <i>Scandinavian Journal of Public Health</i> 2008; 36(2):117-125.
30 31 32 33 34	20 21 22 23	(20)	Sjovall K, Attner B, Englund M, Lithman T, Noreen D, Gunnars B et al. Sickness absence among cancer patients in the pre-diagnostic and the post-diagnostic phases of five common forms of cancer. <i>Support Care Cancer</i> 2012; 20(4):741-747.
35 36 37	24 25	(21)	Syse A, Tretli S, Kravdal O. Cancer's impact on employment and earningsa population- based study from Norway. <i>J Cancer Surviv</i> 2008; 2(3):149-158.
38 39 40 41	26 27 28	(22)	Mols F, Thong MS, Vissers P, Nijsten T, van de Poll-Franse LV. Socio-economic implications of cancer survivorship: results from the PROFILES registry. <i>Eur J Cancer</i> 2012; 48(13):2037-2042.
42 43 44 45	29 30	(23)	Andersen PK, Keiding N. Multi-state models for event history analysis. <i>Stat Methods Med Res</i> 2002; 11(2):91-115.
46 47 48 49	31 32 33	(24)	Christensen KB, Andersen PK, Smith-Hansen L, Nielsen ML, Kristensen TS. Analyzing sickness absence with statistical models for survival data. <i>Scand J Work Environ Health</i> 2007; 33(3):233-239.
50 51 52 53	34 35 36	(25)	Gjesdal S, Ringdal PR, Haug K, Maeland JG. Long-term sickness absence and disability pension with psychiatric diagnoses: a population-based cohort study. <i>Nord J Psychiatry</i> 2008; 62(4):294-301.
54 55 56 57 58 59	37 38 39	(26)	Lie SA, Eriksen HR, Ursin H, Hagen EM. A multi-state model for sick-leave data applied to a randomized control trial study of low back pain. <i>Scand J Public Health</i> 2008; 36(3):279-283.
60			For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

## **BMJ Open**

2			
3 4	1	(27)	Pedersen I Biorner IB Burr H Christensen KB Transitions between sickness absence
5	2	(27)	work unemployment and disability in Denmark 2004-2008 Scand J Work Environ Health
6	3		2012; 38(6):516-526.
7			
8	4	(28)	Oyeflaten I, Lie SA, Ihlebaek CM, Eriksen HR. Multiple transitions in sick leave, disability
9 10	5		benefits, and return to work A 4-year follow-up of patients participating in a work-related
11	6		rehabilitation program. BMC Public Health 2012; 12:748.
12	7	( <b>20</b> )	Frederiksen DL Oslan M. Hading H. Ladahand S. Langenson T. Da nationt share staristics
13	/ 0	(29)	Frederiksen BL, Osler M, Harling H, Ladelund S, Jorgensen T. Do patient characteristics,
14	0		Mad 2000: 60(7):1107 1115
15	7		<i>Meu</i> 2009, 09(7).1107-1115.
17	10	(30)	IDA - an integrated data base for labour market research. Main report, 1991. 2006.
18	11		Statistics Denmark. Ref Type: Report
19	12		
20	13	(31)	Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. Scand J Public
21	14		Health 2011; 39(7 Suppl):30-33.
22			
24	15	(32)	Kildemoes HW, Sorensen HT, Hallas J. The Danish National Prescription Registry. Scand J
25	16		Public Health 2011; 39(7 Suppl):38-41.
26	17	(33)	Hiollund NH Larsen FB Andersen IH Register-based follow-up of social benefits and
27	18	(55)	other transfer payments: accuracy and degree of completeness in a Danish interdepartmental
20	19		administrative database compared with a population-based survey. <i>Scand J Public Health</i>
30	20		2007; 35(5):497-502.
31			
32	21	(34)	Sanchez KM, Richardson JL, Mason HR. The return to work experiences of colorectal
33	22		cancer survivors. AAOHN J 2004; 52(12):500-510.
35	22	(25)	Testile T. Martileinen D. Historen D. Lindhahm MJ. Commenting stade of second ability
36	23	(35)	hattycon concer survivors and their referente. Fur L Cancer 2007: 42(5):014,020
37	24		between cancer survivors and them references. Eur 5 Cuncer 2007, 45(5).914-920.
38	25	(36)	Mols F. Thong MS. Vreugdenhil G. van de Poll-Franse LV. Long-term cancer survivors
39	26	()	experience work changes after diagnosis: results of a population-based study.
40 41	27		Psychooncology 2009; 18(12):1252-1260.
42			
43	28	(37)	Rodriguez-Bigas MA, Chang GJ, Skibber JM. Barriers to rehabilitation of colorectal cancer
44	29		patients. J Surg Oncol 2007; 95(5):400-408.
45	30		
40 47	31		
48			
49			
50			
51 52			
53			
54			
55			
56			
5/ 58			
50 59			
60			

**BMJ Open** 

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









\* 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 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.

90x92mm (300 x 300 DPI)

