World J Surg (2019) 43:763–771
https://doi.org/10.1007/s00268-018-4830-4

ORIGINAL SCIENTIFIC REPORT (INCLUDING PAPERS PRESENTED AT SURGICAL CONFERENCES)

Labour Market Participation After Emergency Laparotomy: A Nationwide Cohort Study with Long-Term Follow-Up

Lau Caspar Thygesen[1] · **Ismail Gögenur**[2,3]

Published online: 26 October 2018

Abstract

Background Many patients who undergo emergency laparotomy are working, which is a key determinant for an individual's socio-economic status and financial security. The objectives of this study were to compare labour market participation and sick leave in a nationwide patient population undergoing non-malignant emergency resections with a matched reference population.

Methods This nationwide prospective cohort study included all patients aged 18+ years undergoing emergency laparotomy for non-malignant disease resulting in intestinal resections, ostomy or drainage at Danish hospitals 2003–2014 and who were active on the labour market (n = 2895). We included a sex- and age-matched reference population (n = 11,422) and followed all persons in nationwide registers. We used survival analyses and logistic regression.

Results The proportion of people active in the labour market was 85% and 66% 1 and 2 years after surgery compared to 96% and 79% among the reference population. The hazard ratio of dropout was 1.15 (95% CI 1.05–1.25, p = 0.002) among patients compared to reference population. Increased dropout was observed for disability pension (2.58; 2.14–3.11; $p < 0.0001$), while patients did not have increased rate of age-related pensions. The proportion on sick leave was 66% the month following surgery compared to 3–4% among references. The proportion decreased thereafter but was higher up to 3 years after surgery.

Conclusions This nationwide study including all patients undergoing resections demonstrated marked increase in disability pensioning and sick leave after surgery compared to a matched reference group. This supports the need for interventions and programmes during hospital stay and after discharge focusing on labour market participation.

Introduction

Around 4500 patients in Denmark annually undergo an emergency laparotomy, resulting in a high risk of post-operative morbidity and mortality [1, 2]. Up to 35% of patients undergoing gastrointestinal operations are working age [2]. It is unknown how many of these patients are taking active part in labour market when hospitalised. Employment plays a major role in the social life of patients and is a key determinant for an individual's socio-economic status and financial security. An extensive change in the work role due to major surgery can have great influence

✉ Lau Caspar Thygesen
lct@niph.dk

[1] National Institute of Public Health, University of Southern Denmark, Studiestræde 6, 1455 Copenhagen K, Denmark

[2] Department of Surgery, Zealand University Hospital, Lykkebækvej 1, 4600 Køge, Denmark

[3] Institute for Clinical Medicine, Copenhagen University and Danish Colorectal Cancer Group, Copenhagen, Denmark

on quality of life and self-identity, and return to work is seen as an important part of the rehabilitation of persons with severe illnesses [3, 4]. It is of great importance to prevent dropout from the labour market for the individual and society.

All forms of major surgery are associated with a recovery period both in hospital and after discharge [5]. Among surgical abdominal patients, two small studies in England and Australia showed that 33–40% of surgical colorectal cancer patients, who were working before surgery, were not working 1 year post-surgery and that radiation and chemotherapy increased dropout [4, 6–8]. Similar results were found in a large Danish study of 4343 colorectal cancer patients of working age [9]. There are no data regarding the socio-economic consequences among patients undergoing non-malignant major abdominal surgery. This study included emergency laparotomies involving non-malignant surgery including intestinal resection, ostomy or drainage procedures which did not require subsequent adjuvant oncological therapy.

We aimed to quantify the association between emergency laparotomy for non-malignant disease and labour market participation in the Danish population. The first aim was to compare short-term and long-term labour market participation and dropout between post-operative patients and an age- and sex-matched cohort from the general population. The second aim was to compare short-term and long-term sick leave between the same two cohorts.

Materials and methods

Study population

The study population was based on information obtained from the Civil Registration System and the Danish National Patient Register (NPR). The first was established in 1968 and contains information on, e.g. sex, age, migration, and vital status for all persons residing in Denmark [10]. The NPR was established in 1977 and includes information on all contacts to the secondary healthcare system in Denmark [11]. Validation studies have shown that the NPR in general has high validity [12], and for several abdominal surgical procedures, the completeness and validity are very high [13, 14]. No validation studies have been conducted of resections, ostomy or drainage. Since 1996, all surgical procedures have been registered in the NPR by the Nordic Medico-Statistical Committee (NOMESCO) classification of surgical procedures. All registers were linked by the unique personal identification number available to all Danish residents [15].

All patients aged 18+ years that had undergone emergency laparotomy with non-malignant intestinal resections, ostomy or drainage at all Danish hospital between 2003 and 2014 were included. Only patients with an acute admission and surgery performed within 72 h from admission were included. Patients who had undergone abdominal surgery within 30 days prior to the admission were excluded, in order to exclude reoperations. Patients with a primary diagnosis of cancer were excluded. To include only incident patients, patients that had undergone any emergency laparotomy between 1996 and 2002 were excluded. After these inclusions and exclusions, the number of patients was 11,972.

This population was linked with nationwide registers on socio-economic characteristics before and after surgery. Information on labour market participation, sick leave, marital status, disposable income and highest completed education was collected from the Danish Civil Registration System [10], the Employment Classification Module [16], the Population's Education Register [17], the Coherent Social Statistics [18], the Register of Social Pension, Persons Receiving Public Benefits and the Register-based Labour Force Statistics [16]. The registers have national coverage and almost no loss to follow-up [15].

Patients without information on any socio-economic indicators (n = 10) were excluded resulting in 11,962 patients. Patients who were not active in the labour market (pensioners) before surgery (n = 9045) and patients who died on the day of surgery (n = 6) were excluded, resulting in 2911 patients active in the labour market (employed or unemployed). These cases were each age- and sex-matched 1:4 to a reference population from the general population who had not undergone laparotomy before the time of the case's laparotomy and who were active in the labour market. Therefore, the reference population was also matched on calendar time. Sixteen patients had no reference person, 15 had only one reference person, 27 had two reference persons, 59 had only three reference persons and 2794 had four reference persons. The 16 patients without any reference person were excluded resulting in a data set with 2895 patients and 11,422 reference persons.

Outcome

The outcomes of the study were dropout of labour market due to disability pension, early retirement pension (Danish: efterløn) or old-age pension and sick leave.

During the study period, if a person was unable to work due to illness or disability, it was possible to receive compensated sick leave for a maximum of one year during a period of 18 months [19]. The first 2–3 weeks of the sickness period was paid by the employer and therefore not centrally registered, which means that the sick leave presented in this study was the period after 2–3 weeks. If the work ability was reduced to a level where it is not possible

to hold a job, it was possible to apply for disability pension. This pension is available for all Danish citizens independent of job type. During the study period, the early retirement pension age was 60 years and available to employees who had paid a monthly contingent for at least 25 years, while the old-age pension was available to all Danish residents at the age of 65 years.

Dropout as a combined outcome and for each of the pensions were analysed separately. The first time a person left the labour market, i.e. first time a person received disability pension, early retirement pension or old-age retirement pension, was defined. Persons were censored at death and emigration. When analysing each pension, the other pension types were used as censoring times. The proportion of persons active in the labour market defined as persons alive and that had not received any pensions one, three and five years after surgery was also calculated.

The receipt of compensated sick leave was captured from one year preoperative to three years post-operative for each person. For each year, information on whether the person had any sick leave was obtained. For the period 2007–2014, sick leave was also available on a monthly basis.

Covariates

Information on comorbidity was collected by including information from all contacts to Danish hospitals up to 10 years before surgery registered the National Patient Register and combined into the Charlson comorbidity index [20]. Information on educational level and marital status was also included since these factors have been found to be associated with resections, ostomy and drainage and are associated with labour market affiliation.

Data analysis and statistics

The patients and reference population were described by means, medians, standard deviations and proportions.

Dropout of labour market was analysed as time-to-leaving labour market using Kaplan–Meier estimator and Cox regression model, where patients and reference population were followed from date of surgery until pensioning, death, emigration or end of follow-up (31 December 2014), whichever came first. The log-negative–log survival curves were visually inspected to confirm the assumption of proportional hazards, for each exposure variable was not violated. The three pension types (disability pension, early retirement pension and old-age pension) were compared between patients and the reference cohort using multivariate Cox regression models. Kaplan–Meier survival curves were calculated for disability pension and dropout of labour market combined. The analysis of disability pension was stratified by age, sex and comorbidity. Mortality among patients and reference population was calculated as a descriptive measure.

Sick leave was available annually during the whole study period and available monthly from 2007 onwards. Sick leave one year before surgery until three years after surgery for the whole period (2003–2014) and the monthly sick leave from 2007–2014 were evaluated. Logistic regression was used to estimate odds ratio of receiving sick leave among patients compared to the reference population.

Cox and logistic regression models were adjusted for age, sex, Charlson comorbidity index, educational level, calendar time and marital status. Results were presented as hazard ratios (HR) or odds ratios (OR) with 95% confidence interval (95% CI).

All analyses were performed in SAS version 9.4 (SAS Institute Inc, Cary, North Carolina, USA). The reporting of the study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations [21].

Results

The labour market participation at the time of surgery was 24% in patients undergoing resections, ostomy or drainage. The patients consisted of 53% males with mean age of 47.1 years (Table 1). More patients were unmarried compared to the reference population. The mean income before surgery was lower, the educational level was lower and the proportion on sick leave was higher among patients. The comorbidity level was also higher.

The proportion of patients alive and active in the labour market was 85% one year after surgery decreasing to 74% three years and 66% three and five years after surgery, respectively (data not shown). Among the reference population, the proportions were 96%, 87% and 79% at the same time points.

The total number of persons that dropout of labour market was 664 among patients and 2563 in the reference population and the total risk time was 70,996 person-years. The incidence rate of dropout was higher among patients (52.3 per 1000 person-years) compared to reference population (44.0 per 1000 person-years) resulting in a hazard ratio (HR) of 1.15 (95% confidence interval (CI) 1.05–1.25; $p = 0.002$) in the adjusted model (Table 2). Increased dropout was observed for disability pension with HR = 2.58 (2.14–3.11; $p < 0.0001$), while the patients did not have increased rate of early retirement pension and old-age pension (Table 2). The Kaplan–Meier curve of disability pension showed that the increased rate was evident shortly after surgery and continued throughout follow-up

Table 1 Descriptives of patients undergoing resection and reference population the year before baseline, *n* (%) if nothing else noted

	Bowel resection	Reference population
N	2895	11,422
Sex (male)	1527 (53%)	6027 (53%)
Age		
Mean (SD)	47.1 (11.6)	47.0 (11.5)
Median (range)	49 (18–71)	49 (18–71)
18–29	282 (10%)	1102 (10%)
30–39	465 (16%)	1859 (16%)
40–49	736 (25%)	2944 (26%)
50–59	1019 (35%)	4045 (35%)
60–64	342 (12%)	1334 (12%)
65+	51 (2%)	138 (1%)
Operation year/index year		
2003–2005	714 (25%)	2837 (25%)
2006–2008	754 (26%)	2996 (26%)
2009–2011	750 (26%)	2940 (26%)
2012–2014	677 (23%)	2649 (23%)
Marital status		
Married	1614 (56%)	6988 (61%)
Widow	58 (2%)	198 (2%)
Divorced	366 (13%)	1224 (11%)
Unmarried	852 (29%)	2976 (26%)
Income the year before surgery		
Mean/median	242,688 / 225,638	265,339 / 238,591
Low (<190,000 DKK)	883 (31%)	2949 (26%)
Medium (190,000–300,000 DKK)	1453 (50%)	5540 (49%)
High (>300,000 DKK)	559 (19%)	2933 (26%)
Sick leave the year before surgery		
Sick leave (binary)	730 (25%)	1500 (13%)
# Days among those who receive sick leave (mean/median)	67.4 / 25	93.2 / 50
Educational level		
Elementary school	731 (25%)	2387 (21%)
High school	162 (6%)	793 (7%)
Vocational education	1220 (42%)	4404 (39%)
Tertiary education	719 (25%)	3664 (32%)
Charlson comorbidity index		
0	1675 (58%)	9315 (82%)
1–2	753 (26%)	1674 (15%)
3–4	204 (7%)	248 (2%)
5+	263 (9%)	185 (2%)
Emergency laparotomy surgery		
Bowel resection	2455 (85%)	–
Bowel ostomy	972 (34%)	–
Drainage	172 (6%)	–
Number of laparotomies during index admission		
1	2528 (87%)	–
2	280 (10%)	–
3+	87 (3%)	–
Inpatient stay (days) [median (IQR)]	9 (6–15)	–

Table 2 Dropout of labour market on disability pension, early retirement pension and old-age pension and mortality among patients undergoing resection and reference population

	#outcomes	IR (1)	HR (95% CI) (2)	HR (95% CI) (3)
Dropout combined				
Patients	664	52.3	1.31 (1.20–1.42)	1.15 (1.05–1.25)
Reference population	2563	44.0	1.00 (ref)	1.00 (ref)
p value			<0.0001	0.002
Disability pension				
Patients	222	17.5	3.97 (3.32–4.75)	2.58 (2.14–3.11)
Reference population	262	4.5	1.00 (ref)	1.00 (ref)
p value			<0.0001	<0.0001
Early retirement pension				
Patients	278	21.9	0.99 (0.87–1.13)	0.93 (0.82–1.06)
Reference population	1391	23.9	1.00 (ref)	1.00 (ref)
p value			0.925	0.274
Old-age pension				
Patients	164	12.9	0.97 (0.82–1.14)	0.89 (0.75–1.06)
Reference population	910	15.6	1.00 (ref)	1.00 (ref)
p value			0.689	0.179
Mortality				
Patients	424	27.7	7.97 (6.80–9.33)	3.73 (3.16–4.40)
Reference population	240	3.5	1.00 (ref)	1.00 (ref)
p value			<0.0001	<0.0001

IR incidence rate, *HR* hazard ratio, *95% CI* 95% confidence interval

(1) Incidence rate per 1000 person-years

(2) Adjusted for age and sex

(3) Adjusted for age, sex, Charlson comorbidity index, educational level, calendar time and marital status

(Fig. 1a, $p < 0.001$). The result was similar for labour market dropout combined although the difference between patients and reference population was smaller (Fig. 1b, $p < 0.001$).

The mortality rate was markedly higher among patients compared to reference population (HR = 3.73; 3.16–4.40; $p < 0.0001$).

In stratified analyses, the increased HR of disability pension was observed in all subgroups (age, sex and comorbidity) with no indication of effect modification by these factors (Table 3).

The proportion on sick leave was 38% in the month of surgery and increasing to 66% and 56% the months following surgery (Fig. 2a) compared to 3–4% in the reference population during the whole period. The proportion on sick leave decreased thereafter but was higher than the reference population up to three years after surgery. The adjusted OR was increased among patients before surgery and increased markedly at time of surgery to the maximum at the month after surgery (OR = 47.7; 95% CI 40.7–56.0); $p < 0.0001$) (Fig. 2b). One year after surgery, the OR had decreased to 3.9 (3.2–4.7; $p < 0.0001$) and three years after surgery OR = 1.5 (1.1–2.1; $p = 0.007$). The same pattern of long-term increased sick leave was observed when evaluating sick leave during whole years before and after surgery for the whole period 2003–2014 (data not shown).

Discussion

The results of this nationwide study with complete follow-up data on socio-economic outcomes show marked post-operative social consequences of patients undergoing emergency laparotomy including increased risk of disability pensions and sick leave. These differences were observed many years after surgery and were not modified by age, sex and comorbidity. The patient population did not have increased risk of pension types that are not health related (early retirement and old-age pensions).

All forms of major surgery are associated with a recovery period both in hospital and after discharge [3–5]. Among surgical abdominal patients, previous studies show that 33–40% of surgical colorectal cancer patients, who were working before surgery, were not working one year post-surgery [4, 6–8]. All previous studies were based on

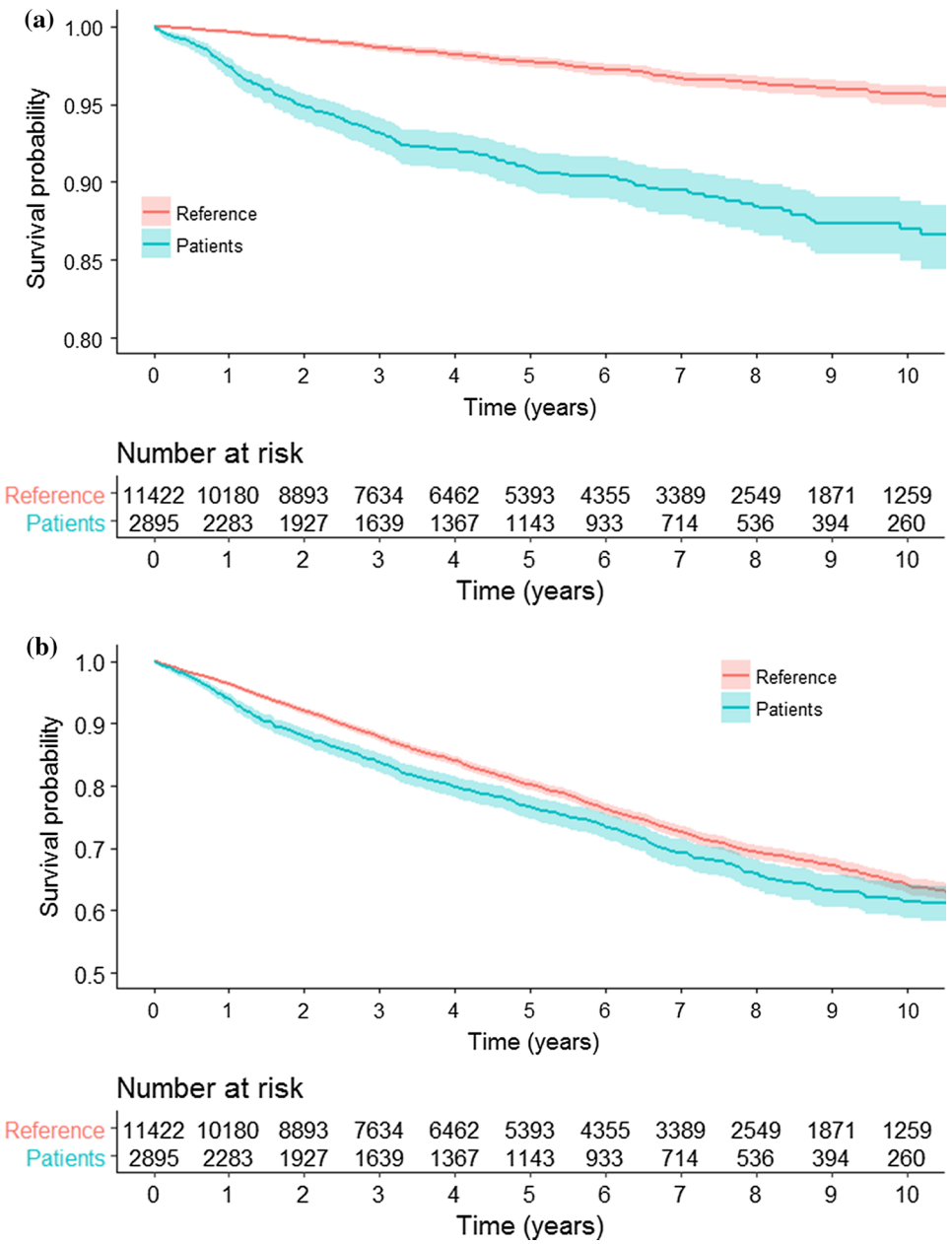

Fig. 1 **a** Kaplan–Meier curve for disability pension for laparotomy patients and reference population, shaded areas are 95% confidence intervals. **b** Kaplan–Meier curve for leaving labour market for laparotomy patients and reference population, shaded areas are 95% confidence intervals

less than 1000 patients, had shorter follow-up (<18 months after surgery) and were based on survey data with the risk of non-response bias. On the other hand, the surveys included more detailed information on factors that increased dropout of labour market including treatment (radiation and/or chemotherapy) [6–8] but also other variables such as self-rated health, activities of daily living and physical symptom distress [7]. In a large Danish study of 4343 colorectal cancer survivors in their working ages, the authors reported that only 62% of patients were working one year after treatment [9].

In this study, cancer patients were not included to elucidate the social consequences among surgical patients treated for non-malignant diseases. The included patients receive well-defined procedures and do not get scheduled for adjuvant oncological treatment. After discharge, there are not any primary disease-related reasons or additional scheduled treatments that may negatively affect the patients' return to their preoperative levels of health. The results show that the proportion of patients active in the labour market was 85% one year after surgery decreasing to 66% five years after surgery, which supports that this population has increased risk of dropout of labour market but not as strong as among colorectal cancer patients. This may be explained by the higher median age among patients

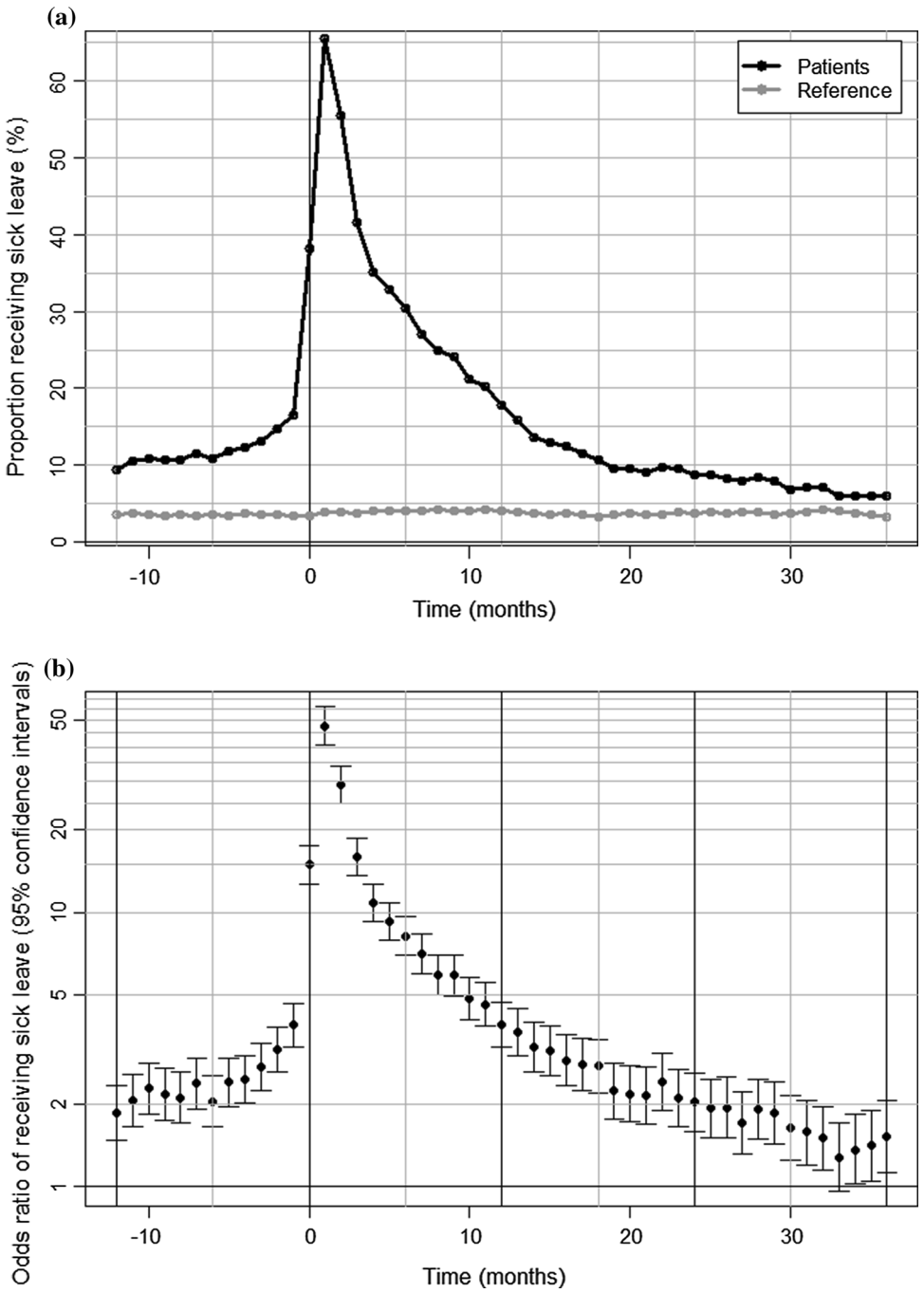

Fig. 2 Sick leave from 12 months before surgery to 36 months after surgery among patients with surgery 2007–2014. **a** is proportion receiving sickness benefits and **b** is logistic regression of sickness benefits adjusted for age, sex, Charlson comorbidity index, educational level, calendar time and marital status

with colorectal cancer, continuous oncological treatment or side effects of this treatment.

On the other hand, emergency laparotomies are high-risk procedures with high risk of long-term complications and death [1, 2]. The patient population has long inpatient stay and, as shown in this paper, among the 24% of the patients active in the labour market, there is a high risk of sick leave and disability pension. The occurrence of chronic pain, functional deficits and reduced quality of life after non-malignant emergency surgery have been shown in other smaller studies [22, 23], but it has, to the authors knowledge, not been shown how these factors may be associated with dropout of the labour market. In future studies, the association between the type of complications and mortality after discharge and secondarily dropout of the labour market should be investigated in detail in order to explore areas of preventive intervention.

In Denmark, there is no standard post-discharge care programme for patients undergoing non-malignant emergency laparotomy. The results support that post-operative

Table 3 Disability pension among patients undergoing resection compared to reference populations stratified by age, sex and comorbidity

	Resection patients		Reference population		
	#outcomes	IR (1)	#outcomes	IR (1)	HR (95% CI) (2)
Age					
<50 years	99	11.9	131	3.6	2.2 (1.7–2.9)
50+ years	123	27.9	131	6.0	3.0 (2.3–3.9)
Sex					
Males	100	14.7	119	3.8	2.5 (1.9–3.3)
Females	122	20.7	143	5.3	2.7 (2.1–3.5)
Comorbidity					
Charlson = 0	62	7.2	124	2.6	2.7 (2.0–3.7)
Charlson ≥ 1	160	39.4	138	13.7	2.5 (2.0–3.2)

IR incidence rate, *HR* hazard ratio, *95% CI* 95% confidence interval

(1) Incidence rate per 1000 person-years
(2) Adjusted for age, sex, Charlson comorbidity index, educational level, calendar time and marital status

care plans may also benefit from including preventive initiatives addressing the social consequences of the surgical intervention. This may include medical social workers as part of the rehabilitation team or including employers in the process of return to work after surgery [24]. The social worker could in collaboration with a physiotherapist examine the physical and psychosocial dimension of jobs and initiatives needed for a safe return to work [25]. A Cochrane systemic review showed that multidisciplinary interventions including vocational counselling, patient counselling and physical interventions lead to higher return to work among cancer patients [26].

Our study has several strengths including the minimal selection and attrition bias due to complete registration of a total population with individual-level data on all variables [27]. The study was based on registers with high validity. The Danish universal healthcare system with free and equal access to care regardless of economic resources offers unique possibilities for studying the social effects of major acute abdominal surgery. Finally, an age- and sex-matched reference population was included and the analyses were adjusted for comorbidities and other potential confounding factors, minimising their influence on the results reported.

Our study also has limitations including lack of information on reason for sick leave and for retirement, which means that no information was available whether these social outcomes are related to the surgical treatment. For sick leave, the temporal ordering with marked increase risk just after surgery supports an association, but for the long-term effects, the link may not be as clear. Furthermore, no validation studies have been conducted regarding the specific procedure codes for resections, drainage or ostomy, but validation studies of other abdominal surgical procedures have shown very high predictive values [13, 14]. Finally, the measure of comorbidity could result in residual confounding as it only included information on comorbidities registered in the secondary healthcare system meaning that diseases less severe may not have been included.

In this nationwide study including all patients undergoing specific abdominal surgical procedures who were active in the labour market, marked post-operative social consequences including increased risk of disability pensions and sick leave were demonstrated. The study supports that post-discharge care programmes should include focus on social consequences after major abdominal surgical interventions.

Funding This study received grants from Frimodt-Heinecke fonden and Fabrikant Frands Køhler Nielsens og Hustrus mindelegat. The funders had no influence on study design, data collection, analysis, manuscript preparation or publication.

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

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