

## Emergency presentation and socioeconomic status in colon cancer

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### Abstract

**Background:** Emergency presentation affects up to every fourth patient with colon cancer, and is associated with worse outcomes. The aim of this study was to investigate any association between socioeconomic status (SES) and mode of presentation in colon cancer.

**Materials and methods:** Individually attained data on civil status, education and income were linked to quality registries for colon cancer in two large Swedish regions 1997–2006 ( $n = 12\,293$ ) and analyzed by logistic regression, adjusting for age, sex, stage, region and socioeconomic variables.

**Results:** The frequency of emergency presentation was 23%; 27.8% among patients above the age of 80, and 20.0% among patients aged 70–79 ( $p < 0.001$ ). There was no difference between men and women (22.6% vs. 23.8%;  $p = 0.1$ ). Among patients with stage IV colon cancer, 34.6% presented as emergencies.

Odds ratio for an emergency presentation in unmarried patients was 1.24 (95% CI 1.04–1.48), and for unmarried patients above the age of 80, OR was 1.45 (95% CI 0.98–2.13).

Among patients below the age of 70 with compulsory education only, OR was 1.22 (95% CI 0.98–1.48). For patients within the lowest income quartile (Q1), OR was 1.24 (95% CI 1.04–1.49). This was most pronounced in men (OR 1.34; 95% CI 1.40–1.72), in patients below the age of 70 (OR 1.36; 95% CI 1.02–1.82), and above the age of 80 (OR 1.41; 95% CI 1.00–1.98).

**Conclusion:** Emergency presentation of colon cancer is consistently associated with socioeconomic factors, and this must be considered in efforts aimed at reducing the overall frequency of emergency cases.

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**Keywords:** Colon cancer; Emergency; Civil status; Education; Income

### Introduction

Colon cancer is the third most common form of malignancy in both men and women worldwide, with an estimated 1.2 million cases annually, as well as the fourth most common cause of cancer-related death.<sup>1</sup> About 20–25% of all colon cancer is estimated to present as a surgical emergency.<sup>2</sup> Such cases being associated with a considerably higher postoperative mortality of 8.2–22.1%,<sup>3–7</sup> and a 5-year survival rate of around 40%, as opposed to that of elective patients, which is over 60%.<sup>8,9</sup> Risk factors for emergency presentation of colon cancer are not well understood, but the combined effect

of it being a relatively common and severe condition, makes it an urgent field to explore.

The association between socioeconomic status (SES) and mode of presentation of colon cancer has, to some extent, been investigated previously. Patients that had lower incomes or lived in deprived areas were more likely to present as emergencies according to a Canadian and a British study.<sup>10,11</sup> Another British study reported the risk of an emergency presentation to be more than twice as high for patients from deprived areas<sup>12</sup> but yet another British study has found no variation in the frequency of emergency presentation of colon cancer between deprived and affluent patients.<sup>13</sup> A recent study from Sweden focused on emergency presentation and educational level, and a trend but no significant association was found among patients below the age of 75.<sup>14</sup> One study from the 1980's in the UK found widowed patients to present as emergencies more often.<sup>15</sup>

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In all, we hypothesized that several aspects of patients' socioeconomic position are of importance for mode of presentation in colon cancer, and set out to explore the association to civil status, education and income, in a population-based setting.

## Materials and methods

### *Regional clinical quality registries on colon cancer*

All cases of colon cancer reported to the Regional Oncology Centre (ROC) in the Uppsala-Örebro and Stockholm regions during 1997–2006 were included. These two regions were chosen as the Uppsala-Örebro region contains both rural and more densely populated areas, while the Stockholm region represents the population and health care of a larger city. The ROC registries in the two regions cover almost 100% of all colon cancer patients since 1997 and 1996, respectively.<sup>16</sup> These quality registries provide information on mode of presentation, likewise surgical and pathological aspects including stage, and type of hospital.

The Uppsala-Örebro registry offers information on mode of presentation by defining emergency cases as operations “performed acutely/subacutely for medical reasons”. In the Stockholm region each surgeon independently classifies the operation as an emergency or non-emergency, and specific reasons for the classification are not included in the registry.

### *Socioeconomic variables from Statistics Sweden*

Statistics Sweden is the governmental agency responsible for reporting national official statistics and has well elaborated registries including several socioeconomic variables. The registries are based on the compulsory personal ten-digit identity number, which is used for almost all administrative purposes in Sweden. In this study, the Total Population Register was used for information on civil status, number of children, and place of birth. Information on patients' highest attained levels of education and annual income was obtained from a continuously updated longitudinal integrated database on labour market research (LISA). Data on education was not available for patients >79 years, as for elderly citizens this information is mainly based on self-reports whereas for younger generations there is direct input from educational institutions. Information on income was received from the national tax office. All socioeconomic variables were retrieved for the year preceding the patient's diagnosis.

Civil status was categorized as *married*, *unmarried*, *divorced* or *widowed*. Educational levels were categorized as *compulsory*, *further* or *university education*. Income comprised family income, and included the total income of a household, presumably in order to give a more accurate measure of the total economic situation of a patient

than one based only on individual income. Income was adjusted for inflation using the price basic amount index and then categorized into *quartiles (Q1-Q4)*. The variable child/ren was dichotomized into *yes* or *no*. Place of birth was categorized into *Sweden*, *the Nordic countries*, *the Rest of Europe* and *the Rest of the world* (except Europe). Hospitals were denoted as *university*, *general district* and *district hospitals*, depending on where the operation had taken place.

### *Patients*

In total, 13 004 patients were reported as being afflicted with colon cancer to the two ROC quality registries between 1997 and 2006; 6691 (54%) in the Uppsala-Örebro region, and 5694 (46%) in the Stockholm region. Some 583 (4.5%) patients were not operated on and could thus not be classified as emergency cases or not, and they were excluded. Another 92 were excluded because they did not live within the regions in question, but were, for various reasons, operated on within one of the two regions. Information on mode of presentation was missing for 36 patients and the resulting total number of patients included was 12 293.

### **Statistics**

Initially, chi-square tests were performed to compare the proportions of patients with emergency and elective presentations within the various groups defined by each variable. If a significant difference ( $p < 0.05$ ) was obtained, the variable was included in a multiple logistic regression analysis. However, no information was available on the pattern of referrals due to the emergency condition itself. Any difference associated with the frequency of emergency presentation by type of hospital would be difficult to interpret, and this variable was therefore not included in the multivariate analyses.

Separate models were performed for men and women, as well as for three different age groups (<70, 70–79 and ≥80 years). Time periods (1997–2001 vs. 2002–2006), and regions (Uppsala-Örebro vs. Stockholm) were also compared. The results were expressed as an odds ratio with a 95% confidence interval. *P*-values were two-sided. All analyses were performed using SPSS® version 19.0 (SPSS, Chicago, Illinois, USA).

### **Results**

#### *Basic characteristics*

Overall, 23.2% of all colon cancer patients presented as an emergency (Table 1). About half of the patients had a localized (stage I and II) tumor and just above half of all patients were married when diagnosed with colon cancer. Educational data was missing for every fourth patient,

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