

Productivity loss and indirect costs in the year following acute coronary events in Switzerland

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Summary

Acute coronary syndrome (ACS) is highly prevalent in Switzerland and a leading cause of death. Associated productivity loss and indirect costs have rarely been studied. We investigated these factors in the first year after ACS in 24 Swiss patients (mean (SD) age 56 (8) years, 79% male). Data on patient productivity loss, absenteeism, presenteeism and caregiver assistance, were collected with the Productivity Cost Questionnaire during a routine cardiologist visit 3 to 12 months after hospitalisation for ACS and at least 4 weeks after patients returned to work. To estimate costs, lost hours were converted into 8-hour workdays, pro-rated to 1 year, combined with time off work due to initial hospitalisation and sick leave, and valued at Swiss labour costs. Additional data came from medical records. ACS patients lost on average (SD, range) 79 (81, 0.3–294) workdays; 38 (36, 0.3–153) days due to the initial hospitalisation and sick leave, 37 (75, 0–243) due to absenteeism after patients returned to work, and 4 (11, 0–41) due to presenteeism. Caregivers lost 10 (23, 0–90) additional workdays. The total indirect costs amounted to CHF 43,205 (44,026, 122–148,648); including CHF 18,514 (17,507, 122–74,619) for initial hospitalisation and sick leave and CHF 17,988 (36,394, 122–143,277) and CHF 1,849 (5181, 0–20,158) for absenteeism and presenteeism after patients returned to work, respectively. Costs of caregiver assistance amounted to CHF 4,855 (11,015, 0–43,843). This study showed that ACS patients lost on average 36% of their annual productive time. Caregivers lost an additional 5%. Lost work time was associated with substantial indirect costs that exceeded estimates of direct costs for ACS during 1 year. This suggests that costs and burden could be reduced through better risk reduction management.

Keywords: acute coronary syndrome, productivity loss, indirect costs, Switzerland

Introduction

Coronary heart disease is the number one cause of death worldwide and in Switzerland [1, 2]. Whereas related mortality in Switzerland has decreased slightly in the past decades [3], the prevalence of absolute cases has been steadily increasing in the ageing population [4, 5]. The price to society is high and is composed on the one hand of the direct costs of healthcare provision and on the other hand of indirect costs caused by patients' missing, or not actively participating at, work [6, 7]. ACS can impact work force participation in several ways ranging from missed days at work due to hospitalisation and sick leave (i.e., absenteeism), to reduced productivity at work (i.e., presenteeism), early retirement due to ACS-related disability, to premature death. In addition, patients often require help from others for tasks they can no longer do themselves. Thus, working caregivers often have to take time off to lend their support.

In Switzerland, cardiovascular disease is the most costly disease category, accounting for 16% of total healthcare spending [8]. The total direct costs per ACS patient were previously estimated at an average of CHF 47,589, of which over half (CHF 26,463) were incurred in the first year after the clinical event [9]. Comparatively little is known about the indirect costs of ACS. A recent systematic review of overall cardiovascular disease-related productivity loss and indirect costs across several European countries, including France, Germany, Italy, Spain, Sweden and the UK reported total annual costs of EUR 1.40 billion (CHF 1.53 billion) related to absenteeism and EUR 19.7 billion (CHF 21.53 billion) related to premature mortality [10]. (Conversion rate 2019 October 5, EUR 1 = CHF1.09.) The parent study of the current sub-investigation, a European multicentre productivity loss study, was the first to focus on indirect costs associated with patient and caregiver productivity loss [11]. The results showed that across European countries ACS patients and caregivers lost 59 and 11 working days on average, respec-

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tively (approximately 25% and 5% of their total annual workdays). This amounted to a high average indirect cost of EUR 13,953 (CHF 15,209) for patients and caregivers in the first year after an ACS. The results have been described as a serious wake-up call to the socioeconomic consequences of cardiovascular disease [12]. Here we report the detailed results of analyses of productivity loss and indirect costs during the first year after ACS for Swiss patients and their caregivers who took part in the European multicountry parent investigation.

Materials and methods

Study design and sample

Switzerland was one of the seven European countries (also included: Belgium, France, Poland, Portugal, Spain and the UK) that participated in the multi-country productivity loss study that investigated productivity loss and indirect costs during the first year after ACS and stroke. The results for the multinational study were published earlier by Kotseva and colleagues (2019). Swiss data were included and discussed on an aggregate level together with other countries only [11]. Swiss data on ACS were collected through specialist cardiology centres at three hospitals (Geneva University Hospital; Lausanne Centre hospitalier universitaire vaudois; and Bern Inselspital) between September 2016 and November 2017. Inclusion criteria for participants were hospitalisation for ACS (index event) between 3 and 12 months prior to a routine cardiologist visit, being in paid employment at the time of the index ACS, being back at work for at least 4 weeks prior to recruitment, and receiving lipid modifying therapy at discharge from hospital. The average time (mean (standard deviation, SD)) since the ACS index event was 5.7 (2.2) months. A total of 24 fully employed patients with ACS were recruited. The study was approved by the research ethics committee Geneva (Ref R2016-00974). All participants signed informed consent forms prior to inclusion.

Measures and data collection

Data on productivity loss including patient absenteeism, presenteeism, and caregiver time, were collected with the Productivity Cost Questionnaire (iPCQ), which was developed by the Institute for Medical Technology Assessment, Erasmus University, Rotterdam [13]. The standard iPCQ consists of 18 questions. Nine questions assess demographic information and respondents' work status (e.g., number of hours paid work per week and number of working days per week) and productivity loss. For the current study, two additional questions were added to the iPCQ to assess absenteeism due to ACS index hospitalisation and sick leave immediately after discharge. The modified iPCQ was reviewed by the original developers to ensure its integrity. The modified questionnaire was translated into the languages of participating countries using the forward and back translation method. The German and French translations were used in Switzerland. The modified iPCQ took about 10 minutes to complete. Patients' demographic and clinical characteristics (e.g., age, gender, smoking status, body mass index (BMI), blood lipid levels, blood pressure, medication, and comorbidities), data on index ACS hospitalisation and sick leave were collected from the patients'

medical records by the recruiting physicians via an electronic case report form.

Data analysis

The reported working hours lost for the 4 weeks preceding recruitment were calculated at patient level and prorated to 1 year [14, 15]. The time lost due to index hospitalisation and sick leave were then added to the prorated costs. Indirect costs of lost productivity for patients and caregivers were estimated according to published Swiss labour cost in 2017 (CHF 61.0/hour) [16], using the "human capital method" [17], following the costing manual of the iPCQ. This method assumes that each worker is irreplaceable and calculates any not worked hours by patients and caregivers as lost productivity time. We report descriptive statistics including frequency (n) and percentage (%) for categorical variables and means with standard deviations (SDs) and ranges for continuous variables (baseline characteristics); we additionally report medians, interquartile ranges (IQRs) and the 5th and 95th percentiles in tables 2 and 3. Missing clinical values were not replaced; missing numbers of days lost were assumed to be equal to zero. All analyses were performed using SAS Statistical software (©SAS Institute, Cary, NC) version 9.4.

Results

Demographic and clinical characteristics of the study participants are shown in table 1. The average (SD) patient age was 56 (8) years and 79% were male. Twenty-one percent had a history of prior cardiovascular events before their index event.

The vast majority of patients (96%) had experienced myocardial infarction, with a mean left ventricular ejection fraction of 51% (9%), 92% had undergone revascularisation with percutaneous coronary intervention. At discharge from the index hospitalisation 71% of patients had low-density lipoprotein cholesterol (LDL-C) levels of ≥ 1.4 mmol/l (≥ 55 mg/dl) and 67% had ≥ 1.8 mmol/l (≥ 70 mg/dl). Forty-six percent had hypertension. Of all patients, 67% were on high-intensity statin therapy. Rehospitalisation after the ACS-related index hospitalisation occurred in 21%. Patients worked an average (SD) of 37 (12) hours per week over the course of 5 (1) days with an average workday length of 7 (2) hours. Most had completed secondary or higher education (54%) and the majority (75%) had white-collar professions.

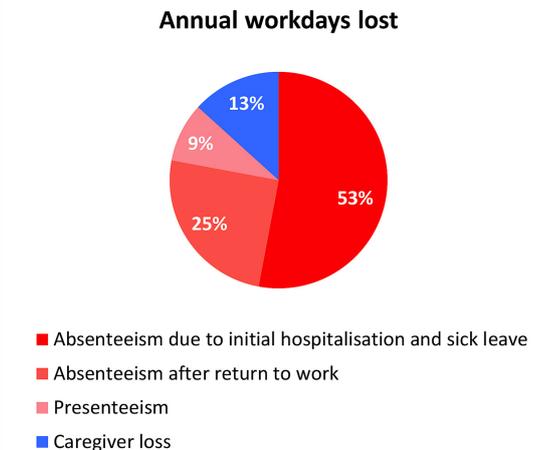
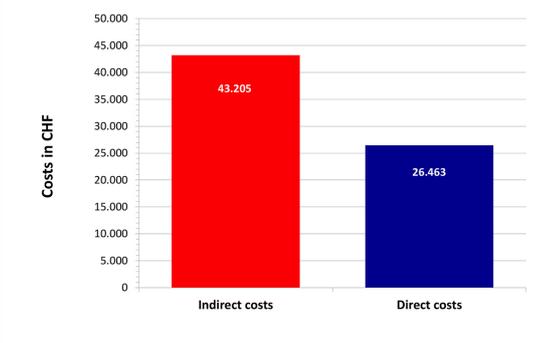
The number of working days lost and associated indirect costs are presented in tables 2 and 3, respectively. On average (SD, range) patients lost 79 (81, 0.3–294) workdays during the year after the index cardiovascular event. Of those 38 (36, 0.3–153) days were lost owing to the initial hospitalisation and sick leave, absenteeism after return to work accounted for additional 37 (75, 0–250) days; finally, 4 (11, 0–41) days were lost to presenteeism. On average, caregivers lost an additional 10 (23, 0–90) workdays for patient support (fig. 1).

Indirect costs for initial hospitalisation and sick leave amounted to CHF 18,514 (17,507, 122–74,619). The costs for absenteeism and presenteeism after patients returned to work were CHF 17,988 (36,394, 0–118,564) and CHF 1,849 (5181, 0–20,158), respectively. The total average indirect costs were CHF 38,351 (39,304, 122–143,277)

Table 1: Demographic and clinical characteristics at discharge or closest available date.

Variable	ACS (n = 24)
Demographic characteristics	
Sex, male, n (%)	19 (79%)
Age, years, mean (SD)	56 (8)
Type of residence, n (%)	
Urban	18 (75%)
Rural	6 (25%)
Occupation, n (%)	
White collar (office employee)	18 (75%)
Blue collar (manual worker)	6 (25%)
Clinical parameters and CV risk factors	
Index CVE hospital days, mean (SD)	6 (6)
SBP, mm Hg, mean (SD)	126 (24)
Hypertension	11 (46%)
SBP \geq 140 mm Hg	5 (21%)
Left ventricular ejection fraction (mean, SD)	51 (9)
Lipid values, mg/dl, mean (SD):	
– LDL	116 (51)
– HDL	48 (21)
– Triglycerides	131 (62)
– Hypercholesterolaemia, n (%)	11 (46%)
– % with LDL \geq 1.4 mmol/l (55 mg/dl)	17 (71%)
– % with LDL \geq 1.8 mmol/l (70 mg/dl)	16 (67%)
– % with LDL \geq 2.6 mmol/l (100 mg/dl)	14 (58%)
LDL-C category, mmol/l, n (%)	
– <1.80	5 (21%)
– 1.80–2.69	2 (8%)
– 2.70–3.36	6 (25%)
– 3.37–4.14	6 (25%)
– >4.14	2 (8%)
– Unknown	3 (13%)
BMI, kg/m ² , mean (SD)	28 (4)
BMI $>$ 30 kg/m ²	7(29%)
Smoking status, n (%)	
– Current	9 (38%)
– Former	5 (21%)
– Never	8 (33%)
Diabetes mellitus, n (%)	1 (4%)
Charlson comorbidity index (CCI)	
– CCI, mean (SD)	1 (0)
– CCI \geq 2, n (%)	3 (13%)
Multiple (2+) CVE, n (%)	5 (21%)
Established CVD	5 (21%)
CVE post-index hospitalisation, n (%)	5 (21%)
Medication at discharge, n (%)	
– Antihypertensive	23 (96%)
– Antithrombotic	16 (67%)
– Antidiabetic	1 (4%)
– None	0
Statin therapy intensity[†], n (%)	
High	16 (67%)
Moderate	7 (29%)
Low	1 (4%)

ACS = acute coronary syndrome; BMI = body mass index in kg/m²; CCI = Charlson comorbidity index; CVE = cardiovascular event; LDL-C = low-density lipoprotein cholesterol reported in mmol/l (mg/dl); SBP = systolic blood pressure; SD = standard deviation * For secondary prevention in very-high-risk patients an LDL-C goal of <1.4 mmol/l (<55 mg/dl) is recommended, for patients at high risk an LDL-C goal of <1.8 mmol/l (<70 mg/dl) is recommended, for patients at moderate risk an LDL-C goal of <2.6 mmol/l (<100 mg/dl) is recommended [14]. † High: 50% LDL-C lowering; moderate: 30–50% LDL-C lowering; low: <30% LDL-C lowering [30].

Figure 1: Patient and caregiver productivity loss (average) for acute coronary syndrome in the first year after the cardiovascular event.**Figure 2:** Average indirect and direct costs for acute coronary syndrome (ACS) in the year after the cardiovascular event. Estimates of direct costs for ACS are based on [9].

per patient. Average costs for caregiver productivity loss amounted to CHF 4,855 (11,015, 0–43,848). The estimated total average indirect costs for lost productivity of ACS patients and their caregivers were CHF 43,205 (44,026, 122–148,648) (fig. 2).

Discussion

The current study assessed productivity loss and associated indirect costs in working-age ACS patients (75% office workers, 25% manual workers) and their caregivers in Switzerland.

Productivity loss in the first year after the cardiovascular event was substantial, with an average of 36% (79/222) of annual workdays lost by the patients. On average caregivers helping ACS patients lost about 10 additional days (5%) of their annual productive time. This loss of productivity was associated with substantial costs both for patients (CHF 38,351) and caregivers (CHF 4,855) leading to an average of CHF 43,205 total annual indirect costs in the year after ACS. Notably, this amount exceeds a 2008 estimate of the direct costs of ACS of CHF 26,563 for Swiss patients 1 year after their cardiovascular event [9]. Productivity loss in ACS observed by Kotseva et al. (2019) in seven European countries varied considerably from 47 workdays in Portugal to 91 days in Poland with an average of

Table 2: Annual workdays lost for acute coronary syndrome.

Reason for lost productivity	Workdays lost per year mean (SD)	Median (IQR)	Range (min-max)
Patient absenteeism total	75 (80)	43 (20; 1208)	0.3–293.5
– Initial hospitalisation and sick leave	38 (36)	28 (13; 48)	0.3–152.9
– Absenteeism at work	37 (75)	0 (0; 11)	0–242.9
Patient presenteeism	4 (11)	0 (0; 0)	0–41.3
Total productive time lost by patient	79 (81)	45 (23; 126)	0.3–293.5
Caregiver loss	10 (23)	0 (0; 0)	0–89.8
Total workdays lost	89 (90)	47 (26; 126)	0.3–304.5

IQR = interquartile range; SD = standard deviation

Table 3: Annual indirect costs of acute coronary syndrome.

Reason for lost productivity	Annual indirect costs (CHF), mean (SD)	Median (IQR)	Range (min-max)
Patient absenteeism total	36,502 (38,886)	20,934 (9,558; 52,526)	122–143,277
– Initial hospitalisation and sick leave	18,514 (17,507)	13,756 (6,237; 23,514)	122–74,619
– Absenteeism at work	17,988 (36,394)	0 (0; 5,499)	0–118,564
Patient presenteeism	1,849 (5,181)	0 (0; 0)	0–20,158
Total productive time lost by patient	38,351 (39,304)	22,176 (11,232; 61,581)	122–143,277
Caregiver loss	4,855 (11,015)	0 (0; 0)	0–43,843
Total indirect costs	43,205 (44,026)	22,724 (12,689; 61,581)	122–148,648

IQR = interquartile range; SD = standard deviation

70 workdays across all participating countries (fig. 3). Loss of productive time in the Swiss population was the second highest among the participating countries; only Polish patients lost more productive time.

The duration of hospitalisation and initial sick leave was comparable across countries and the high loss of productivity in the Swiss sub-sample was mainly due to higher absenteeism after patients had returned to work. Possibly, the longer absenteeism observed in Switzerland compared with elsewhere could be due to patient characteristics and/or socio-cultural differences, for instance in social security, generosity of granting sick leave and employment protection [18]. A higher illness severity compared with patients from other countries (e.g., left ventricular ejection fraction of 51% was low compared with the other European countries (range 51–62% [11]) and higher rates of chronic cardiovascular disease could all be part of the characteristics of Swiss patients that contribute to the higher absenteeism. With 10 lost workdays for caregivers, Switzerland was in-

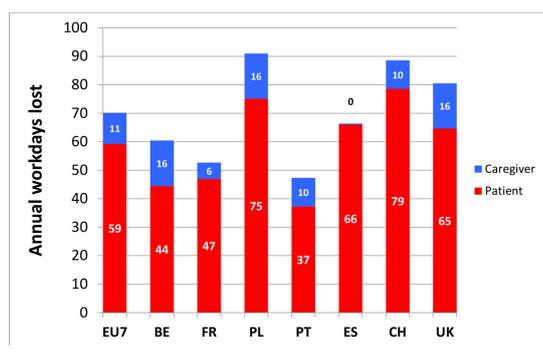
termediate in comparison with the other European countries (mean 11 days, range 0–16, see fig. 3).

ACS is associated with high direct and indirect costs to society, as well as a high burden on individuals [1, 2, 7, 19]. A reduction of costs and burden could be achieved through reduction of risk. Our data show several high-risk indicators in ACS patients [3], with 38% being current smokers, 29% being obese (BMI ≥ 30 kg/m²) and with about 21% presenting with uncontrolled hypertension (i.e., systolic blood pressure ≥ 140 mm Hg). Many ACS patients have lifestyle-related risk factors that contribute to their cardiovascular risk. This highlights the need for better risk management through lifestyle modifications in the form of weight reduction and smoking cessation [15]. In addition, although all of the included patients were on statin therapy, about 30% did not receive beneficial high-intensity treatment [20]. Crucially, 67% did not meet the LDL-C treatment goal of <1.8 mmol/l (<70 mg/dl), as recommended by the current 2016 ESC/EAS guidelines for the management of dyslipidaemias. The fact that patients were included more than 3 months after their index ACS (5.7 months on average, range 3–12 months) [21], and that beneficial effects of the treatment would be expected within this time frame [22], suggests that the discrepancy between guideline targets and patients' LDL-C cannot be attributed to a short duration of statin treatment.

When referenced against the new 2019 guidelines, as many as 71% failed to meet the recommended LDL-C goal for very high-risk patients of <1.4 mmol/l (<55 mg/dl) [14]. In line with other studies, our findings highlight problematic LDL-C control in clinical practice [23, 24]. The importance of lipid lowering therapy and LDL-C as a causal risk factor for ACS are well recognised [14, 23–26]. Gaps between LDL-C goals as set by guidelines and patients' real world outcomes [19, 27–29] highlight the need for more effective LDL-C management.

The current study is the first to show a detailed report on the indirect costs associated with ACS in Switzerland. The

Figure 3: Average patient and caregiver productivity loss for acute coronary syndrome in the first year after the cardio-vascular event across European countries. EUR7 = average of all included countries; BE = Belgium, FR = France, PL = Poland, PT = Portugal, ES = Spain, CH = Switzerland, UK = United Kingdom. For more information on the data in this figure see [11].



findings yielded important new insights, but need to be interpreted in the light of several methodological considerations. First, retrospective studies may be subject to recall biases. We tried to mitigate these by using the short, standardised and validated iPCQ to collect productivity loss data for our cost estimations [13]. The recall period of 4 weeks used in iPCQ is the longest time period for which the recall bias can be sufficiently mitigated. Second, this study had a relatively small sample size, and the generalisability of the results may therefore be limited. Third, patients in our study returned to work relatively quickly, implying that their CVEs were most likely relatively mild. Relatively low Charlson comorbidity index scores in our sample suggest better patient outcomes. More severely ill patients who might have died or dropped out of the workforce after their event and who would have required more intensive caregiver help were by definition not included. The current study results, therefore, may represent the lower bound of the productivity losses and indirect costs associated with ACS in Switzerland.

In conclusion, the Swiss data show significant productivity loss one year after CVE, with approximately 36% lost annual workdays for ACS patients and 5% lost annual workdays for their caregivers. This loss in productivity is associated with indirect costs that are about twice as high as the direct costs for ACS in Switzerland, highlighting the need for more effective cardiovascular disease risk reduction efforts.

Disclosure statement

This study was funded by Amgen (Europe) GmbH. KK, PL, RH, and FM received consulting fees from Amgen. BD is an employee of IQVIA, which has received consulting fees from Amgen. CW was a full-time employee of Amgen Switzerland AG when working on the publication and held Amgen stock options. NR is a full-time employee of Amgen Switzerland AG and holds Amgen stock options. ES is a full-time employee of Amgen (Europe) GmbH and holds Amgen stock options. Prof. Mach is editor in chief of Cardiovascular Medicine.

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