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Days spent in acute care hospitals at the end of life of cancer patients in four Swiss cantons: a retrospective database study (SAKK 89/09)

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ABSTRACT

Number of days spent in acute hospitals (DAH) at the end of life is regarded as an important care quality indicator for cancer patients. We analysed DAH during 90 days prior to death in patients from four Swiss cantons. Claims data from an insurance provider with about 20% market share and patient record review identified 2086 patients as dying of cancer. We calculated total DAH per patient. Multivariable generalised linear modelling served to evaluate potential explanatory variables. Mean DAH was 26 days. In the multivariable model, using complementary and alternative medicine (DAH = 33.9; +8.8 days compared to non-users) and canton of residence (for patient receiving anti-cancer therapy, Zürich DAH = 22.8 versus Basel DAH = 31.4; for other patients, Valais DAH = 22.7 versus Ticino DAH = 33.7) had the strongest influence. Age at death and days spent in other institutions were additional significant predictors. DAH during the last 90 days of life of cancer patients from four Swiss cantons is high compared to most other countries. Several factors influence DAH. Resulting differences are likely to have financial impact, as DAH is a major cost driver for end-of-life care. Whether they are supply- or demand-driven and whether patients would prefer fewer days in hospital remains to be established.

INTRODUCTION

More days in hospital, frequent hospitalisations and a high proportion of deaths in hospital are considered poor quality of care indicators in end-of-life cancer patients (Earle et al. 2003; Grunfeld et al. 2006, 2008; Setoguchi et al. 2008). The length of stay in acute care hospitals of end-of-life cancer or other patients is known to be dependent on demographical (Smith et al. 2009) and geographical (Wennberg et al. 2004) factors, and the place of death differs considerably between European countries (Cohen et al. 2010; Gao et al. 2013; Matter-Walstra et al. 2014). In a previous study of end-of-life care of cancer patients in four Swiss cantons, we showed that cancer-specific delivery of care and hospitalisation rates were dependent on both demographical and geographical factors (Matter-Walstra et al. 2014). In a follow-up in-depth analysis of the influence of the treating

hospitals, we established that the hospital type (Fos 2006) had a significant effect on the delivery of care (Matter-Walstra et al. 2015). Being hospitalised in a university hospital in Switzerland significantly increased the odds of receiving any kind of cancer-related therapy (two of five Swiss university hospitals were in the catchment area of our study).

Here, we focus on the number of days cancer patients spend in acute hospitals (DAH) during the last 90 days of life. DAH is important: (1) because it is an important indicator of the quality of end-of-life care, and an increasing number of days spent in hospital is regarded as associated with decreased quality of life (Earle et al. 2003; Grunfeld et al. 2006, 2008; Setoguchi et al. 2008); and (2) because inpatient care may account for the largest proportion of total costs that cancer patients incur (Langton et al. 2014). Patient-determined factors, such as the choice of insurance package or use of specific healthcare provision like complementary and alternative medicine (CAM) therapies, may also be associated with DAH. For instance, the consumption of mistletoe (Van Der Weg & Streuli 2003) may reduce the use of conventional therapies in cancer patients (Heusser et al. 2006; Bar-Sela et al. 2013). The use of mistletoe and other CAM therapies is widespread in Switzerland (Wolf et al. 2006); however, their effect on length of stay of cancer patients has yet to be determined.

The aim of this study was to investigate the causes of disparities in end-of-life care of cancer patients in four Swiss cantons, in terms of DAH, and discuss the possible economic impact. In the current study, the effects of demographical, geographical and patient-determined factors on DAH were investigated.

METHODS

Study population

The study population and data collection methods are described in detail in our previous publication (Matter-Walstra et al. 2014). Briefly, the study population included patients 20 years or older at time of cancer diagnosis who died between 2006 and 2008, lived in one of the participating Swiss cantons, and were Helsana Group insurance company customers for at least 1 year prior to death. In

total, 3809 patients from the Cantons of Basel (BS, German speaking, one university hospital), Ticino (TI, Italian speaking, no university hospital), Valais (VS, German/French speaking, no university hospital) and Zürich (ZH, German speaking, one university hospital) were eligible and included. In the 30 days prior to death, 2608 (68.5%) of these patients were hospitalised in acute care hospitals. Inpatient information was available for 2494 (96%) of the 2608 patients, and 2086 (83.6%) had a cancer-related hospitalisation. Hospitalisations were defined as cancer-related if there was: a primary admission diagnosis indicative of cancer; and/or the patient had cancer-related symptom(s) or diseases; and/or there was a non-cancer-related reason for admission but the patient had ongoing active cancer according to the patient records. Subsequent analyses are based on these 2086 patients.

Outcome measure

For all patients with cancer-related hospitalisations, the total number of DAH during the last 90 days of life, potentially representing more than one hospitals/hospitalisations, was calculated. The number of days included the day of admission and day of discharge, each counted as one.

Explanatory variables

The effect of the following variables on DAH was investigated:

1. Patient age at death, gender and cancer type (colon, haematological, lung, breast, prostate and all others combined).
2. Type of hospital supplementary insurance (HSI): no HSI = basic (mandatory health insurance, hospitalisation only on general ward in predefined hospitals within canton of residence); ECO = basic HSI (hospitalisation on general ward in any hospital in Switzerland); SP+P = semi-private or private (hospitalisation in double or single bedroom in any hospital in Switzerland).

3. Use of CAM therapies. Patients were labelled as a CAM patient when: treated with mistletoe (according to the anatomic therapeutic chemical code or pharmacode); consulted a CAM physician (homoeopath, anthroposophic physician, neural therapist or traditional Chinese medicine practitioner including acupuncture, as designated by the insurance claim); or was treated as an inpatient and/or outpatient in a CAM hospital (five in total; http://vitagate.ch/sites/default/files/wem_files/Therapieformen/Leitlinien_Dakomed.pdf) during the last year of life. Otherwise, the patient was labelled as a conventional medicine (COM) patient.
4. Whether or not the patients received any kind of anticancer therapy (ACT; chemotherapy, or radiotherapy, see Matter-Walstra et al. 2014) during the last 90 days of life.
5. Whether or not the patient died while in an acute hospital.
6. The number of days spent in other institutions (nursing homes, rehabilitation, geriatric or psychiatric institutions).

Statistical analyses

Patient characteristics and categorical explanatory values were described using frequency tables. The 95% confidence intervals for the mean and median were calculated for age, DAH and days spent in other institutions (DOI).

Univariable associations between potential explanatory variables and DAH were analysed using a generalised linear model with a Poisson distribution and a logarithmic link function (Proc Genmod SAS®) (Kianifard & Gallo 1995). In the log-linear model, the literal interpretation of the estimated coefficient $\hat{\beta}$ bis that a one-unit increase in an explanatory variable will produce an expected increase in log DAH of $\hat{\beta}$ units. In terms of DAH itself, this means that the expected DAH value is multiplied by $\hat{\beta}$. For clarity, we also report estimated DAH results.

Thereafter, a multivariable generalised linear model was developed using a backward selection method and only including explanatory variables with $P < 0.05$. All possible interactions were tested,

and interactions with $P < 0.05$ were included in the model. The final model used a weighting scheme for the computation of least squares means coefficients to compensate for unbalanced covariates such as CAM/COM users (12% versus 88% of the patients). The standard least squares means have equal coefficients across classification effects; however, the weighting option changes these coefficients to be proportional to those found in the data set. This adjustment is reasonable when inferences need to be applied to a population that is not necessarily balanced but has the margins observed in the data set. To illustrate the impact of the observed effect estimates, DAH values are reported for different scenarios (i.e. combinations of parameter values for gender, ACT, CAM use and canton of residence). The results of the multivariable generalised linear model are regarded as the main results of the analysis.

Statistical analyses were performed with SAS® version 9.3 (SAS, Cary, NC, USA).

RESULTS

Descriptive statistics

The overall mean age at death of the 2086 eligible patients (Matter-Walstra et al. 2015) was 72.4 years (Table 1). The majority of patients were men (54.8%, Table 1). Lung cancer, residence in the Canton of Zürich and basic (ECO) supplementary hospital insurance were most frequent. Forty-nine per cent of patients had received any kind of ACT during the 90 days prior to death, and 79.82% died in an acute hospital. Patients were hospitalised in 83 different hospitals of all types, from university hospitals to small regional service hospitals and small specialised hospitals (Fos, 2006). On average, patients had 2.3 (median 2.0) hospitalisations during the 90 days prior to death, and 35.1% had only one hospitalisation.

Of all patients, 11.6% were classified as CAM users (see Table 2 for all data by canton). CAM patients were more often female and had breast cancer, had semi-private or private HSI and received anti-cancer therapies slightly more frequently than COM patients (Fig. 1).

There was a minor decrease in DAH with increasing age, while DOI increased markedly with increasing age (Fig. 2). On average, lung cancer patients and patients who lived in the Canton of Zürich, had received ACT or were classified as CAM users were younger. The overall mean DAH was 26.4 days (95% CIs 3.0–63.0, median 22.0; Table 3). The highest DAH was seen in the Canton of Basel (mean 31.1 days, 95% CIs 28.4–33.7, median 27 days), which was almost 7 days longer than in the Canton of Valais, which had the lowest DAH (23.5 days, 95% CIs 20.5–26.5, median 19.0 days). The largest difference in DAH of 8.5 days was seen between COM (mean 25.4 days, 95% CIs 24.6–26.3, median 22.0 days) and CAM (mean 33.9 days, 95% CIs 31.2–36.6, median 30.0 days) patients.

Uni- and multivariable (regression) models

Univariable modelling (Table 4) did not show a significant effect of cancer type, HSI type or receiving ACT on DAH. The most significant effect was seen for CAM users (33.9 DAH versus 25.4 DAH for COM patients; $P < 0.0001$), resulting in an increase in DAH of 33% (mean difference in DAH 8.5 days), followed by canton of residence with a difference in DAH of 6.7 days between BS (31.1 DAH) and ZH (24.3 DAH; 28% increase compared to ZH, $P < 0.001$).

In the multivariable model, the use of CAM therapies and canton of residence again showed the strongest influence on DAH. Use of CAM therapies was associated with a DAH increase by 35% ($P < 0.0001$), from 25.1 (COM) to 33.9 (CAM) days. The effect of canton of residence depended on whether or not the patients received ACT (significant interaction between canton and ATC). The largest difference in DAH was seen in patients not receiving ATC, between cantons TI (33.7 days) and ZH (24.4 days; increase by 39%; $P < 0.001$; Table 5). Furthermore, gender (female versus male, 10% increase for women), age at death (0.5% decrease in DAH per increasing year), DOI (0.24% decrease in DAH per increasing day spent in other institutions) had a significant effect on DAH. The effect of receiving ACT was dependent on the canton of residence. While those in TI and ZH receiving ACT had reduced DAH, BS and VS residents had increased DAH (Fig. 3 and Table 5).

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DISCUSSION

High numbers of days spent in acute hospitals, a high frequency of hospitalisations, and dying while in hospital all are regarded as indicators of decreased quality of care at the end of life (Earle et al. 2003; Grunfeld et al. 2006, 2008; Setoguchi et al. 2008; Langton et al. 2014). Here, we show that the number of days patients with cancer spend in acute hospitals during the last 90 days of life is not only strongly dependent on the canton of residence but also increases in patients using CAM therapies during their last year prior to death. While age (decreasing DAH with increasing age), gender (men having lower DAH than women), receiving ACT (direction of effect depending on canton of residence) and days spent in other institutions (decreasing DAH with increasing numbers of days spent in other institutions) played a lesser (but still significant) role, insurance status and cancer type had no significant influence on DAH.

Sessa et al. (1996) reported that cancer patients in southern Switzerland stayed a median of 24 days in acute hospitals during the last 3 months prior to death, 75% had one or two hospitalisations, and 65% died while in an acute hospital. In our analysis of a southern canton (Ticino), there were slightly higher numbers of DAH and almost 20% higher rates of dying in an acute hospital. This is in contrast to the general observation that DAH in Switzerland decreased between 1998 and 2010 (Roth & Roth 2012).

A comparison of our data and international data is difficult, since DAH over the last 90 days of life is not always given or the patient population is different (Langton et al. 2014). In addition, healthcare system differences are difficult to incorporate. Braga et al. (2007), in a single institution study in Portugal of patients with solid tumours, found that the median DAH during the last 3 months of life was 16. In a Belgian study (Gielen et al. 2010), the median DAH during the last 6 months prior to death in cancer patients was 18–21 days (except patients 90+), which is lower than our reported median of 22 days during the last 3 months of life. Our reported percentage of cancer patients dying while in an acute hospital (almost 80%) is much higher than other studies in western countries

(Smith et al. 2009; Setoguchi et al. 2010; Gonsalves et al. 2011; Teno et al. 2013) and similar to, but still higher than, deaths in acute hospitals in Taiwan (Tang et al. 2009).

One of the reasons for the high DAH seen in Switzerland may be that many acute care hospitals provide palliative care beds, while only few institutions solely focusing on palliative care or hospices are available (Eychm€uller & Raemy-Bass 2001). The available claims data did not allow us to differentiate between hospitalisations with palliative intention and hospitalisations for other (acute) reasons. Therefore, part of the DAH observed may have been with palliative intent, and might not have been counted as DAH in other countries. Additional reasons for the higher DAH seen in Switzerland in comparison with other European countries may be economic or cultural. Swiss patients may have a more positive perception of being hospitalised and dying in hospital, and may regard this as an indicator of good quality care. Societal wealth and affordability, demand side factors and supply side factors such as financial incentives on the side of the healthcare providers may play a role.

As well as the generally higher DAH and dying in an acute hospital for Swiss patients, a large and significant difference in DAH between the four cantons was observed (difference in mean DAH of 7.5 days) that remained after correction for other explanatory variables. Plausible but difficult to verify reasons may be the structures of cantonal healthcare systems, differing cultural attitudes between cantons, or different financial incentives. For example, there are large differences in acute bed density and hospitalisation rates between Swiss cantons, with cantons BS and TI being among the highest ranking for both parameters (Fos, 2013a,b). Our observed DAH for the cantons follow the same pattern, however data for more cantons would be required to substantiate this relationship.

One noticeable finding was that insurance status has no significant influence on DAH. However, we grouped patients with semi-private and private insurance together in order to be able to work with sufficiently sized groups. Separating these two insurance types would be relevant in order to investigate whether patients with private and semi-private insurance may show different patterns in terms of DAH. For this, however, a larger data set would be required.

The other main observation was the statistically highly significant difference in DAH between CAM and COM patients, with CAM patients having a median of 7 days more DAH. In one randomised controlled study, the use of mistletoe reduced hospitalisation rates in lung cancer patients (Bar-Sela et al. 2013). In addition, several non-randomised controlled studies with mistletoe report a reduction in ACT-induced adverse events (Bock et al. 2004; Augustin et al. 2005; Friedel et al. 2009), which might also be associated with fewer and/or shorter hospitalisations. These results are in contrast to our findings. It may be that CAM patients tend to try all possible treatment options, thereby requiring more days in hospital, which is possibly reflected by their more frequent semi-private or private HSI.

This study has some weaknesses and limitations. First, the definition of cancer-related hospitalisation was based on patients with a hospitalisation during the month prior to death (Matter-Walstra et al. 2014, 2015). Patients who died with cancer but had no hospitalisation(s) during their final month were not included because no direct information on the presence of active cancer was available from patient records. This may have resulted in over- or underestimation of DAH over the last 90 days of life, since patients dying of cancer but with a hospitalisation during the 30–90 days prior to death could not be included. Including all patients (as previously Matter-Walstra et al. 2014), however, might have resulted in underestimation of effect due to including patients not dying from cancer. Second, the identification of CAM patients was limited to only those therapies reimbursed by the compulsory insurance. In addition, mistletoe was only included in the ambulatory care setting, since information on inpatient-administered mistletoe is not documented in the Helsana database. Therefore, the number of CAM patients was lower than expected (Molassiotis et al. 2005; Heusser et al. 2006; Adams & Jewell 2007). It is likely that the real CAM population was larger than that identified. Finally, and notwithstanding the fact that Helsana is one of the largest insurance companies in Switzerland with 1.28 million customers and covering about 20% of the Swiss population in 2006, this study relies only on data from one insurance company and four out of 26 cantons. On average, Helsana serves an older population then the general Swiss population

(Achermann et al. 2011). As intensity of care decreases with age (Matter-Walstra et al. 2014, 2015), DAH in Switzerland may be even higher than reported here. Including data from more insurance companies and more cantons, especially ones with large rural and mountain regions and purely French-speaking cantons, would be desirable since regional differences in supply and utilisation of healthcare have been described for Switzerland (Klauss et al. 2005; Busato et al. 2010; Ess et al. 2011). We could not investigate the impact of rural versus urban borough type as the proportion of patients living in a rural borough was only 8% (Matter-Walstra et al. 2014). Finally, our analyses focused on the total number of days in hospital. As many patients had several episodes of hospitalisation in different hospitals, we could not include hospital type as a covariate in our analyses or distinguish effects of public versus private hospitals (as few as 35% of the patients had one hospitalisation only).

In conclusion, this study shows that cancer patients in four Swiss cantons spent more days in acute hospitals in the last 90 days of their life and had a high likelihood of dying in an acute hospital than in most other countries. These results suggest that Swiss patients might perceive longer hospitalisations and dying in hospital differently to other populations. There were also differences in DAH between cantons and between CAM and COM patients. Since the impact of the time spent in hospital for end-of-life care is, at least in part, financial, it will be important to establish whether such differences are supply or demand driven and whether or not lowering days spent in hospital at the end of life is likely to be favoured by patients.

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CONFLICT OF INTEREST

None.

ETHICS

This study was approved by the Ethics Committees of the cantons Basel, Ticino, Valais and Zürich and the expert committee for data protection and professional secret in medical research of the federal office of health.

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TABLES

Table 1: Descriptive statistics for the patients included in the study

ACT, anti-cancer therapies; CAM, complementary/alternative medicine; ECO, basic hospital supplementary insurance (hospitalisation on general ward with free choice of hospital across Switzerland); SP+P, semi-private or private hospital supplementary insurance.

	n	%	Mean age at death
Overall	2086		72.4
Cancer type			
Other	1049	50.3	72.4
Lung	378	18.1	69.5
Colon	154	7.4	73.7
Mamma	179	8.6	71.3
Prostate	170	8.2	78.8
Haematological	156	7.5	72.4
Canton of residence			
Basel	226	10.8	72.8
Ticino	524	25.1	73.3
Valais	137	6.6	72.8
Zürich	1199	57.5	71.9
Gender			
Male	1142	54.8	72.2
Female	944	45.3	72.7
CAM user			
No	1845	88.5	73.0
Yes	241	11.6	68.1
Insurance			
Basic	601	28.8	72.5
ECO	832	39.9	72.3
SP + P	653	31.3	72.4
Received ACT			
No	1060	50.8	75.8
Yes	1026	49.2	68.8
Place of death			
Out of acute hospital	421	20.2	74.1
In acute hospital	1665	79.8	72.0
Number of hospitalisations during the last 90 days before death			
1	732	35.1	73.1
2	616	29.5	71.7
3	391	18.7	71.6
>3	347	16.6	73.0

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435 **Table 2:** Patient characteristics by canton

436 Values in bold indicate highest cantonal result.

Canton	Cancer type	*n*	%	95% CIs	Patient	Characteristic	*n*	%	95% CIs
Basel	Other	111	49.12	42.6–55.6	Patient type	CAM	33	14.60	10.0–19.2
	Lung	44	19.47	14.3–24.6	Gender	Male	130	57.52	51.1–64.0
	Colon	22	**9.73**	5.9–13.6	Insurance	Basic	70	30.97	24.9–37.0
	Mamma	18	7.96	4.4–11.5		ECO	92	40.71	34.3–47.1
	Prostate	16	7.08	3.7–10.4		HP+P	64	28.32	22.4–34.2
	Haematological	15	6.64	3.4–9.9	ACT	Yes	111	49.12	42.6–55.6
	Patients with >3 separate hospitalisations	51	**22.7**	17.1–28.0	Died in Hospital		194	**85.84**	
Ticino	Other	272	51.91	47.6–56.2	Patient type	CAM	16	3.05	1.6–4.5
	Lung	81	15.46	12.4–18.6	Gender	Male	308	58.78	54.6–63.0
	Colon	36	6.87	4.7–9.0	Insurance	Basic	112	21.37	17.9 –24.9
	Mamma	37	7.06	4.9–9.3		ECO	234	44.66	40.4–48.9
	Prostate	47	**8.97**	6.5–11.4		HP+P	178	**33.97**	29.9–38.0
	Haematological	51	**9.73**	7.2–12.3	ACT	Yes	294	**56.11**	51.9–60.4
	Patients with >3 separate hospitalisations	65	12.4	9.6–15.2	Died in Hospital		426	81.30	
Valais	Other	83	60.58	52.4–68.8	Patient type	CAM	6	4.38	0.6–7.8
	Lung	31	**22.63**	15.6–29.6	Gender	Male	89	**64.96**	57.0–73.0
	Colon	7	5.11	1.4–8.8	Insurance	Basic	48	35.04	27.0–43.0
	Mamma	4	2.92	0.1–5.7		ECO	75	54.74	46.4–63.1
	Prostate	9	6.57	2.4–10.7		HP+P	14	10.22	5.1–15.3
	Haematological	3	2.19	0.0–4.6	ACT	Yes	53	38.69	30.5–46.8
	Patients with >3 separate hospitalisations	21	15.3	9.2–21.4	Died in Hospital		101	73.72	
Zürich	Other	583	48.62	45.8–51.5	Patient type	CAM	186	**15.51**	13.5–17.6
	Lung	222	18.52	16.3–20.7	Gender	Male	615	51.29	48.5–54.1
	Colon	89	7.42	5.9–8.9	Insurance	Basic	371	30.94	28.3–33.6
	Mamma	120	**10.01**	8.3–11.7		ECO	431	35.95	33.2–38.7
	Prostate	98	8.17	6.6–9.7		HP+P	397	33.11	30.4–35.8
	Haematological	87	7.26	5.8–8.7	ACT	Yes	568	47.37	44.5–50.2
	Patients with >3 separate hospitalisations	210	17.5	15.4–19.7	Died in Hospital		944	78.73	

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Table 3: Unadjusted values for days spent in acute care hospitals or other institutions during the last 90 days prior to death and percentage of patients dying in acute hospitals. DAH, days in hospital; DOI, days in other institutions; ACT, anti-cancer therapies; CAM, complementary alternative medicine; ECO, basic hospital supplementary insurance (hospitalisation on general ward with free choice of hospital acrross Switzerland); SP+P, semiprivate or private hospital supplementary insurance

	Days spent in:		
	DAH Mean (95% CIs), median	DOI Mean (95% CIs), median	% dying in acute hospital (95% CIs)
Category (mean age at death)			
Overall	26.4 (3.0–63.0), 22.0	5.4 (0.0–38.0), 0	79.8
Canton			
Basel	31.1 (28.4–33.7), 27	5.1 (3.2–7.1), 0	85.8 (81.3–90.4)
Ticino	29.9 (28.2–31.7), 26.0	5.3 (3.9–6.7), 0	81.3 (78.0–84.6)
Valais	23.5 (20.5–26.5), 19.0	5.3 (3.2–7.3), 0	73.7 (66.3–81.1)
Zürich	24.3 (23.3–25.3), 21.0	5.5 (4.6–6.4), 0	78.7 (76.4–81.1)
Cancer type			
Lung	26.3 (24.5–28.2), 23.0	4.6 (3.2–5.9), 0	77.2 (73.0–81.5)
Colon	28.9 (25.5–32.3), 23.5	6.3 (3.6–8.9), 0	76.6 (70.0–83.3)
Mamma	24.8 (2.3–27.4), 23.0	6.9 (4.2–9.6), 0	82.1 (76.5–87.7)
Prostate	23.9 (21.4–26.4), 20.0	5.7 (3.3–8.1), 0	81.2 (75.3–87.1)
Haematological	26.2 (23.2–29.2), 20.0	7.5 (4.3–10.7), 0	84.6 (79.0–90.1)
Other	26.8 (25.6–27.9), 23.0	5.0 (4.0–5.9), 4.0	79.9 (77.5–82.3)
CAM user			
Yes	33.9 (31.2–36.6), 30.0	4.8 (3.3–6.3), 0	77.6 (72.3–82.9)
No	25.4 (24.6–26.3), 22.0	5.5 (4.7–6.2), 0	80.1 (78.3–81.9)
Gender			
Male	25.2 (24.2–26.3), 21.0	4.1 (3.4–4.9), 0	79.9 (77.6–82.3)
Female	27.8 (26.6–29.1), 24.0	6.9 (5.8–8.1), 0	79.7 (77.1–82.2)
Insurance			
Basic	25.4 (23.9–26.9), 21.0	6.4 (5.0–7.8), 0	78.5 (75.3–81.8)
ECO	26.4 (25.1–27.6), 23.0	5.1 (4.0–6.1), 0	80.2 (77.5–82.9)
SP+P	27.4 (26.0–28.9), 24.0	4.9 (3.8–6.1), 0	80.6 (77.5–83.6)
Received ACT			
Yes	26.5 (25.4–27.6), 23.0	3.0 (2.3–3.7), 0	82.2 (80.0–84.5)
No	26.4 (25.2–27.6), 22.0	7.7 (6.6–8.9), 0	77.5 (75.0–80.1)
Place of death			
Acute hospital	26.8 (25.9–27.8), 22.0	3.0 (2.4–3.6), 0	
Other	24.4 (23.2–26.3), 23.0	14.9 (12.7–17.1), 4.0	

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443 **Table 4:** Univariable association (regression-based) between DAH and covariates. DAH, days in
444 hospital; DOI, days in other institutions; ACT, anti-cancer therapies; CAM, complementary
445 alternative medicine; ECO, basic hospital supplementary insurance (hospitalisation on general ward
446 with free choice of hospital across Switzerland); SP+P, semiprivate or private hospital supplementary
447 insurance

Parameter	Log estimate	Standard error	Wald 95% confidence limits		$P > \chi^2$	Overall P value	Means for DAH (exponentiated) (95% CI)
Intercept	3.1921	0.0209	3.151	3.2331	<0.0001	<0.0001	
Canton							
BS	0.2442	0.0476	0.151	0.3374	<0.0001		31.1 (28.6–33.8)
TI	0.2064	0.0354	0.1369	0.2758	<0.0001		29.9 (28.3–31.6)
VS	−0.0365	0.0665	−0.1668	0.0939	0.5835		23.5 (20.7–26.6)
ZH	0	0	0	0			24.3 (23.4–25.4)
Intercept	3.1744	0.0567	3.0632	3.2856	<0.0001	0.1779	
Cancer							
Colon	0.1896	0.0785	0.0357	0.3434	0.0157		28.9 (26.0–32.1)
Haematological	0.0901	0.0802	−0.067	0.2472	0.2609		26.2 (23.4–29.2)
Lung	0.0967	0.0673	−0.0353	0.2286	0.1511		26.3 (24.5–28.3)
Mamma	0.0378	0.0785	−0.1161	0.1916	0.6303		24.8 (22.3–27.6)
Other	0.1135	0.0607	−0.0055	0.2324	0.0616		26.8 (25.7–27.9)
Prostate	0	0	0	0			23.9 (21.4–26.7)
Intercept	3.236	0.0165	3.2036	3.2685	<0.0001	<0.0001	
CAM user							
Yes	0.2878	0.043	0.2036	0.372	<0.0001		33.9 (31.4–36.7)
No	0	0	0	0			25.4 (24.6–26.23)
Intercept	3.228	0.0213	3.1863	3.2697	<0.0001	0.0014	
Gender							
Female	0.0985	0.0308	0.0381	0.1589	0.0014		27.8 (26.7–29.1)
Male	0	0	0	0			25.2 (24.2–26.3)
Intercept	3.234	0.0293	3.1766	3.2914	<0.0001	0.1504	
Insurance							
ECO	0.038	0.0381	−0.0368	0.1127	0.3197		26.4 (25.1–27.7)
HP+P	0.0774	0.0399	−0.0007	0.1556	0.0521		27.4 (26.0–28.9)
Basic	0	0	0	0			25.4 (24.0–26.9)
Intercept	3.2719	0.0217	3.2294	3.3143	<0.0001	0.897	
Received ACT							
Yes	0.004	0.0309	−0.0565	0.0645	0.897		26.5 (25.4–27.6)
No	0	0	0	0			26.4 (25.3–27.5)
Intercept	3.209	0.0354	3.1396	3.2785	<0.0001		
Died in hospital							
Yes	0.0805	0.0393	0.0034	0.1576	0.0407		26.8 (25.9–27.7)
No	0	0	0	0			24.8 (23.1–26.5)
Intercept	3.6583	0.0259	3.6075	3.709	<0.0001	<0.0001	
Age	−0.0053	0.0004	−0.006	−0.0046	<0.0001		
Intercept	3.2871	0.0045	3.2783	3.2959	<0.0001	<0.0001	
Days in other institutions	−0.0026	0.0003	−0.0032	−0.002	<0.0001		

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450 **Table 5:** Multivariable results for days spent in acute hospitals during the last 90 days prior to death.

451 DAH, days in hospital; ACT, anti-cancer therapies; CAM, complementary alternative medicine; ECO,

452 basic hospital supplementary insurance (hospitalisation on general ward with free choice of hospital

453 across Switzerland); SP+P, semi-private or private hospital supplementary insurance.

Parameter	Coefficient estimate	Standard error	Wald 95% confidence limits		$P > \chi^2$	Overall P value	Exponentiated DAH (95% CIs)
Intercept	3.5008	0.1056	3.2937	3.7078	<0.0001	<0.0001	
Canton							
BS	0.1935	0.0664	0.0633	0.3237	0.0036	<0.0001	
TI	0.3204	0.05	0.2224	0.4185	<0.0001		
VS	−0.072	0.0866	−0.2418	0.0978	0.4059		
ZH	0	0	0	0			
Received ACT							
Yes	−0.0709	0.0426	−0.1544	0.0127	0.0964	0.8511	
No	0	0	0	0			
Age	−0.0051	0.0013	−0.0078	−0.0025	0.0001	0.0001	
Days in other institutions	−0.0024	0.001	−0.0044	−0.0003	0.0233	0.0206	
CAM user							
Yes	0.3012	0.0437	0.2156	0.3867	<0.0001	<0.0001	33.9 (31.4–36.7)
No	0	0	0	0			25.1 (24.3–25.9)
Gender							
Female	0.1	0.0303	0.0407	0.1593	0.001	0.001	27.4 (26.3–28.6)
Male	0	0	0	0			24.8 (23.8–25.9)
BS						0.0446	
ACT yes	0.1286	0.0933	−0.0543	0.3115	1.9		31.4 (28.0–35.2)
ACT no	0	0	0	0			29.7 (26.4–33.4)
TI							
ACT yes	−0.0931	0.0697	−0.2297	0.0434	1.79		28.6 (26.5–30.8)
ACT no	0	0	0	0			33.7 (31.1–36.5)
VS							
ACT yes	0.2163	0.1317	−0.0418	0.4744	2.7		26.3 (21.8–31.7)
ACT no	0	0	0	0			22.7 (19.4–26.7)
ZH							
ACT yes	0	0	0	0			22.8 (21.4–24.2)
ACT no	0	0	0	0			24.4 (23.1–25.9)

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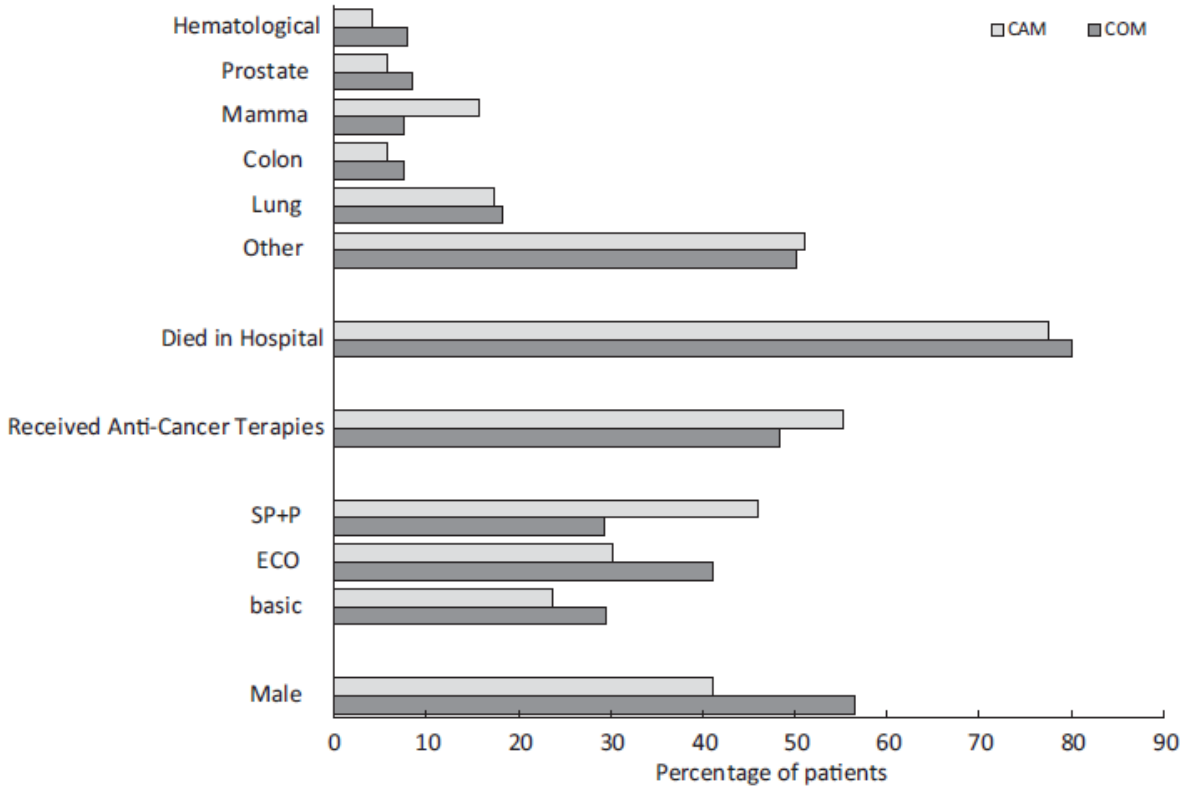
455 **FIGURES**

456 **Figure 1:** Descriptive statistics for patients who use or do not use complementary/alternative
457 therapies. COM, conventional medicine only; CAM, complementary alternative medicine; ECO, basic
458 hospital supplementary insurance (hospitalisation on general ward with free choice of hospital
459 across Switzerland); SP+P, semi-private or private hospital supplementary insurance.



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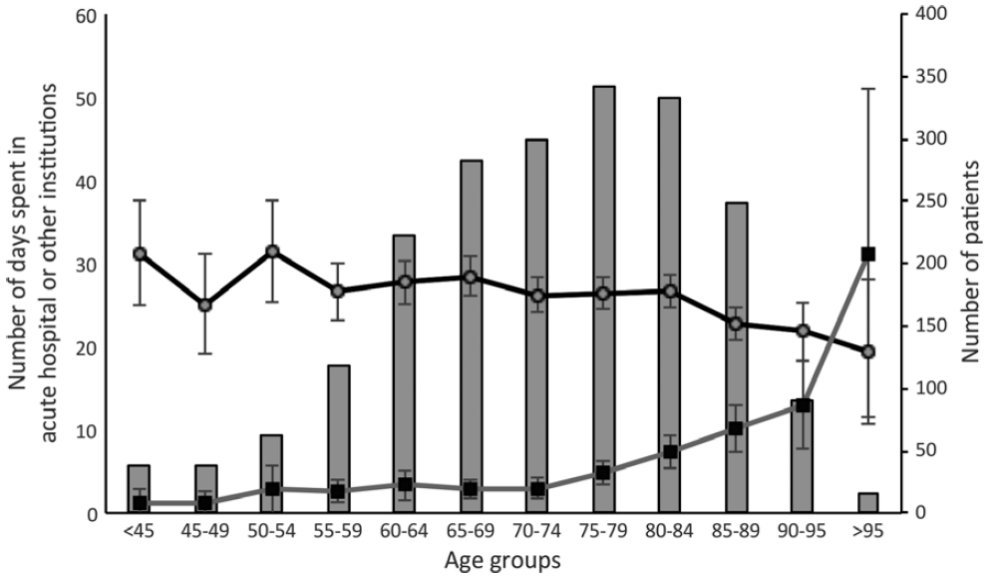
461 **Figure 2:** Relationship between age at death and days spent in acute hospitals or other institutions
462 during the last 90 days prior to death. ○–○ = days spent in an acute hospital, ▪–▪ = days spent in
463 other institutions, ⊥ T = 95% confidence intervals, bars show number of patients within the age
464 group.



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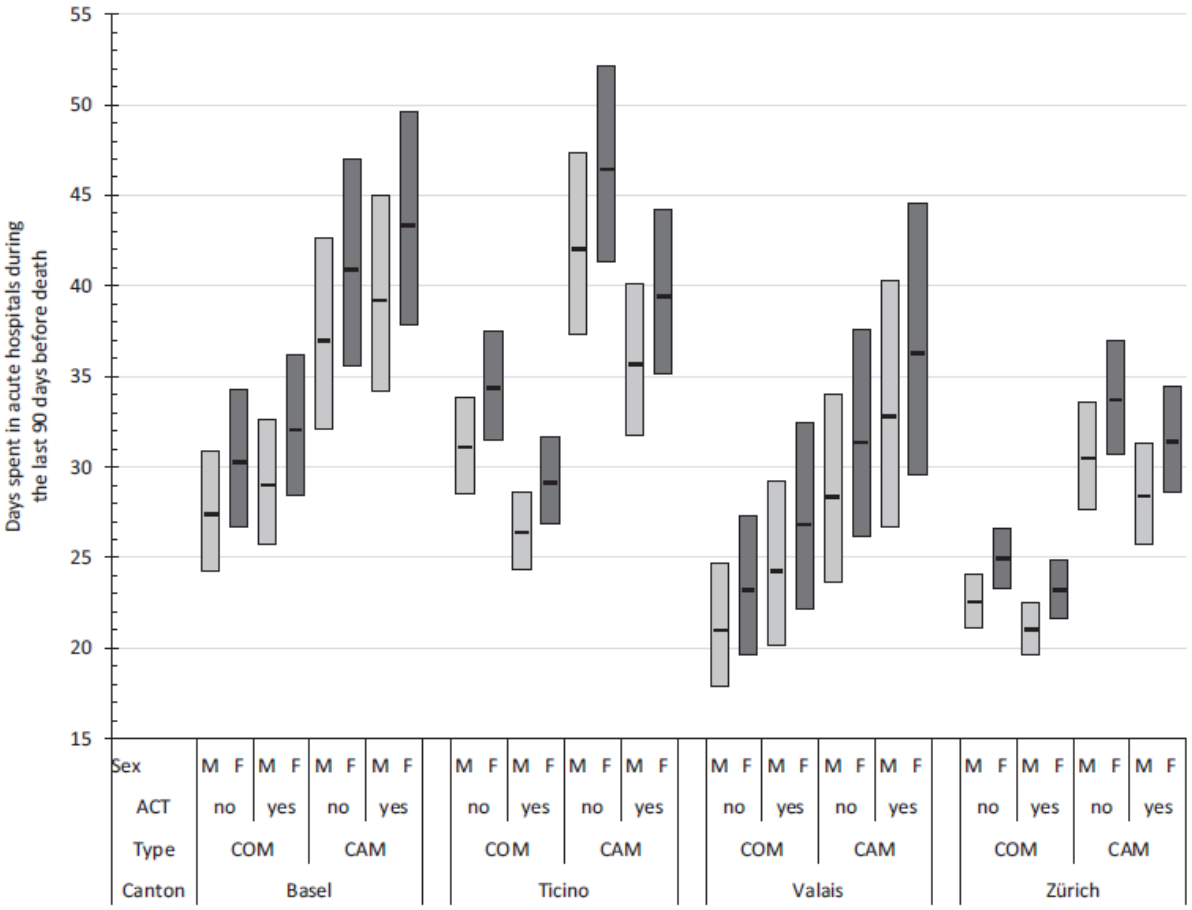
466 **Figure 3:** Estimated days spent in acute hospitals, results of the multivariable model for a patient
467 with a mean age at death of 72.4 and a mean DOI of 5.4 days. DOI, days in other institutions; ACT,
468 anti-cancer therapies; COM, conventional medicine only; CAM, complementary alternative
469 medicine; F, female; M, male. — = mean, bars = 95% confidence intervals



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