



Original article

Suicide assisted by right-to-die associations: a population based cohort study

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Abstract

Background: In Switzerland, assisted suicide is legal but there is concern that vulnerable or disadvantaged groups are more likely to die in this way than other people. We examined socio-economic factors associated with assisted suicide.

Methods: We linked the suicides assisted by right-to-die associations during 2003–08 to a census-based longitudinal study of the Swiss population. We used Cox and logistic regression models to examine associations with gender, age, marital status, education, religion, type of household, urbanization, neighbourhood socio-economic position and other variables. Separate analyses were done for younger (25 to 64 years) and older (65 to 94 years) people.

Results: Analyses were based on 5 004 403 Swiss residents and 1301 assisted suicides (439 in the younger and 862 in the older group). In 1093 (84.0%) assisted suicides, an underlying cause was recorded; cancer was the most common cause (508, 46.5%). In both age groups, assisted suicide was more likely in women than in men, those living alone compared with those living with others and in those with no religious affiliation compared with Protestants or Catholics. The rate was also higher in more educated people, in urban compared with rural areas and in neighbourhoods of higher socio-economic position. In older people, assisted suicide was more likely in the divorced compared with the married; in younger people, having children was associated with a lower rate.

Conclusions: Assisted suicide in Switzerland was associated with female gender and situations that may indicate greater vulnerability such as living alone or being divorced, but also with higher education and higher socio-economic position.

Key words: assisted suicide, end of life care, cohort study, vulnerability, gender, Switzerland

Key Messages

- In Switzerland, assisted suicide is legal but there is concern that vulnerable groups are more likely to die in this way than other people.
- This study linked the mortality records of 1301 suicides assisted by right-to-die organisations 2003–2008 with census records and examined the association of socio-economic variables with assisted suicide.
- Assisted suicide was associated with female gender and indicators of vulnerability such as living alone or being divorced, but also with higher education and higher socio-economic position.
- Malignancies and nervous system conditions were common underlying causes on death certificates, but in 16% of cases no underlying cause was recorded. In 20 cases a mental disorder was the only underlying cause.
- Anonymous registration of assisted suicides should be implemented, including data on patient characteristics and underlying comorbidities, so that trends can be monitored.

Introduction

There is debate on assisted dying in many industrialized countries where life expectancy is high and chronic conditions are the leading causes of death.^{1–4} The proponents of assisted dying argue that medical ethos is not restricted to healing, but includes accompanying the patient in situations in which healing is impossible and unbearable suffering present, taking the patient's personal values into account. Opponents argue that there is evidence for a 'slippery slope' in countries and states that have legalized euthanasia or assisted suicide, from a last-resort option in few situations to something that is sought more often and more quickly, with the danger that those belonging to the more vulnerable groups of society may be coerced to choose an assisted death.^{5–7}

Four European countries and three US states allow assisted suicide, euthanasia or both: Switzerland, The Netherlands, Belgium and Luxembourg in Europe and Oregon, Washington and Montana in the USA.⁸ The situation in Switzerland is not the result of a deliberately liberal policy. Whereas euthanasia is prohibited, article 115 of the penal code states that assistance in suicide is allowed if no selfish interests are involved.¹ Proposed in 1918, the article did not intend to regulate assisted suicide from a medical perspective. Rather, lawmakers were concerned with suicides motivated by honour and romance.⁹ Today, assisted suicides in Switzerland involve volunteers working for 'right-to-die associations'. The role of physicians is restricted to assessing the decisional capacity of the person requesting assistance and to prescribing the lethal drug. Of note, the person requesting assistance does not need to have a terminal illness.^{1,8,10}

The Swiss National Cohort is a longitudinal study based on the census, with detailed information at the level of the person, household and dwelling.^{11–12} We linked this study to the records of the right-to-die associations to examine the rate of assisted suicide in different population groups,

including groups defined by gender, marital status, religion, educational attainment, the composition of households, socio-economic position of neighbourhoods or language region, and thus to inform the debate on which groups are more likely to die by assisted suicide.

Methods**The Swiss National Cohort**

The Swiss National Cohort (SNC) is a longitudinal study of mortality in Switzerland based on linkage of census and mortality records. The SNC has been described in detail elsewhere.^{11–12} Briefly, the records of the 1990 and 2000 censuses were linked to a death or emigration record using deterministic and probabilistic linkage procedures, based on gender, date of birth, place of residence and other variables. The present analysis is based on the 2000 census, for which coverage is estimated at 98.6%.¹³ We excluded people younger than 25 years or older than 94 years at census 2000 because linkage was less complete in these age groups.^{11–12} We also excluded people who died or emigrated before 1 January 2003. Individuals were followed from 1 January 2003 until death, emigration or the end of the study period on 31 December 2008. The SNC was approved by the Cantonal Ethics Committees of Bern and Zurich, with approval covering this study.

Right-to-die associations and identification of assisted suicides

During the study period, four right-to-die associations were active in Switzerland. One of them (EXInternational) is exclusively concerned with persons living abroad and was excluded. The other three associations, Exit Deutsche Schweiz, Exit Suisse Romande and Dignitas, assist deaths of Swiss residents. The associations have been described in

detail elsewhere.^{8–10} Briefly, the two Exit associations were founded in 1982 to strengthen patient rights at the end of life. Members who wish assistance to die have to request this of their own free will and be legally competent. According to internal regulations, they have to suffer from an incurable illness, intolerable suffering or a severe disability. In contrast to Exit, Dignitas also assists people who are not resident in Switzerland, applying criteria similar to Exit.¹ The three right-to-die associations provided anonymous data on all deaths of Swiss residents they assisted from 2003 to 2008 to the Federal Statistical Office (FSO).¹⁴ We then identified these deaths in the SNC based on cause of death, date of death, date of birth, gender and community of residence, in accordance with a legal agreement with the FSO.

Underlying cause of death

We determined the underlying cause of death using the International Classification of Diseases, 10th Revision (ICD-10) codes of the causes recorded on the death certificates. We used the first underlying cause and created broad categories of all-cancer (C00-C97), mental and behavioural disorders (F00-F99), diseases of the nervous system (G00-G99), diseases of the circulatory system (I00-I99), diseases of the musculoskeletal system (M00-M99) and other diseases (A00-B99, D00-D89, E00-E90, H00-H95, J00-J99, K00-K93, L00-L99, N00-N99, O00-O99, P00-P96, Q00-Q99, R00-R99). Separate analyses were done for cancers of the digestive system (C15-C26), cancers of the respiratory system (C30-C39), breast cancer (C50), cancers of male genital organs (C60-C63) and other cancers as well as for mood disorders (F30-39). Motor neuron disease [including amyotrophic lateral sclerosis (ALS), G12.2], Parkinson's disease (G20), multiple sclerosis (G35) and other nervous system diseases were also analysed separately.

Statistical analysis

We analysed the data in two ways. First, we performed time-to-event analyses with outcome assisted suicide. We calculated rates by dividing the number of assisted suicides by the number of person-years at risk and calculated hazard ratios for variables of interest using Cox regression models. Second, we did a logistic regression analysis with the outcome assisted deaths among all deaths, stratified by underlying cause. The fully adjusted models included sex, age (in 10-year bands), religion (Protestants, Catholics and no affiliation), education (compulsory schooling, secondary and tertiary education), marital status (single, married,

divorced and widowed), type of household (single person, multi person and institution), having children (yes or no), urbanization (urban, peri-urban and rural), the Swiss neighbourhood index of socio-economic position (Swiss-SEP, in quartiles), language region (German, French and Italian) and nationality (Swiss or foreign). Swiss-SEP is based on 1.27 million neighbourhoods of about 50 households and data from the 2000 census on the median rent per square metre, the mean number of persons per room and the proportions of households headed by someone with primary education or less, or headed by a person in manual or unskilled occupation.¹⁵ Models adjusted for age only were also calculated.

We examined what underlying causes of death were associated with assisted suicide. We divided the number of assisted suicides with an underlying condition by the number of deaths with the same condition and expressed it as a percentage, excluding external causes (ICD-10 codes S00-T98, V01-X59, X85-Y98). In a further logistic regression analysis, we identified factors associated with death certificates that did not list any underlying cause.

Statistical analyses were done in Stata version 12 (Stata Corporation, College Station, TX, USA). Results are given as rates per 100 000 population, hazard ratios (HRs), odds ratios (ORs) and percentages of assisted suicides among all deaths across underlying causes, with 95% confidence intervals (CIs).

Results

Study population

The three right-to-die associations reported a total of 1329 assisted suicides of Swiss residents during 2003 to 2008. The number of cases per year increased from 189 in 2003 to 252 in 2008. Twenty-eight assisted suicides (2.1%) were excluded for the reasons given in Table 1; 1301 (97.9%) were included. The SNC included 7 275 402 individuals at the end of 2000. A total of 189 980 (2.6 %) people were excluded because they died or emigrated between the census 2000 and 1 January 2003. Furthermore, 2 076 910 (28.5%) individuals younger than 25 years at census were excluded, including three persons who died by assisted suicides: one man and two women aged 25, 26 and 27 years at death, with underlying conditions retinoblastoma, leukaemia and personality disorder. Furthermore, 4109 (0.6%) individuals aged 95 years or older were excluded, among them a woman suffering from heart failure who died by assisted suicide. A total of 5 004 403 people at risk on 1 January 2003 were thus included in the analyses. The characteristics of the study population at the census 2000

Table 1. Numbers of deaths assisted by right-to-die associations in Switzerland during the years 2003 to 2008 and numbers excluded from and included in analyses

Number	Right-to-die association			Total (%)
	Exit Deutsche Schweiz	Exit Suisse Romande	Dignitas	
All assisted suicides	927	337	65	1329 (100)
Excluded from analysis				
Linkage to Swiss National Cohort unsuccessful	13	5	6	24 (1.8)
Aged <25 or >94 years at census 2000	2	2	0	4 (0.3)
Included in analysis	912	330	59	1301 (97.9)

are shown in [Table 2](#). There were slightly more women than men (52% and 48%, respectively); the median age was 48 years (interquartile range 36–61 years). During the study period a total of 321,616 persons died.

Rates of assisted suicide

Crude rates of assisted suicide were based on 28.7 million person-years of follow-up. Rates increased exponentially with age from 0.3 (95% CI 0.2–0.5) per 100 000 person-years in age group 25–34 years to 38.9 (95% CI 32.8–46.2) per 100 000 person-years among those aged 85–94 years ([Figure 1](#)). Rates were higher among women than men, but differences between genders depended on age (P from test of interaction <0.001). There were also interactions between age and education ($P < 0.001$), religion ($P < 0.001$), parenthood ($P = 0.005$), Swiss SEP ($P = 0.01$) and nationality ($P = 0.039$). Analyses were therefore stratified by age (439 assisted suicides in the age group 25–64 years and 862 assisted suicides in the age group 65–94 years). The cut-off at 65 years reflects retirement age for men in Switzerland.

Factors associated with assisted suicide

[Table 3](#) shows the results from the fully-adjusted Cox and logistic regressions models. In the Cox model, assisted suicide was more likely in people with secondary or tertiary compared with compulsory education, in those living alone compared with those living with others and in those with no religious affiliation compared with Protestants or Catholics. The rate was also higher in urban compared with rural areas, in neighbourhoods of higher socio-economic position and in the French- compared with the German- or Italian-speaking regions of the country. Associations were stronger in the older than in the younger age group for some variables. For example, the HR comparing those with no religious affiliation with Catholics was 6.40 (95% CI 5.11–8.01) in those aged 65–94 years at

census compared with 2.66 (95% CI 2.03–3.47) in those aged 25–64 years. Having children was associated with a lower rate of assisted suicide in the younger (HR 0.54, 95% CI 0.42–0.70) but not in the older age group. The logistic regression analysis generally showed similar associations. The association with gender was stronger in the logistic than in the Cox model: ORs comparing women with men were 2.45 (95% CI 1.99–3.01) in the younger and 1.66 (95% CI 1.40–1.96) in the older age group, respectively. Conversely, the association with living in an institution, which was evident in the older age group in the Cox model, disappeared in the logistic model. The differences between the two models are due to the fact that the Cox model, but not the logistic model, is affected by the underlying risk of severe illness and death: women have a lower risk than men, whereas those living in institutions have a higher risk than those living at home.

When comparing fully-adjusted estimates with estimates that were adjusted for age only (shown in [supplementary Table S1](#), available as [Supplementary data](#) at [IJE online](#)), results were qualitatively similar but HRs and ORs tended to be attenuated in the fully adjusted analysis. One association that was not evident in the age-adjusted analysis emerged in the fully adjusted analysis: the higher rate of assisted suicide in the French-speaking compared with the other language regions of the country.

Underlying causes of death

In 1093 (84.0%) cases, the death certificates mentioned at least one underlying cause ([Table 4](#)). In age group 25–64 years, the majority of individuals dying by assisted suicide had cancer (223 of 393 deaths, 56.7%), followed by nervous system causes (81, 20.6%). Eleven persons (2.8%) had a mood disorder listed as the first underlying cause and three (0.8%) another mental or behavioural disorder. The percentage dying by assisted suicide ranged from 0.03% (95% CI 0.0 to 0.08) for circulatory system causes in men to 9.3% (95% CI 6.2–13.2) for multiple sclerosis in

Table 2. Socio-demographic characteristics of study population and crude rates of assisted suicide, Switzerland 2003–2008

Characteristics	Study population		Assisted suicides		Crude rate per 100 000		
	Number	%	Number	%	Estimate	95% CI	
All	5 004 403	100	1,301	100	4.5	4.3–4.8	
Gender							
	Male	2 402 899	48.0	561	43.1	4.1	3.8–4.4
	Female	2 601 504	52.0	740	56.9	5.0	4.6–5.3
Age (years)							
	25–34	1 061 090	20.9	18	1.4	0.3	0.2–0.5
	35–44	1 177 743	23.1	50	3.8	0.7	0.5–0.9
	45–54	986 903	19.4	143	11.0	2.5	2.1–2.9
	55–64	775 352	15.3	228	17.5	5.1	4.5–5.8
	65–74	564 545	11.4	360	27.7	11.4	10.3–12.7
	75–84	341 317	7.4	370	28.4	22.3	20.1–24.7
	85–94	97 453	2.6	132	10.2	38.9	32.8–46.2
Religious affiliation							
	Protestant	1 813 645	36.2	612	47.0	5.9	5.5–6.4
	Catholic	2 114 883	42.3	272	20.9	2.2	2.0–2.5
	No affiliation	578 718	11.6	331	25.4	9.9	8.8–11.0
	Other/unknown	497 207	9.9	86	6.6	3.0	2.4–3.7
Education							
	Compulsory	1 157 143	23.1	270	20.8	4.2	3.8–4.8
	Secondary	2 600 564	52.0	687	52.8	4.6	4.2–4.9
	Tertiary	1 095 834	21.9	335	25.8	5.2	4.7–5.8
	Unknown	150 826	3.0	9	0.7	1.0	0.5–2.0
Marital status							
	Single	975 300	19.5	157	12.1	2.8	2.4–3.2
	Married	3 268 448	65.3	642	49.4	3.4	3.1–3.7
	Widowed	363 677	7.3	314	24.1	17.3	15.5–19.3
	Divorced	396 978	7.9	188	14.5	8.2	7.1–9.5
Type of household							
	1 person	1 022 589	20.4	542	41.7	9.5	8.7–10.3
	≥ 2 persons	3 825 366	76.6	714	54.9	3.2	3.0–3.5
	Institution	146 448	2.9	45	3.5	6.2	4.6–8.3
Children							
	No	1 368 354	27.3	331	25.4	4.2	3.7–4.7
	Yes	3 406 593	68.1	909	69.9	4.7	4.4–5.0
	Unknown	229 456	4.6	61	4.7	4.8	3.7–6.1
Urbanization							
	Urban	1 469 703	29.4	571	43.9	6.8	6.3–7.4
	Peri-urban	2 248 963	45.0	558	42.9	4.3	4.0–4.7
	Rural	1 285 737	25.7	172	13.2	2.3	2.0–2.7
Neighbourhood index of SEP							
	Lowest quartile	1 204 410	24	160	12.3	2.3	2.0–2.7
	Second quartile	1 204 433	24	249	19.1	3.6	3.2–4.1
	Third quartile	1 204 459	24	329	25.3	4.7	4.3–5.3
	Fourth quartile	1 204 443	24	536	41.2	7.6	7.0–8.2
	Unknown	186 658	4	27	2.1	2.7	1.8–3.9
Language region							
	German	3 607 624	72.1	924	71.0	4.5	4.2–4.8
	French	1 164 032	23.3	339	26.1	5.1	4.6–5.7
	Italian	232 747	4.7	38	2.9	2.8	2.1–3.9
Nationality							
	Swiss	4 064 126	81.2	1,220	93.8	5.2	4.9–5.5
	Foreigner	940 277	18.8	81	6.2	1.5	1.2–1.9

SEP, socio-economic position.

women. For all causes except Parkinson's disease, the percentage dying by assisted suicide was higher in women than in men. Overall 0.9% (95% CI 0.7–1.0) of women compared with 0.4% (95% CI 0.3–0.4) of men died by assisted suicide. The ratio of women to men was 2.27 (range 0.43 for Parkinson's disease to 3.99 for mood disorders).

In age group 65–94 years, the most common underlying cause was again cancer (285 of 700 deaths, 40.8%),

followed by circulatory (106, 15.2%) and nervous system causes (80, 11.3%). Thirty persons (4.3%) had a mood disorder listed as the underlying cause and six persons (0.9%) another mental or behavioural disorder. The percentage dying by assisted suicide ranged from 0.01% (95% CI 0.0–0.1) for other mental and behavioural causes in women to 4.0% (95% CI 2.5–6.1) for mood disorders in women. Overall the percentage dying by assisted suicide

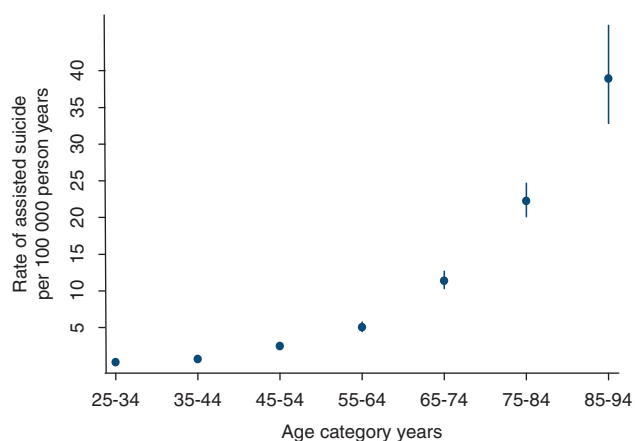


Figure 1 Crude rates of assisted suicide across categories of age at census, with 95% confidence intervals

was 0.3% (95% CI 0.2–0.3) both in men and in women. The ratio of women to men was 0.84 (range 0.09 for other mental and behavioural disorders to 3.56 for respiratory cancers).

Figure 2 shows a Venn diagram of the overlap between mental and behavioural disorders, cancer and all other causes. Most cases (62/82, 75.6%) with a mental or behavioural cause on the death certificate also had another cause listed, for example cancer, but there were 20 assisted suicides with a mental and behavioural underlying cause only. Supplementary Table S2 (available as Supplementary data at *IJE* online) lists all first underlying causes by age group and gender and Supplementary Table S3 (available as Supplementary data at *IJE* online) shows the results from the logistic regression model of not having an underlying

Table 3. Number of assisted suicides, hazard ratios from multivariable Cox models and odds ratios from multivariable logistic regression models stratified by age at census; all results are adjusted for age and all variables listed^a

Characteristics		Aged 25–64 years			Aged 65–94 years		
		Assisted suicides	Results of Cox model hazard ratio (95% CI)	Results of logistic regression odds ratio (95% CI)	Assisted suicides	Results of Cox model hazard ratio (95% CI)	Results of logistic regression odds ratio (95% CI)
Gender	Male	175	1	1	330	1	1
	Female	229	1.25 (1.01–1.54)	2.45 (1.99–3.01)	436	0.87 (0.73–1.02)	1.66 (1.40–1.96)
Religion	Catholic	115	1	1	143	1	1
	Protestant	167	1.37 (1.07–1.76)	1.33 (1.04–1.70)	424	2.12 (1.74–2.59)	2.05 (1.68–2.50)
	No affiliation	122	2.66 (2.03–3.47)	2.59 (1.98–3.39)	199	6.40 (5.11–8.01)	6.63 (5.29–8.32)
Education	Compulsory	45	1	1	186	1	1
	Secondary	243	1.49 (1.07–2.08)	1.88 (1.35–2.61)	393	1.55 (1.28–1.86)	1.74 (1.45–2.10)
	Tertiary or higher	116	1.48 (1.02–2.15)	2.52 (1.74–3.64)	187	2.11 (1.67–2.67)	2.71 (2.15–3.43)
Marital status	Married	237	1	1	360	1	1
	Single	72	0.84 (0.58–1.23)	0.67 (0.45–0.98)	59	1.03 (0.70–1.51)	0.79 (0.54–1.17)
	Widowed	76	1.05 (0.62–1.75)	0.74 (0.44–1.24)	252	1.17 (0.89–1.54)	0.79 (0.60–1.05)
	Divorced	19	1.24 (0.90–1.71)	0.89 (0.63–1.24)	95	1.73 (1.28–2.35)	1.35 (0.99–1.85)
Type of household	≥ 2 persons	267	1	1	387	1	1
	1 person	132	1.75 (1.30–2.34)	1.51 (1.11–2.05)	344	1.42 (1.02–1.83)	1.44 (1.11–1.87)
	Institution	5	0.60 (0.08–4.29)	0.29 (0.04–2.09)	35	1.60 (1.00–2.58)	0.84 (0.52–1.36)
Children	No	150	1	1	162	1	1
	Yes	254	0.54 (0.42–0.70)	0.66 (0.52–0.85)	604	0.89 (0.72–1.10)	0.97 (0.79–1.19)
Urbanization	Rural	71	1	1	91	1	1
	Urban	148	1.42 (1.05–1.93)	1.22 (0.89–1.65)	347	1.68 (1.32–2.15)	1.61 (1.26–2.06)
	Peri-urban	185	1.13 (0.84–1.52)	1.06 (0.78–1.42)	328	1.36 (1.07–1.74)	1.36 (1.06–1.74)
Neighbourhood index of SEP	Lowest quartile	64	1	1	96	1	1
	Second quartile	91	1.21 (0.87–1.68)	1.34 (0.96–1.86)	158	1.30 (0.99–1.71)	1.36 (1.04–1.79)
	Third quartile	106	1.11 (0.80–1.56)	1.32 (0.94–1.85)	223	1.73 (1.33–2.45)	1.90 (1.46–2.47)
	Fourth quartile	169	1.53 (1.10–2.12)	2.06 (1.48–2.85)	367	2.50 (1.74–2.92)	2.68 (2.06–3.47)
Language region	German-speaking	292	1	1	553	1	1
	French-speaking	101	1.26 (1.00–1.59)	1.22 (0.97–1.55)	186	1.22 (1.02–1.44)	1.27 (1.06–1.51)
	Italian-speaking	11	0.80 (0.43–1.49)	0.86 (0.47–1.60)	27	1.16 (0.77–1.72)	1.33 (0.89–1.99)
Nationality	Swiss	375	1	1	727	1	1
	Foreigner	29	0.56 (0.38–0.83)	0.64 (0.43–0.95)	39	0.83 (0.59–1.15)	0.86 (0.61–1.19)

^aA total of 790 233 individuals with missing or unclear data were excluded from this analysis. SEP, socio-economic position.

Table 4. Number and percentage of assisted suicides among all deaths from selected underlying causes^a by gender and age

Cause	Aged 25–64 years				Aged 65–94 years			
	No. of assisted suicides/ total no. of deaths		Percent (95% CI)		No. of assisted suicides/ total no. of deaths		Percent (95% CI)	
	Men	Women	Men	Women	Men	Women	Men	Women
Cancer	99/20033	124/15323	0.5 (0.4–0.6)	0.8 (0.7–1.0)	146/32060	139/26703	0.5 (0.4–0.5)	0.5 (0.4–0.6)
Digestive	29/6263	31/3336	0.5 (0.3–0.6)	0.9 (0.6–1.3)	40/8856	41/8493	0.5 (0.3–0.6)	0.5 (0.3–0.7)
Respiratory	16/6003	18/2895	0.3 (0.2–0.4)	0.6 (0.4–1.0)	12/6711	18/2824	0.2 (0.1–0.3)	0.6 (0.4–1.0)
Breast	0/20	32/3712	0.0	0.9 (0.6–1.2)	0/25	34/4407	–	0.8 (0.5–1.1)
Male genital	13/1109	–	1.2 (0.6–2.0)	–	48/6882	–	0.7 (0.5–0.9)	–
Others	41/6638	43/5380	0.6 (0.4–0.8)	0.8 (0.6–1.1)	46/9586	46/10979	0.5 (0.4–0.6)	0.4 (0.3–0.6)
Mental and behavioural	5/2514	9/1284	0.2 (0.1–0.5)	0.7 (0.3–1.3)	14/5040	22/11003	0.3 (0.2–0.4)	0.2 (0.1–0.3)
Mood disorders	3/857	8/566	0.4 (0.1–1.0)	1.4 (0.6–2.8)	9/365	21/519	2.5 (1.1–4.6)	4.0 (2.5–6.1)
Other	2/1657	1/718	0.1 (0.0–0.4)	0.1 (0.0–0.8)	5/4675	1/10484	0.1 (0.0–0.2)	0.01 (0.0–0.01)
Nervous system	32/1261	49/1157	2.5 (1.7–3.6)	4.2 (3.1–5.6)	33/5566	47/8771	0.6 (0.4–0.8)	0.5 (0.4–0.7)
Motor neuron disease	13/266	13/181	4.9 (2.6–8.2)	7.2 (3.9–12.0)	8/243	8/284	3.3 (1.4–6.4)	2.8 (1.2–5.5)
Parkinson's disease	4/87	1/51	4.6 (1.3–11.4)	2.0 (0.0–10.4)	10/1764	14/1569	0.6 (0.3–1.0)	0.9 (0.5–1.5)
Multiple sclerosis	6/150	27/290	4.0 (1.5–8.5)	9.3 (6.2–13.3)	1/77	5/228	1.3 (0.0–7.0)	2.2 (0.7–5.0)
Other	9/758	8/635	1.2 (0.5–2.2)	1.3 (0.5–2.5)	14/3482	20/6690	0.4 (0.2–0.7)	0.3 (0.2–0.5)
Circulatory system	4/12018	3/4176	0.03 (0.0–0.1)	0.1 (0.0–0.2)	44/48709	62/70065	0.1 (0.1–0.1)	0.1 (0.1–0.1)
Musculoskeletal	2/192	8/209	1.0 (0.1–3.7)	3.8 (1.7–7.4)	8/691	54/1964	1.2 (0.5–2.3)	2.7 (2.1–3.6)
Other	27/9740	31/5230	0.3 (0.2–0.4)	0.6 (0.4–0.8)	56/26342	75/32633	0.2 (0.2–0.3)	0.2 (0.2–0.3)
All causes	169/45758	224/27379	0.4 (0.3–0.5)	0.9 (0.8–1.0)	301/118408	399/151139	0.3 (0.3–0.3)	0.3 (0.3–0.4)

^aAnalysis is based on all deaths except external causes (ICD-10 codes S00-T98, V01-X59, X85-Y98). The first underlying cause is shown.

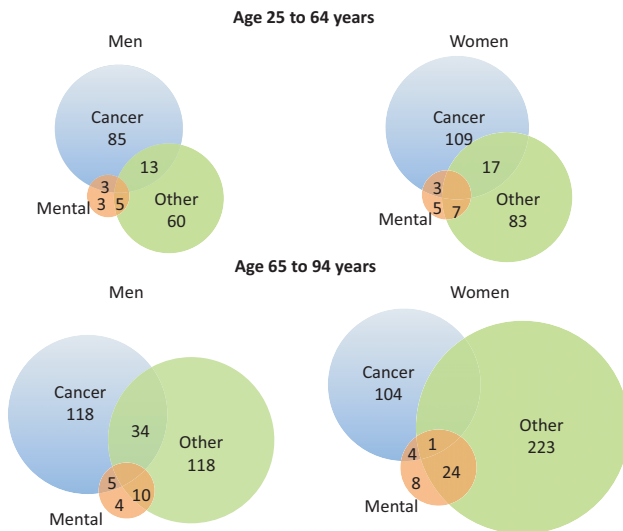


Figure 2. Venn diagram of underlying causes recorded on 1092 death certificates of assisted suicides in Switzerland, 2003 to 2008. Age relates to age at census in December 2000

cause. In multivariable analysis, death certificates without an underlying cause were more common in the older than in the younger age group, more common in urban than in rural regions and more common in the French- and Italian- than in the German-speaking regions of the country.

Discussion

We found that in Switzerland, assisted suicide was more likely in women compared with men, those living alone compared with those living in households with others, the divorced compared with the married and those without religious affiliation compared with Protestants or Catholics. In younger people, assisted suicide was less likely in people with children than in those without. We also found that assisted suicide was more common in well-educated people, in urban areas and in neighbourhoods of higher socio-economic position compared with people with compulsory education only, rural areas and neighbourhoods of lower socio-economic position. Most of the people who died by assisted suicide had cancer, but the percentage dying in this way was much higher among patients with diseases of the nervous system such as multiple sclerosis, ALS or Parkinson's disease.

Strengths and weaknesses

The study was based on the national census of the year 2000, which had near complete coverage of the Swiss population,¹³ and on data from all three right-to-die associations that assist suicides in people resident in the country. The census included detailed information on

individuals, households and buildings which could be linked to the mortality and emigration records to create a cohort of the entire population resident in Switzerland. We recently reviewed the literature on euthanasia and assisted suicide in European countries and US states.⁸ To our knowledge, the present study is the first population-based cohort study of assisted suicide. The census data also made it possible to develop a neighbourhood index of socio-economic position,¹⁵ which is associated with mortality from different causes including, as shown here, with assisted suicide.

Although assisted suicides are investigated routinely by the authorities, there is no obligation to report them to a central registry that could be used for monitoring and research. We could therefore only include the suicides assisted by lay volunteers working for right-to-die associations but not those assisted by physicians. In a survey of physicians, one-third of doctors had been confronted with a request to assist a suicide, but only 6% indicated that they assisted a suicide without involvement of a right-to-die association.¹⁶ It therefore seems likely that our study included most assisted suicides. Analyses of the percentage dying by assisted suicide among all deaths with a given underlying cause depended on information on the death certificate. The reliability of death certificates is generally high for major groups of causes such as cancer or myocardial infarction, and also high for well-defined rare conditions such as ALS.^{17,18} The reliability is however lower for other chronic conditions, for example diabetes or renal insufficiency and for psychiatric disorders such as depression.¹⁷ All assisted suicides are reported as unnatural deaths and investigated by a forensic team. The information on the death certificate might therefore be more accurate than for natural deaths.

Implications for policy and further research

Our study is relevant to the debate on a possibly disproportionate number of assisted suicides among vulnerable groups.^{6,19} The higher rates among the better educated and those living in neighbourhoods of higher socio-economic standing does not support the 'slippery slope' argument but might reflect inequities in access to assisted suicide. Assistance by the right-to-die associations is provided free of charge to members who pay an annual fee (45 to 105 US\$). Non-members pay a higher one-off fee of at least 1000 US\$. We have earlier shown that the protective effect of a religious affiliation, and particularly of the Catholic faith, is evident both for assisted and non-assisted suicides.²⁰ The association with religion may reflect greater social integration among the religious as well as social norms and dogma.²⁰ On the other hand, we found a higher

rate among people living alone and the divorced. Social isolation and loneliness are well-known risk factors for non-assisted suicide.^{21,22} Our results suggest that they may also play a role in assisted suicides. Also, the observation that women die more frequently than men by assisted suicide is potentially of concern. Interestingly, studies from The Netherlands^{23,24} and Oregon^{25,26} reported more men than women among assisted deaths.

We identified 20 assisted suicides with a mental and behavioural cause but no other underlying cause on the death certificate. Sixteen (80%) suffered from depressive disorders and dementia was mentioned in four cases (20%). Assistance with suicide can legally be provided only to persons who are competent to make this decision. In 2009 the Federal Court convicted a psychiatrist for reckless homicide, who assisted the suicide of two persons suffering from mental illness.²⁷ The same court had previously argued that assistance with suicide in patients with psychiatric disorders may be justified in exceptional cases, if the patient's wish to die clearly is not a consequence of the mental illness. In contrast, the Swiss Medical Association argued that assisted suicide should be banned altogether in patients with mental illness.²⁸

In a substantial minority of death certificates (16%), no underlying cause of death was recorded, despite the fact that only those who suffer from an incurable illness, intolerable suffering or a severe disability are eligible for assistance by the associations. The fatal disease or the condition associated with intolerable suffering or severe disability should of course have been recorded on the death certificate. Of note, a study of suicides assisted by Exit Deutsche Schweiz and Dignitas from 2001 to 2004 found that in about 25% no fatal illness was present.²⁹ The authors concluded that 'weariness of life' may be an increasingly common reason for people choosing assisted suicide.²⁹

In 2013, The European Court of Human Rights asked Switzerland to clarify whether and under what conditions individuals not suffering from terminal illnesses can be helped to end their lives,³⁰ suggesting that Switzerland should more precisely regulate assisted dying. We believe that such new regulation should mandate the anonymous registration of assisted suicides in a dedicated database, including data on patient characteristics and underlying comorbidities, so that the suicides assisted by right-to-die associations can be monitored. Finally, further research is required to explore the reasons for the differences in assisted suicide rates found in this study, and to what extent they reflect greater vulnerability. Such research should include studies into the attitudes and values of those choosing to die by assisted suicide and their next of kin, and research in to access to palliative care.

Supplementary Data

Supplementary data are available at *IJE* online.

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References

- Burkhardt S, La Harpe R. Debates about assisted suicide in Switzerland. *Am J Forensic Med Pathol* 2012;**33**:410–13.
- Nitschke P, Stewart F. ‘What’s it got to do with you?’ Challenging the medical profession’s future in the assisted suicide debate. *Aust N Z J Psychiatry* 2011;**45**:1017–19.
- Smith H, Smith R. Time to legalise assisted dying? Doctors cannot simultaneously be patient centred and reject assisted suicide. *BMJ* 2005;**331**:842–43; discussion 43.
- Simon-Lorda P, Barrio-Cantalejo IM. End-of-life healthcare decisions, ethics and law: the debate in Spain. *Eur J Health Law* 2012;**19**:355–65.
- Pereira J. Legalizing euthanasia or assisted suicide: the illusion of safeguards and controls. *Curr Oncol* 2011;**18**:e38–45.
- Finlay IG, George R. Legal physician-assisted suicide in Oregon and The Netherlands: evidence concerning the impact on patients in vulnerable groups – another perspective on Oregon’s data. *J Med Ethics* 2011;**37**:171–74.
- Scoccia D. Slippery-slope objections to legalizing physician-assisted suicide and voluntary euthanasia. *Public Affairs Quarterly* 2005;**19**:143–61.
- Steck N, Egger M, Maessen M, Reisch T, Zwahlen M. Euthanasia and assisted suicide in selected European countries and US states: Systematic literature review. *Med Care* 2013;**51**:938–44.
- Hurst SA, Mauron A. Assisted suicide and euthanasia in Switzerland: allowing a role for non-physicians. *BMJ* 2003;**326**:271–73.
- Andorno R. Nonphysician-assisted suicide in Switzerland. *Camb Q Healthc Ethics* 2013;**22**:246–53.
- Bopp M, Spoerri A, Zwahlen M *et al.* Cohort Profile: the Swiss National Cohort—a longitudinal study of 6.8 million people. *Int J Epidemiol* 2009;**38**:379–84.
- Spoerri A, Zwahlen M, Egger M, Bopp M. The Swiss National Cohort: a unique database for national and international researchers. *Int J Public Health* 2010;**55**:239–42.
- Renaud A. *Methodology Report – Coverage Estimation for the Swiss Population Census 2000*. Neuchâtel, Switzerland: Swiss Federal Statistical Office, 2004.
- Bundesamt für Statistik. *Sterbehilfe in der Schweiz 1998-2009: Knapp 300 assistierte Suizide 2009 [Assisted dying in Switzerland 1998-2009: almost 300 assisted suicides in 2009]*. Neuchâtel, Switzerland: Swiss Federal Statistical Office, 2012.
- Panczak R, Galobardes B, Voorpostel M, Spoerri A, Zwahlen M, Egger M. A Swiss neighbourhood index of socioeconomic position: development and association with mortality. *Epidemiol Community Health* 2012;**66**:1129–36.
- Burkhardt S, Wyss K, La Harpe R. L’assistance au suicide de Suisse: la position des médecins [Assisted suicide in Switzerland: physicians’ position]. *Rev Med Suisse Romande* 2007;**3**:2861–64.
- Harteloh P, de BK, Kardaun J. The reliability of cause-of-death coding in The Netherlands. *Eur J Epidemiol* 2010;**25**:531–38.
- Chio A, Magnani C, Oddenino E, Tolardo G, Schiffer D. Accuracy of death certificate diagnosis of amyotrophic lateral sclerosis. *J Epidemiol Community Health* 1992;**46**:517–18.
- Battin MP, van der Heide A, Ganzini L, van der Wal G, Onwuteaka-Philipsen BD. Legal physician-assisted dying in Oregon and the Netherlands: evidence concerning the impact on patients in ‘vulnerable’ groups. *J Med Ethics* 2007;**33**:591–97.
- Spoerri A, Zwahlen M, Bopp M, Gutzwiller F, Egger M. Religion and assisted and non-assisted suicide in Switzerland: National Cohort Study. *Int J Epidemiol* 2010;**39**:1486–94.
- Martin JS, Ghahramanlou-Holloway M, Englert DR *et al.* Marital status, life stressor precipitants, and communications of distress and suicide intent in a sample of United States Air Force suicide decedents. *Arch Suicide Res* 2013;**17**:148–60.
- Joiner TE Jr, Rudd MD. Disentangling the interrelations between hopelessness, loneliness, and suicidal ideation. *Suicide Life Threatg Behav* 1996;**26**:19–26.
- Onwuteaka-Philipsen BD, Brinkman-Stoppelenburg A, Penning C, de Jong-Krul GJ, van Delden JJ, van der Heide A. Trends in end-of-life practices before and after the enactment of the euthanasia law in the Netherlands from 1990 to 2010: a repeated cross-sectional survey. *Lancet* 2012;**380**:908–15.
- van der Heide A, Onwuteaka-Philipsen BD, Rurup ML *et al.* End-of-life practices in the Netherlands under the Euthanasia Act. *N Engl J Med* 2007;**356**:1957–65.
- Hedberg K, Hopkins D, Kohn M. Five years of legal physician-assisted suicide in Oregon. *N Engl J Med* 2003;**348**:961–64.
- Hedberg K, Hopkins D, Leman R, Kohn M. The 10-year experience of Oregon’s Death with Dignity Act: 1998-2007. *J Clin Ethics* 2009;**20**:124–32.
- Federal Court, Lausanne. *Decision 6B_48/2009*. Lausanne, Switzerland: Federal Court, 2009.
- Raggenbass R, Kuhn H. Kein Menschenrecht auf ärztliche Suizidhilfe. Kommentar zum Urteil des Bundesgerichts vom 3 November 2006 2A.48/2006; 2A.66/2006 [No human right to medical assistance in suicide. Comment on the decision of the Federal Court of 3 November 2006 2A.48/2006; 2A.66/2006]. *Schweizerische Ärztezeitung* 2007;**88**:455–56.
- Fischer S, Huber CA, Imhof L *et al.* Suicide assisted by two Swiss right-to-die organisations. *J Med Ethics* 2008;**34**:810–14.
- European Court of Human Rights. *Gross v. Switzerland*, 14 May 2013. Application No. 67810/10. Strasbourg: European Court of Human Rights, 2013.